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Item 4.4 of the provisional agenda*

REGIONAL REPORTS ON TAXONOMIC NEEDS ASSESSMENT AND PROJECT DEVELOPMENT

Note by the Executive Secretary

1. At its eighth meeting, the Conference of the Parties (COP) to the Convention on Biological Diversity, in decision VIII/3 paragraph 9 (b), urged Parties and other Governments to undertake or complete or update, as a matter of priority, national taxonomic needs assessments, including related technical, technological and capacity needs, and establish priorities for taxonomic work that take into account country-specific circumstances. These assessments should take into account ongoing national biodiversity strategies and action plans as well as regional strategies and initiatives under development, with particular regard to user needs and priorities.

2. In paragraph 15 of the same decision, the Conference of the Parties requested the Executive Secretary to convene, with support from relevant organizations and donors, a project-development seminar aimed primarily for those countries that have already identified taxonomic needs or that have submitted proposals for pilot projects under the Global Taxonomy Initiative, to promote formulation of country-driven projects based on identified taxonomic needs and to explore potential benefits of developing new, and enhancing existing, regional or global projects to address common taxonomic needs that have already been identified.

3. Accordingly, the Executive Secretary is circulating herewith, for the information of participants in the fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, the reports of the relevant workshops as submitted by the following organizations.

a) Botanical and Zoological Taxonomic Networks for Eastern Africa;

b) BioNET International;

c) East and South East Asian Biodiversity Information Initiative.

4. The report is circulated in the form and language in which it was received by the Secretariat.

* UNEP/CBD/SBSTTA/14/1.

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BOZONET

Botanical and Zoological Taxonomic Networks for Eastern Africa

'Linking Taxonomy to Conservation'

REGIONAL CONSULTANCY REPORT ON BIODIVERSITY DATA ACCESS AND MANAGEMENT STRATEGY

By

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February 2007

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ACRONYMS

AAU	Addis Ababa University
ABIS	Automatic Bee Identification Software
AETFAT	*Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale* (Association for the Study of the Flora of Tropical Africa)
BOZONET	Botanical and Zoological Taxonomic Networks in Eastern Africa
BRAHMS	Botanical Research
CBO	Community Based Organisation
CD	Compact Disc
DIZ	Department of Invertebrate Zoology (National Museums of Kenya)
IBC	Institute of Biodiversity Conservation
IBIS	Intelligent Bioacoustic Identification System
ICT	Information and Communication Technology
ILRI	International Livestock Research Institute
IPNI	International Plant Names Index
IUCN	The World Conservation Union
EAH	East African Herbarium
EBG	Entebbe Botanic Gardens
ECAT	Electronic Catalogue of Names of Known Organisms
EHNRI	Ethiopian Health and Nutrition Institute
EIAR	Ethiopian Institute of Agricultural Research
ETH	National Herbarium (Addis Ababa University)
FTEA	Flora of Tropical East Africa
GBIF	Global Biodiversity Information Facility
GIS	Geographical Information Systems
ICIPE	International Centre for Insect Physiology and Ecology
ITIS	Integrated Taxonomic Information System
IPNI	International Plant Name Index
IT	Information Technology
KARI	Kawanda Agriculture Research Institute
KMFRI	Kenya Marine and Fisheries Research Institute
LAN	Local Area Network
MAN	Metropolitan Area Network
MASDEA	Marine Species Database for Eastern Africa
MHU	Makerere University Herbarium
MoARD	Ministry of Agriculture and Rural Development (Ethiopia)
MOU	Memorandum of Understanding
MS Excel	MicroSoft Excel Software
MS Access	MicroSoft Access Database Software
MUARIK	Makerere University Agricultural Research Institute, Kabanyolo
MUIENR	Makerere University Institute of Environment and Natural Resources
NAFIRRI	National Fisheries Resources Research Institute
NARO	National Agricultural Research Organisation
NBDB	National Biodiversity Data Bank
NGO	Non Governmental Organisation
NMK	National Museums of Kenya
OARE	Access to Research in Environment
OARI	Oromia Regional Agricultural Research Institute
TSE	Taxonomic Search Engine
UBio	Universal Biodiversity Indexer and Organizer
UDSM	University of Dar es Salaam, Tanzania
UNEP	United Nations Environment Programme
VSAT	Very Small Aperture Terminals
WAN	Wide Area Network
WCD	Wildlife Conservation Department

WWW	World Wide Web
ZNHM	Zoological Natural History Museum (Addis Ababa University)

EXECUTIVE SUMMARY

The main objective of this consultancy was to carry out a review of existing information and Communication technology infrastructure and capacities within members of Bozonet and to develop a biodiversity data access and management strategy for the full project.

Earlier, national consultants had been given the task of assessing the Botanical and Zoological capacities within each country and preparing reports on the same. These various reports formed the main source of information for this study. Reports of proceedings of national and regional workshops also contributed to this report. A number persons who work in these institutions were also contacted through visits, telephone conversations and use of Internet/electronic mail. Interaction and discussions were held in order to elucidate further information and to clarify specific issues on the reports and taxonomic activities within their institutions. The National Consultants reports provided useful information on the taxonomic activities within each country, an assessment of the status of botanical and zoological taxonomic capacity and capacity building needs.

The East African region is among the world's richest hotspots in biodiversity with diverse fauna and flora as well as a range of ecological systems. Scientists continue to describe new plant and animal species from within the region. Because this region will continue to depend on these resources for their livelihood, it is essential that they are identified and conserved for the future. Taxonomy, which is the discipline of description, naming and classification of organisms, plays a critical role in the identification of organisms.

Taxonomy therefore enables the researchers identify specimens, document and then monitor them over time. With information on the environment and other ecological patterns, we are able to understand factors which lead to loss of biodiversity resources and put in place conservation measures. The fauna and flora held in museums, herbaria and related institutions provide an information resource dating back decades of years. Primary species occurrence data is useful for elucidation of new taxa and phylogenetic relationships, and are important for the basic study of taxonomy

Some products of well managed taxonomic information comprise of names and taxonomic indices, publication of floras and faunas, field guides, image databases, phylogenes, automated identification tools and in bio-geographic studies. Digitisation involves capturing images of specimen collections and making those available over the web or in digital media. This makes the collections available electronically and results in savings time and resources for the herbaria staff, shipping and handling of loans and reduction in cost of travel to the researcher.

Fauna and flora taxonomic tools play a critical role in correct determination and description of taxa and come in various forms and types. The most common of these are Identification keys, Guidebooks, Checklists, Databases, ICT Network system, Internet facility, Journals, newsletters, Specialized libraries and resource centres. A good number of these tools use ICT facilities directly and some do so indirectly. Among Ethiopian institutions involved in plant conservation work, over half were using taxonomic tools in their work and over 70% had access to the internet. Addis Ababa and Hiramaya Universities as well as EIAR had the bulk of taxonomic tools while most of the remaining institutions had only 40% of the tools. Databases were reported in only four institutions.

Most Zoological institutions had access to the internet and guidebooks which were the two most frequently used taxonomic tools. Other tools such as Identification keys, journals newsletters and networks including databases were available in less than 30% of institutions. Databases were reported in only two institutions. There is an apparent lack of qualified staff, limited know how, lack of resources and facilities for application of ICT to taxonomy.

Kenya institutions also report a poor state of databasing, although most institutions have basic ICT equipment such computers and printers. ICT manpower and resources are lacking in most institutions. Retention of ICT personnel has been a challenge given the demand for such personnel by the highly paying private sector companies. However the training of paratoxonomists and exposure of scientists to ICT/databases has helped. Most institutions have access to internet services and also have a website through which they communicate information about the institution. Access to web based databases is reported by the National Museums of Kenya and KMFRI who both host databases on the web. The Museums also report of developing a policy document to facilitate sharing and exchange of data with other institutions.

Among Tanzanian BOZONET members, there is a general lack of ICT equipment in most institutions. ICT facilities are only reported in University of Dar es Salaam and the National Museum and house of culture, and Sokoine University of Agriculture. There are no established programmes for generation of taxonomic data, most taxonomic data is collected from students' studies. The few reported databases are old and outdated and incompatible with current software. There is also a lack of opportunity to share and exchange data both locally and internationally.

A fair number of institutions in Uganda report of use of taxonomic tools in conservation, use of databases, pictures, maps, GIS, guidebooks and checklists. Taxonomic databases exist at Makerere University Herbarium and National Biodiversity Data Bank (NBDB) who reported of having databases such as the Flora of Tropical East Africa (FTEA). The NBDB produces electronic and hard copy checklists, distribution data and modeled distribution and atlases of known and predicted occurrence. Other databases are not developed based on established standards and are therefore uncorrelated and incompatible. Other institutions lack ICT manpower. Advanced ICT infrastructure such Local Area Networks and web access are reportedly available in most institutions although the internet speeds are not always stable.

There need for much work to be done to bring the BOZONET institutions up to speed in application of ICT to taxonomic work. Clearly there has been some headway within the region with some institutions in advanced stages of application while others have hardly began. The challenge BOZONET has is to try to bring every institution to a level where they can communicate to each other, recognize strengths and weakness and take advantage of each other's strengths. The following are recommended implementation:

1. Conduct a regional assessment of BOZONET institution's ICT capacity
2. From the needs assessment provide institutions with sufficient ICT hardware facilities for production.
3. Establish National and Regional focal point of reference in ICTs.
4. Establish database standards and protocols.
5. Select database software systems for regional application in managing databases (flora and fauna systems). BRAHMS and SPECIFY are suggested for implementation.
6. Establish small Local Area Networks to facilitate access to distributed resources (Internet, data access, data-entry, email communication)
7. Establish more efficient Internet (leased line, VSAT or advanced local technology)
8. Develop the capacity of research scientist and para-taxonomists in ICTs
9. Each institution establish policy for exchange and sharing of data so as to facilitate sharing of data within the network
10. Establish a Regional BOZONET office

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1 INTRODUCTION

The Eastern African region is among the top 25 of the world's hotspots in biodiversity having a diverse array of living organisms and showing an impressive variability in terms of species and ecosystem diversity. New endemic plants and animals continue to be described – over 200 in the period 1995-2000 alone in coastal forests. The East African countries of Kenya, Uganda, Tanzania and Ethiopia will be dependent on these biological resources for most of their needs, including food, shelter and income (Norman Myers et. al., Jan 2000). It is essential that these resources are identified and conserved for future generations.

Understanding the factors that lead to this loss of biodiversity resource, and the actual monitoring of the patterns and rates of loss of biodiversity, depend on an ability to first identify and then document the organisms that we are dealing with. Such identification requires tools in the field of taxonomy. Taxonomy, which is the description, naming and classification of organisms, provides input into biodiversity conservation and sustainable use in several ways (Green SV, 1998).

Fauna and Floral specimen data held in museums, herbaria and institutions, survey data and species observational data provide a vast information resource, providing not only present day information on the locations of these entities, but also historic information going back several hundred years (Chapman and Busby 1994). It is estimated that there are approximately 2.5-3 billion collections worldwide in museums, herbaria and other collection institutions (Duckworth *et al.* 1993, OECD 1999).

Most if not all members of BOZONET and particularly National Museums, Herbaria and educations institutions are involved primarily in collecting specimens of plants and animals and these are held as collections within the concerned divisions of those institutions. Older institutions which comprise of museums, herbaria and universities have the large and old collections dating 20-100 years or more.

Collections comprise of the physical specimens, their description, geographical information and the collector and other observational details. These data which are essentially primary species data, provide a vast information resource on location of entities as well as very rich historic information going back several decades.

Traditionally, museum and herbaria collections were only made with the main purpose of taxonomic and biogeographic studies. The long-term mission is to document biodiversity and its distribution through time and space for research and education (Winker 2004) and to serve the public. Data in museums and herbaria have primarily been used for the determination and description of new taxa. Additionally collections were also used for studying pollination biology, evolutionary relationships, and phylogenetics. Although these uses continue, and with users now having access to data from a greater geographic range, they are able to expand on these studies

It is clear that collection of data is an important and a necessary task, it has to be kept in mind that the data alone does not add to the knowledge about biodiversity. For that, it is important to have the tools that can convert the data into useful information and enhance our understanding of the biological and physical processes going on around us. Such information and knowledge about our surrounding will empower us to make critical and important decisions concerning our environment and will be useful for policy development and planning.

The advent of Information Technology with its power of processing and Database Management has opened up a vast array of possibilities and uses which were otherwise non-existent (Chapman, 1999). Some of the opportunities that have been brought about by databases are discussed.

1.1 IMPORTANCE OF BIODIVERSITY DATABASES

The richest source of scientific information on biodiversity—the world's natural history collections and the associated library materials and observational databases—is as yet essentially untapped. Larry Speers, the GBIF officer for the digitization portion of the GBIF work programme notes, "just as GenBank is a persistent data store on which molecular biologists can depend, the natural history collections of the world are a persistent data store on which biodiversity scientists depend. The difference is that GenBank is digitally accessible, and as yet the collections are not." Research scientists who study biodiversity have been limited in their ability to understand its complexity because most of the data are not digital. Many environmental decisions have been made that were not as informed as they could have been if more primary data were available in digital format." Biodiversity databases comprising mainly of species-occurrence data i.e. presence data as collected by museums. Most models are based on this kind of data and the following are some of the uses that these models have been applied to using these primary data:

1.2 APPLICATIONS IN TAXONOMIC RESEARCH

There are thousands of published examples of uses of primary species-occurrence data in taxonomy and in the elucidation of new taxa and phylogenetic relationships. Species data in museums are core to the study of basic taxonomy – the elucidation of new taxa and their descriptions. The world has about 1.4 million taxa already described (World Resources, 1992) most derived from collections in museums and herbaria. Many more still need to be described and thus one of the basic uses of species-occurrence data is the description and classification of plants, animals, algae, fungi, viruses and so on. Without these data, these processes could not continue. Museums and herbaria therefore play a crucial role in taxonomic work all over the world and their work is published in journals and monographs.

i) Name and Taxonomic Indices

Primary species-occurrence data has been used to develop lists of names and taxa. Just like in a language dictionary, indexes of names and taxa are used for the language of biodiversity. Collection institutions use them as authority files for their databases, taxonomists use them to help determine the correct spelling and the place of original publication, and scientists and amateurs use them to find the correct spelling of a name of a species, its synonyms and other information. These indexes can vary from being just a list of names, to detailed lists that include taxonomic information, synonyms, place of publication, type specimen information, references to different uses of the names (taxonomic concepts), etc.

Examples:

- Species2000 <http://www.species2000.org>;
- Integrated Taxonomic Information System (ITIS) <http://www.itis.usda.gov/>;
- International Plant Name Index (IPNI) <http://www.ipni.org/index.html>;
- Electronic Catalogue of Names of Known Organisms (ECAT) program of GBIF <http://www.gbif.org/prog/ecat>;
- Universal Biodiversity Indexer and Organizer (UBio) <http://www.ubio.org/>;
- Index Fungorum <http://www.indexfungorum.org/>;
- Index of Viruses <http://www.ncbi.nlm.nih.gov/ICTVdb/Ictv/index.htm>;
- Taxonomic Search Engine (TSE) <http://darwin.zoology.gla.ac.uk/~rpage/portal/>;
- Nomenclator Zoologicus <http://uio.mbl.edu/NomenclatorZoologicus/>;
- Global Lepidoptera Names Index <http://www.nhm.ac.uk/entomology/lepindex/>;
- Tropicos <http://mobot.mobot.org/W3T/Search/vast.html>;
- Gray Card Index of Harvard University <http://www.huh.harvard.edu/databases/>.

ii) Floras and Faunas

The publication of floras and faunas is one of the first outputs from the results of taxonomic research and their development is being greatly enhanced through access to species-occurrence databases. Most published floras and faunas include location information, and more often than not a simple mapped distribution. Traditionally, these maps were drawn by hand, and were invariable created without access to the totality of collections available. With sophisticated databases systems and use of basic GIS systems, these maps can now be produced quickly and easily, and by having access to many more collections, it is more likely to cover the totality of the distribution.

iii) Field Guides

Most field guides incorporate a mapped distribution of the species under consideration and comprise of hand-drawn maps derived from the author's knowledge of the species. The availability of distributed species data now makes the production of maps and the inclusion of distributional information much easier and far more accurate (see Fig 1).

iv) Image Databases

The use of Image (digital) databases, especially of type specimens is reducing damage to natural history collections as taxonomists use images of the specimens, or of the labels, rather than borrowing specimens. In their study Dall'Asta and Desmet (2005) digitized Lepidoptera type material and have placed 4,374 digital photographs and corresponding databases on their website. At the time one of the expected outcomes of their website was a policy of complete cessation of lending of type material. This was because researchers would now be able to find low resolution pictures on the web as first information. If better quality was needed, original photographs would be sent by email. If this was still unsatisfactory, the person would have to visit the section and look at the actual specimens. This was expected to result in reduced effort and expenditure on maintenance of natural history collections.

v) *Phylogenies*

The study of phylogenies, or evolutionary trees is enhanced by the use of primary species occurrence data.

vii) Parataxonomy

Parataxonomists carry out preliminary sorting of collections. They rely on good species-occurrence data and products to be able to carry out their work efficiently and effectively.

viii) Automated Identification Tools

Automated identification tools that use pattern recognition followed by clustering, ordination or use of artificial neural network are being tested for use with insects, birds and frogs.
Examples:

- In Germany bees can be identified using pattern recognition with the Automatic Bee Identification Software (ABIS), <http://www.informatik.unibonn.de/projects/ABIS/ABIS_Contact.html>;
- In Japan, cicadas and grasshoppers are being identified using hand-held recorders to recognise calls using the Intelligent Bioacoustics Identification System (IBIS) <http://www.elec.york.ac.uk/intsys/users/ijf101/research/acoustics/grasshoppers.shtml>;
- In Britain, the Intelligent Bioacoustic Identification System (IBIS) is being used to identify bats <http://www.elec.york.ac.uk/intsys/users/ijf101/research/acoustics/bats.shtml>; as

1.3 APPLICATIONS IN BIOGEOGRAPHY STUDIES

Natural history collections are a unique and irreplaceable record of the natural and cultural history of the land. A good majority of specimens and related data in collections were obtained prior to the major modifications of the landscape and they are irreplaceable (Chapman 1999, Page *et al.* 2004). Additionally continuing as well as current collections reflect the changing times, seasons, landscapes including developments on the land. Collections therefore constitute the fundamental database on the changing environment, landscapes and patterns of species distributions. There are numerous bio-

geographic studies using species-occurrence data ranging from simple to complex ones involving the use of multiple information layers and sophisticated model (see fig 1).

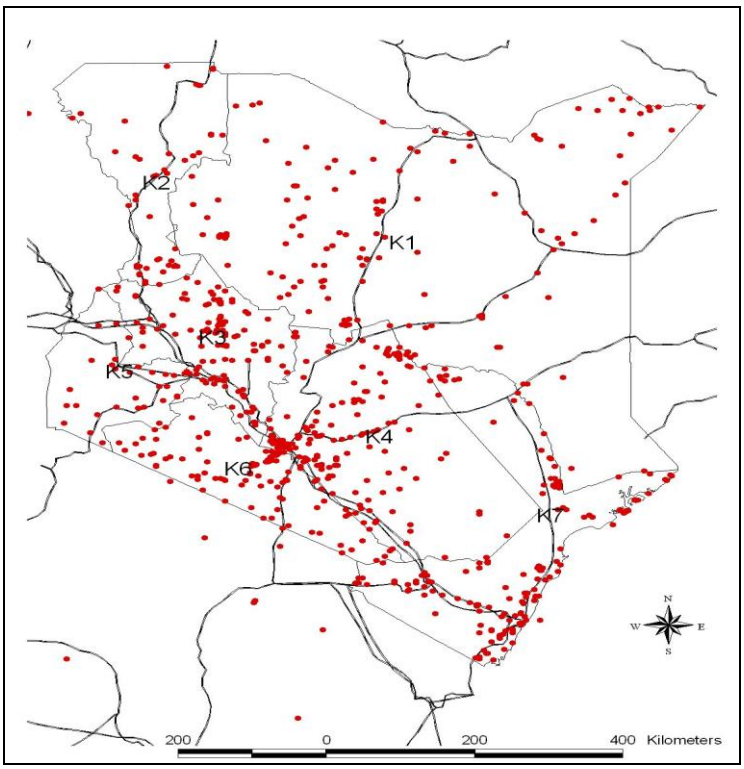

Fig 1: Map showing the distribution of Acacia in Kenya over layed with the road network. Acacia, a genus of trees and shrubs (commonly known as thorn bushes), is significant to agriculturalist and wildlife managers as an indicator of certain climatic conditions and as a primary resource. (Source: EA. Herbarium)

Such applications enable the creation of species distribution atlases, species distribution modeling with related environmental parameters, studying/predicting new species distributions and species decline.

Other areas of study are species diversity and richness; species history and phenology, endangered, migratory and invasive species; Impact of climate change; ecology evolution and genetics; environmental regionalization; conservation planning; natural resource management; bioprospecting; ecotourism and numerous other areas.

1.4 THE VALUE OF DIGITISATION OF COLLECTIONS

Many of the uses of species-occurrence have required the user to visit the collections institution i.e. the museum or herbarium, to seek access to the information, or to obtain identifications. This has involved the staff of the museum spending time and resources in identifying the material for the user (which may be from hundreds to thousands a year for some collectors (Suarez and Tsutsui 2004) or readying the data for the user. Vast amounts of resources are used by scientists to travel to museums to use the collections, or as museums loan specimens to researchers. Most museums and herbaria loan numerous specimens each year and most of the world's larger museums, annually hosts hundred of visiting researchers.

It makes sense for collections institutions to save valuable time and resources by making available electronically as much of that data as is possible. An example is with the Botanischer Garten und Botanisches Museum Berlin-Dahlem where their herbarium loan system has been completely replaced with a digital loan system. Not only does it free up resources, more often than not, those resources are

the taxonomists and researchers that can then spend more time on basic research and curation and less on administration and on helping others.

Although this is definitely the way for the future, however the process of digitisation of the hundreds of millions of collections held in natural history museums is a Herculean task and will take a long time and resources to complete. The increased use of species data through electronic based systems will allow the following:

- Consolidation of collections infrastructure and holdings within museums, herbariums, botanical gardens, zoological gardens, germplasm banks, etc.;
- A reassignment of resources toward increased research and curation;
- Improvements in the standardization, quality, maintenance and organization of important biodiversity collections;
- Reduce physical handling of specimens, ensuring their longevity;
- Reduce costs of shipping, insurance, and costs of transferring loans and specimens between institutions;
- The sharing of information between institutions and researchers, including with countries of origin;
- A more rapid advancement of the biodiversity knowledge-base as researchers build on the information in a more timely manner;
- Establishment of international biodiversity information networks between institutions involved with biodiversity research, conservation, genetics, production, resource management, tourism, etc.;
- Improvements in the management and availability of image, cartographic, genetic, and other databases that will subsidize biodiversity research;
- Improvements in the management of conservation units as knowledge about biodiversity becomes more readily available;
- Improved evaluation of the representativeness of existing conservation units and reserves, and the identification of priority areas for the establishment of new ones;
- Development of projects to study problems that affect conservation, such as the effects and consequences of habitat fragmentation and climate change on biodiversity;
- Improvements in border controls for managing and monitoring movements in endangered species, pests and diseases as identification tools and knowledge about the distributions of taxa are improved;
- Increased and more efficient production of identification tools, keys, catalogues and monographs (electronic and/or paper publications);
- More and improved inventories and studies for identifying biodiversity information gaps (both taxonomic and geographic);
- Development of research projects that aim at understanding the temporal and spatial distribution of biological diversity processes and functions;
- Comparative and retrospective studies for estimating biodiversity loss within regions, habitats, ecosystems, and across political and geographic boundaries;
- Comparative studies on environmental impact, such as climate change, urbanization, agriculture, fisheries, etc. and establishment of reference patterns for evaluation and monitoring of environmental impact with respect to biological diversity; Increased opportunities for bio-prospecting, and the linking of programs with related and similar interests;
- The development of professionals in new fields of knowledge and in new interfaces, such as biodiversity informatics, image services, and geographic information systems;
- Production of improved teaching material, such as field guides, identification keys, image databases, and on-line information for students and educators;
- Improved guides and information resources for use in ecotourism;

- Improved rates of publishing in taxonomy as researchers spend less time on identifications and on making data available on an individual basis;
- Development of new sources of funding for supporting collections.

2 OBJECTIVES

2.1 ASSESSMENT OBJECTIVES

The objective of BOZONET (Botanical and Zoological Taxonomic Networks in Eastern Africa: Linking Conservation to Taxonomy) of the Information and Communications Technology undertake a review existing Information and Communication Technology infrastructure and capacities within the members of BOZONET and to develop a biodiversity data access and management strategy for the full project.

2.2 SPECIFIC TASKS

1. Consult the PDF-B Project document and other documents prepared by the National Consultants of the four countries
2. Interact with National Institutions through national consultants, and develop a biodiversity data access and management strategy for the full project
3. Use lessons learnt from the SABONET project in this regard as well as emerging opportunities presented by other such initiatives including GBIF, BarCode of Life, Species 2000, IT IS, Inter-American Biodiversity Information Network, and African Types Project and make recommendations to the full project
4. Review existing databases and other biodiversity data management systems at local, regional and international level and link up with national consultants in reviewing the experiences (e.g. software types and robustness, ease of operation and compatibility with other databases) and outline gaps, bottlenecks and opportunities.
5. Provide an overview of the status of existing supporting infrastructure and manpower for the generation of taxonomic information (buildings, facilities/ICT) at regional level.
6. Give a variety of options for IT systems outlining ease of implementation, potential bottlenecks and cost of implementation
7. Make recommendations for regional workshop to review and accept
8. Prepare a high quality report and submit to the regional Secretariat. The report to include an outline of a communications strategy on how to make taxonomic products and taxonomy more relevant to end-users.

2.3 EXPECTED OUTPUTS

Prepare a report detailing the following:

1. Develop and document a biodiversity database access and management strategy for the whole region
2. Make recommendations on the design, options and specifications for the website, how it should be managed and where to be hosted

3. METHODOLOGY

The National Consultants contracted within each country, had prepared various reports comprising Training Needs Assessments reports for fauna, flora and capacity building. Each country had held workshops and the proceeding of these workshops were also used as material for review. Various relevant literature comprising of books, reports and publications were also used as research material. Visits, email, discussion and telephone conversations were also used in acquiring information. A questionnaire was also used as an instrument to collect additional information from the National Program Coordinators.

3.1 REVIEW OF NATIONAL CONSULTANTS REPORTS AND WORKSHOP PROCEEDINGS

The National Consultants reports provided a useful source of background information for each country. The reports assessed the capacities and needs for each country and were detailed on infrastructural, equipment and human taxonomic capacity in country. There was some assessment of the status information and communication technology. Each country provided several proceedings of the workshops held and these were also reviewed.

3.2 REVIEW OF LITERATURE: BOOKS, REPORTS AND PUBLICATIONS

Various books, reports and publications downloaded from the internet were reviewed and critical information on current trends and developments in ICT applied to Taxonomic work were obtained. The information was obviously vast and ranged in complexity from simple to highly sophisticated. Only information and ICT systems which were deemed as relevant and applicable to the local situation were selected for reporting.

Relevant websites quoted in literature were also visited and information and downloads obtained from them.

3.3 INSTITUTIONAL VISITS

Visits were made to key local institutions in Kenya and discussions were held with various persons in those institutions. Also the National Coordinators were visited and discussions and clarifications carried out.

Discussions and clarifications were held on capacities of the institutions focussing on the status of ICT with regard to facilities, human resources and databases.

3.4 QUESTIONNAIRE TO NATIONAL PROJECT COORDINATORS

In order to aid acquisition of detailed information on the status of ICT capacity and manpower and related a questionnaire was prepared and sent to the National Project Coordinators to report back on. The questionnaire consisted of open ended and closed questions. The questions were soliciting information on the level and availability of ICT manpower in national taxonomic institutions, their level of training in ICTs, constraints in recruitment and maintenance of qualified ICT personnel, the capacity of ICT equipment and facilities in national institutions, the types of taxonomic databases and analytical software tools available and being used and their experiences in implementing and managing those software tools. Other questions sought to elicit information on the existing local, regional and international sharing and exchange activities and mechanisms used to facilitate such activities, the level, types and reception of internet connectivity, availability of institutional websites and the management of such websites. Concluding questions required a self-assessment of each institution to identify their areas of need with regard to ICT capacities and make recommendations on how these needs can be addressed.

3.5 DATA ANALYSIS

Data from the reports and questionnaires were analysed by computing frequencies and cross-tabulations of the reported capacities in the ICT facilities, taxonomic databases, infrastructure and human resources of the institutions. The results have been interpreted and documented in the report.

4. ASSESSMENT OF REGIONAL ICT STATUS

Fauna and flora taxonomic tools play a critical role in correct determination and description of taxa and come in various forms and types. The most common of these are Identification keys, Guidebooks, Checklists, Databases, ICT Network system, Internet facility, Journals, newsletters, Specialized libraries and resource centres. A good number of these tools use ICT facilities directly and some do so indirectly. For instance guide books, checklists and databases will result directly from the application of ICT facilities such as a computer and printer, the analytical capacity of a software program and so on. The ICT network facility and Internet access can only be achieved with computer hardware and software and communication infrastructure.

Although the existence, quantity and quality of ICT facilities within institutions reported in the consultants reports are not specified explicitly, the presence of some taxonomic tools, by extension, points to the existence of some types and level of ICT facilities. Several institutions responded to the questionnaire from each country and these were useful in providing an indicator of the national ICT status with regard to taxonomic institutions.

4.1 ETHIOPIAN INSTITUTIONS

4.1.1 ICT Hardware and Related Equipment

i) Botanical

An analyses of the ten taxonomic tools indicated in the botany report shows that over 50% of the 21 institutions surveyed had identification keys, Internet facilities, guide books and checklists in that order (ref. to table 1). It was positively noteworthy that 71% had access to Internet.

Table 4.1.1 i) Botanical Taxonomic tools

Type of Tool	% Institutions with Facility
Identification keys	76
Internet facility	71
Guide books	62
Checklists	52
Journals	38
Newsletters	33
ICT Network system	29
Databases	19
Specialized libraries	10
Resource centre	5

Clearly this table points to the existence of some form of hardware facilities such as Desktop computers and printers.

Further analyses of the data points to the fact that only three institutions comprising Addis Ababa University, Hiramaya University and EIAR organization have at least 70% and more of this tools, on average most institutions only have 40% of the tools in existence with some having only one tool, namely the Identification keys only.

Ethiopian institutions have some basic ICT equipment which have been used to achieve some of the tools mentioned above. The ICT are also equipped with basic software such as Microsoft based programs to facilitate basic tasks such as word processing, spreadsheet, graphics and databasing work. However given the fast changing technologies, it can be safely said that these equipment will be near obsolete in the coming years. The table also indicates that over 80% of botanical institutions surveyed had no databases of their specimens. Clearly there is little GIS and digitization work being carried out because the required equipment or outputs are hardly mentioned in any of the reports.

ii) Zoological

Analyses of the 15 Zoological institutions on the level of availability of the nine taxonomic tools listed in Table 4.1.1 ii) showed a different picture compared to the Botanical tools previously discussed. The main tool was the Internet, which was available in 67% of institutions followed by guidebooks at 53% of institutions. The remaining tools comprising of Identification keys, journals, newsletters, ICT network systems, databases and specialized libraries were available in less than 30% of the institutions surveyed.

Table 4.1.1 ii) Zoological Taxonomic tools

Type of Tool	% Institutions with facility
Internet	67
Guide books	53
Checklists	47
Identification keys	27
Journals	27
Newsletter	27
ICT Network system	20
Databases	13
Specialized library	13

The availability of internet in 67% of institutions points to the presence of basic ICT facilities such as computers and printers. Also from the level of sophistication of use of the available ICT facilities, it is clear that the available hardware are quite basic. The quantity and type of hardware and software available are the type that comes packaged with the computer facilities.

4.1.2 ICT Databases and Software Tools

The consultants report state that taxonomic databases are not available and the available data are not complete in terms of dating, location, etc. This shows a lack of qualified staff, limited know how, lack of resources and facilities.

The analyses on Tables 4.1.1 i) and ii) does indicate that databasing is very weak and needs strengthening among Ethiopian Botanical and Zoological institutions. Out of the 21 botanical institutions surveyed only four reported to be having databases and these were Addis Ababa University, Haramaya University, EIAR and EHNRI. The National Herbarium (ETH) has two major databases, Medicinal Plants of Ethiopia which is an Access based system whose purpose if to make information available to researchers. The database is still being updated and has a total of 850 taxa of vascular plants. A second database also at ETH is the African Plants Initiative (API) database which is an image database of types of vascular plants of African (Ethiopia) origin.

Only Addis Ababa University and EIAR out of the 15 zoological institutions reported to having zoological databases. These databases are fairly simple and mainly comprise of lists, the taxonomic content is limited.

4.1.3 ICT Manpower resources

The consultant reports clearly indicate that the human capacity to develop and maintain ICT products is in most cases none existent or very weak if available. The scientists/researchers by virtue of their training and exposure do appear to have basic skills in using computers for basic tasks such as word-processing, spreadsheets, simple analyses and web browsing. This state is qualified by the consultant reports which state a lack of qualified staff, know how, resources and facilities.

4.1.4 ICT Networking and Web Access

It is positive to note that most institutions have access to the web (71% Botanical and 67% Zoological institutions) as reported in the analyses in Tables 4.1.1 i) and ii) above. The consultants also reported that the connectivity was poor and downloading tended to be slow and not useful for access to web based databases and taxonomic tools. The reported type of connectivity indicates that most institutions are hooked to Internet Service Providers through local telephone lines rather than through special leased lines or VSATs connections. It is possible that advanced connectivity technology is not available locally, however better solutions can only be ascertained after an assessment is done at a local level. Local phone lines tend to have very poor reception and are often unable to maintain strong reception for downloading large files or reliable speeds for web based work.

Computer networks comprising of Local Area Networks (LAN) and related distributed systems have

the power of enhancing computer capability. Networks enable sharing of resources such as database/s on a file server, printers, CDROM facilities, internet resources etc. A network also enables easy internal and external communication, report preparation, sharing of minimal resources and ease of work through distributed functionality towards the same work objective. However networks also require competent management because they are sensitive and require support by experienced personnel.

Out of the 21 institutions that were surveyed on botanical resources only six had network resources and these were Addis Ababa University, Bahir Dar University, Jimma University, Hawassa University, Dilla University and OARI. Of the zoological institutions only Bahir Dar University, Jimma University and Dilla University reported to have Local Area Networks within their facility.

4.1.5 Data Sharing and Exchange Activities

Since very few databases are reported and databasing activity is weak, data sharing and data exchange is hardly reported among botanical and zoological institutions. Botanical institutions reported some linkage related activities with the main ones with AAU (23 institutions), IBC (10 institutions), EIAR (3 institutions). Twenty seven of these linkages where with local/national, regional and international institutions, among which are found foreign universities, IUCN, ILRI and NMK. The reported linkages are mainly the areas of plant specimen identification (listing of species, specimen collection, botanical information, taxonomic service, and taxonomic help), research, genetic material provision (germplasm, seed samples), teaching taxonomy (training) and conservation.

Among the Zoological institutions only 50% of the surveyed institutions reported to be having linkage/partnerships with local and/or international institutions. The main ones were Addis Ababa University (5), IBC, MoARD-WCD and Parks Development and Protection Authority-Amhara Region have 3 linkages each. The main linkage activities were collection, storage, identification, research collaboration, information exchange, technical support and hunting license provision. The main international linkages on zoological taxonomy were with Birdlife International, CAB International, Carnegie Museum NH, Frankfurt Zoological Society, ICIPE/Kenya, ILRI, IUCN, University of Antwerp, University of Bern, and Zurich University.

Regarding the framework on which the linkages are based, a range of mechanisms are reported comprising of collaboration ventures, Memoranda of Understanding and adhoc based on relationships between organizations and between researchers.

4.2 KENYAN INSTITUTIONS

4.2.1 ICT Hardware and Related Equipment

Overall the consultant's reports indicate very poor state of databasing in the country, with only 4% and less than 20% having databases on flora and fauna respectively.

Most institutions have basic hardware facilities however they vary in their capacity and ability. Largely the hardware would not be suitable for storage capacity intensive work such as would be required to database and digitize the collections. However due to lack of taxonomic tools involving the use of ICT facilities it would seem that most institutions lack hardware facilities for taxonomic work for both botanical and zoological collections.

4.2.2 ICT Databases and Software tools

Only 4% of botanical institutions have a form of database for their specimens and nearly all are yet to achieve 50% databasing of their vast collections. Most of the existing zoological databases are not well designed and therefore extracting information from them is complex.

The National Museums of Kenya is a prime example, as one of the most reputable institution in taxonomy in the nationally and also within the region, it has managed to develop and implement

several electronic databases, however only 73,000 (0.073%) specimens out of approximately 1 million Herbaria specimens have been databased using the software BRAHMS. Of the 2.5 million Zoological collections, only 40,000 (0.016%) specimens have been databased using a software tool called SPECIFY. The slow progress is due to the vast collections, manpower and ICT facility requirements. The smaller collections such as those of reptiles, fish, and amphibian collections have however been fully databased at NMK. The NMK has also initiated digitization of its botanical collections and invertebrate collections.

4.2.3 ICT Manpower resources

Apart from a few institutions, the ICT manpower resources are lacking and most institutions do not have ICT personnel who understand taxonomy or the specialized needs in this area. Most institutions are unable to retain ICT personnel due to the competition for such professionals by the highly paying private sector. However, a number of institutions have circumvented these constraints by exposing and skill development of technical staff through specialized training, to the use of IT and databases.

Also reported is the lack of strong ICT awareness among botanical and zoological personnel and this should not necessarily be the case as most personnel can use computers to accomplish basic tasks such as word processing, internet access and using databases.

4.2.4 ICT Networking and Web Access

Nearly all institutions have access to the web and equally most institutions have a web address from which information about the institution can be accessed. The main constraint is with connectivity speeds on the Internet. These tend to be variable and even though institutions have good connectivity through leased lines, they tend to experience unstable connectivity speeds.

Access to databases on the web was reported by very few institutions main ones being the National Museums of Kenya and KMFRI. At NMK the fish, reptile and amphibian collection is accessible on the web via Fishbase, KMFRI reports of providing data for the Marine Species Database for Eastern Africa (MASDEA), which contains 18,000 records and is available on the web.

4.2.5 Data Sharing and Exchange Activities

Although data sharing and exchange activities were not reported specifically, it is clear from the vibrant ongoing collaborative activities, that there is data sharing and exchange between institutions.

The National Museums has numerous collaboration activities with a number of local, regional and international institutions. With local institutions, such as the Universities and Government parastatals and NGOs, over the years MOU's have guided the data sharing arrangements. Recently, however, the NMK has developed a policy document to govern sharing and exchange of information which covers most critical issues in this area. This document is guiding present exchange and sharing arrangements.

4.3 TANZANIAN INSTITUTIONS

4.3.1 ICT Hardware and Related Equipment

Reports indicate that there are only a few computers and related hardware in most institutions. There is a general lack of ICT computer hardware and software for management of taxonomic data and information. University of Dar es salaam and the National Museum and house of culture and the Sokoine University of Agriculture Herbarium have reported having some ICT facilities but these are very few and very basic. TAFORI on the other hand reports of having hardly any ICT facilities. Generally ICT facilities are few and where they exist they are obsolete and incompatible.

4.3.2 ICT Databases and Software Tools

Reports indicate that there are no established programmes for generating taxonomic data and that most taxonomic information collected is from student studies, research projects, biodiversity inventories and consultancies. Generally the specimen collection is done opportunistically. There are hardly any specimen or taxonomic databases within the country.

There is also lack of computer hardware and software to store taxonomic data and information. Few computers are available and most institutions lack databases to store taxonomic data. The few existing databases are dated and not compatible with current software.

4.3.3 ICT Manpower Resources

The ICT manpower resource is almost non-existent in most institutions because the institutions lack hardware capacity and databases for storage of data. Existing databases are either obsolete or are not compatible or transferable.

4.3.4 ICT Networking and Web Access

Because of a strong lack of computer hardware and databases, there is hardly any report on ICT network or web access.

4.3.5 Data Sharing and Exchange Activities

Access to some taxonomic information for many people including scientists and local people is restricted. Even taxonomic data posted on the web which originates from the country cannot be easily accessed in Tanzania because access to the website requires subscription.

Most of the taxonomic information is locked up in data generating institutions in the country and outside and is not being used nor accessed by those who could benefit from it.

4.4 UGANDAN INSTITUTIONS

The consultant report categorises the Ugandan institutions involved in taxonomic botany in to three broad groups as those involved in research, conservation and utilization. The institutions that store information and reference collections and databasing were identified as Makerere University Herbarium (MHU) in Botany Department, collects and stores reference botanical specimens and taxonomic information; the National Biodiversity Data Bank (NBDB) housed in MUIENR does documentation and data basing for monitoring of national biodiversity and also acts as an agency to provide end users with information. Reference collections are also stored by Entebbe Botanic Gardens (EBG), the National Gene Bank (NGB), the Uganda Museum of natural history, Kawanda Agriculture Research Institute (KARI), and the National Fisheries Resources Research Institute (NAFIRRI).

In comparison there is a vibrant application of ICTs in taxonomy within institutions in Uganda.

4.4.1 ICT Hardware and Related Equipment

Analyses of the consultant reports indicate existence of Internet and websites in most institutions and some databases at institutions such as MHU, NBDB and NARO (see table 4.4 i). Access to the Internet appears to be the most available taxonomic tool accessible in most institutions. This clearly indicates the availability of ICT hardware facilities and also implies a level of sophistication in use of ICTs. It is not clear what type of facilities exist, how advanced or recent they may be. What is reported is a weakness in management, lack of staff skilled in taxonomy and curatorial staff to carry out referencing and translation.

Table 4.4 i) Access to Botanical Taxonomic tools

Type of Tool accessed	Number of institutions	% of total institutions
Internet	16	66.7
Guide books	15	62.5
Id. Keys	12	50.0
Checklists	11	45.8
Specimens	7	29.2
Floras	6	25.0
ICT network	6	25.0
Journals	6	25.0
Maps	5	20.8
Data bank	4	16.7
Assorted literature	4	16.7
Newsletter	4	16.7
Monographs	2	8.3
GIS	2	8.3
Distribution atlases	1	4.2

4.4.2 ICT Databases and Software tools

The consultant report indicates that, out of sixteen botanical institutions who reported the use of taxonomic tools in conservation, use of databases, pictures, maps, GIS, guide books and checklists were the most frequent see table 4.4.

A fair number of institutions report of developing databases of various types. Development of taxonomic databases is specifically noted at MHU. The National Biodiversity Data Bank (NBDB) has a database with species already recorded for Uganda in the various parts of the Flora of Tropical East Africa (FTEA). NBDB produces electronic and hard copy checklists, distribution data and modeled distribution and atlases of known and predicted occurrence.

Existing databases do not appear to be developed based on established database standards and this makes them uncorrelated and incompatible. The reported databases are basically flat files of MS Excel or dbase-based files. These do not quite qualify to be Taxonomic databases. Perhaps the most sophisticated database is the one at MUIENR which uses BRAHMS that was introduced from the East African Herbarium in Nairobi. BRAHMS qualifies as an Internationally recognised system for management of Herbaria.

Among the most used taxonomic tools are databases, Pictures, maps, GIS, guidebooks and check lists. It appears that although only two institutions are reported to have a GIS laboratory, this facility is being shared intensely because GIS and Maps feature as the most commonly used tools.

4.4.3 ICT Manpower resources

Lack of ICT manpower resources is not specifically reported and because there is some database work going on, there appears to be some professional ICT manpower particularly in the main institutions such as MUIENR and NBDB. Other institutions around the country seem to lack ICT manpower.

4.4.4 ICT Networking and Web Access

Advanced communication infrastructures such as LAN and Internet facilities are available in most institutions. At Makerere University it is possible to access international online journals through a central subscription at the Main Library. The Internet access speeds are however slow and unstable thereby making it difficult to browse and download documents from the net. Access to Web based databases is also a constraint, as they also require subscription.

Table 4.4 ii) Commonly used Botanical Taxonomic tools

Plant taxonomic tools used	Number of Institutions	%
Databases	12	92
Pictures	12	92
Maps	12	92
GIS	12	92
Guide books	11	85
Checklists	11	85
Identification keys	9	69
Journals	9	69
Newsletters	8	62
ICT network system	7	54
Internet facility	4	31

4.4.5 Data Sharing and Exchange Activities

A general lack of MOU and related mechanisms for information exchange/sharing is reported. Commonly adhoc arrangement between individuals is used and information is accessed according to the request. Non-commercial information such as for writing reports or teaching is often free. Financial bottlenecks in making packaging information from existing databases in the country, has put a constraint in making useful information available to those who would need it for conservation and other end-uses. There is no cross fertilization of information.

Current channels and mechanisms for exchange of information at local or international basis are through books, reports or journal reprints and by attending conferences and conference proceedings. There is a lot of taxonomic information in international conference proceedings such as that of AETFAT, but also from national and regional conferences. Other avenues of exchange of taxonomic information have been through diskettes, flash disks or CDs.

5. RESULTS AND DISCUSSION

Although there has been global progress in improving access to Information and Communication Technologies (ICT), developing countries still lag behind in making ICT applications commonplace in governments, NGOs and CBOs. African Governments have made significant attempts at making ICT affordable by knocking of taxes and duty from Computer products thereby reducing costs of hardware. However the cost of advanced Internet access with higher band widths still remains prohibitive for many public institutions, NGOs and CBOs.

The use of ICT with the Internet is a critical component in the development of Taxonomy in the region. This can be seen in the developments of such important projects such as GBIF, Species 2000, ITIS and numerous others which are accessible through the web. In the last 2 decades, ICTs have completely changed the way we live and work today. Presently one can search for and access publications at an instant, it is possible to get literarily any kind of information over the web instantaneously. These functions were not possible a few decades ago. Communication has also gone through a revolution in the last decade, to communicate with a person by letter would often take a week of more by letter, presently one can send an email and receive a response within seconds or at most minutes. The cost of communication has also reduced drastically. All these developments and value have been brought about by tapping into the ICT train. As processed information becomes more precise and systematically structured, new developments in information and communication technologies (ICT) are playing significant roles in science and innovation. Use of ICT is broadening the scope and scale of science, and bringing new opportunities for international collaboration (Schroeder, 2003). Clearly if any organization is to realize incremental value in its function, it will be important to consider how the power of ICTs can be harnessed in achieving its goals.

One of the key issues in Taxonomy is the use of tools for determination and description of new taxa, studying pollination and zoological biology, evolutionary relationships, and phylogenetics. The

development and availability of these tools are therefore fundamental to research in taxonomy. The use of ICTs is making this work much easier, reproducible and transferable to any number of persons.

To achieve the status where the East African region can be said to be mature in the application and use of ICTs in Taxonomy, there is some significant work which needs to be done in the following areas:

5.1 ICT HARDWARE AND RELATED EQUIPMENT

The hardware component of ICTs remains the single most important aspect of accessing technology. It is also the cheapest component presently as the prices have come down drastically in the last decade.

From reports and analyses, it is clear that institutions lack hardware facilities and these facilities should be provided for use in implementing taxonomic databases and for data entry.

Access to ICT hardware is a critical first point of entry into computerization of taxonomic resources. Obviously there will be need for software tools to enable the hardware to function as required. Sufficient hardware resources need to be provided to institutions with significant fauna and floral collections.

The challenge with present ICT equipment is the rapid pace of technological development and change. This provides the challenge of keeping up with changing technology so that data does not become obsolete and incompatible with other modern systems. The answer to this is to develop an institutional policy of upgrading ICT facilities on a three-year basis. In the past projects have not faired well simply because this aspect was not factored in and ICT facilities were budgeted as a one time purchase. Most of the equipment begin to fall apart by the third year and will be obsolete by the fifth year. Where caution is not exercised all the work would be lost and institution would be back to the beginning.

5.2 ICT DATABASES AND SOFTWARE TOOLS

5.2.1 Regional and National focal points

From a broad perspective, the status of application of ICT in managing biodiversity data is low and will require a major effort by the network.

It is important to note that within each country there are institutions of excellence with regard to application of ICTs in management of biodiversity data. These institutions provide national focal points for reference and support to the rest of the country on ICT work. Regionally too, there are institutions which clearly have been acting as points of reference and training for the other countries. BOZONET should take advantage of such institutions and use them as a springboard in the application of ICTs in the region. The active participation of these national and regional institutions in the implementation of ICTs and taxonomic databasing will go along way in ensuring and sustaining success in the creation, implementation and maintenance of databases within BOZONET institutions.

5.2.2 Databases and database standards

There are numerous databases and databasing software on the market and the choice of software will be guided by what the user needs are vis-à-vis the BOZONET institutions.

Eventually institutions that are members of the BOZONET network may want to establish regional databases of their collections, however if this were to happen at some point in the future, there would be need to establish database standards right at the beginning. To integrate data from distributed sources in real time, not only is technology necessary, but standards and protocols are essential Canhos V. P. et. al. (2004). This would make it easier to achieve a regional database because the standards had been set at the onset.

In Uganda, for instance, it was noteworthy that a number of institutions are developing databases.

However, everybody seems to be going about it in their own way and establishing their own personal databases without reference to other scientists and needs. Such databases end up being personal properties with very little use to anyone else except the user.

Because there are a number of high quality database initiatives already in existence within the network, it is unnecessary to re-invent the wheel. Instead, it would be wiser to evaluate the databases which have been operating within the region and choose one or a few which meet the needs as best as possible. The advantages in this case would be that there is the added value of local experience and training on the software, ease of access to cheap/free support on the software and the software is already functioning and helpful to one or more members of the network.

In their publication on SABONET, Willis and Huntley (2001), state that the software PRECIS (National Herbarium Pretoria [PRE] Computerised Information System), was used for databasing of their collections. This databases software, from the University of Pretoria, was used to database all the Herbaria in the countries forming the SABONET. They state that over the 25 years of its existence the database has been adapted and adopted to changing needs and technological advancements. The process involved different countries sending their staff for computer training at the National Herbarium in South Africa, being supplied with computers and the specimen database. The result was significant advances in computerization of specimen collections through this effort.

The East African Herbarium currently the oldest Herbarium in the region also holds the most vast plant collections in East Africa has been using the in-house developed software known as BRAHMs or more appropriately the Botanical Research and Herbarium Management System. In its plant conservation program the EAH has been using the MS. Access based tools EAPCP (East African Herbarium, Plant Conservation Programme) and LEAP (List of East African Plants). The digitization of plant specimens has also been ongoing using Adobe Photoshop to manage the images.

The Invertebrate Zoology department of NMK which houses 2.5 million zoological collections has been databasing their collections using the software called SPECIFY.
Software such as BRAHMS are not only being used in Kenya, but also in Uganda and have proved to be successful so far. Numerous trainings on BRAHMS have been carried out on BRAHMS and related MS Access software to other partners in East Africa. Such software, which have also proved themselves and already gained acceptance in the region should be adopted and developed further.

5.3 ICT NETWORKING AND WEB ACCESS

Computer Networks allow access and utilization of distributed resources. There are various types of networks comprising from the smallest Local Area Networks (LANs), Metropolitan Area Networks (MANs) and the largest or widest Wide Area Networks (WANs). Each of these networks has its uses and limitations. The LAN is the simplest of all the networks and basically consists of a set of computers connected together within a location such as a building or a set of offices. The main strength of a LAN is that it allows the users to access central services and to share central resources such as file/email server, internet access, files, printers etc. A LAN is therefore ideal in an environment where colleagues need to input or output data residing in a central point, access to a single set of printers and CDROM devices centrally, have distributed access to the WWW, communicate internally to each other and so on.

MANs and WANs are wider in their capability and capacity and are also costly to achieve. MANs and WANs are commonly used by banks to facilitate ATM and other banking services. Because MANs and WANs rely on local telephony infrastructure, they tend to be sophisticated and require expensive equipment and resources to achieve. An easier, effective and affordable alternative is the so-called Intranet. The Intranet is a web-based solution and uses the Internet as a vehicle to enable networking between individuals and organizations.

From the study, it is evident that most organizations have access to the Internet, however the

connectivity is unstable in some cases. Because very few organizations report having a LAN, most organizations seem to be accessing the Internet through stand alone computers probably through a telephone line. The telephone bills by each individual office for each individual connectivity must be high if the costs were to be consolidated for the different offices. The establishment of a LAN within the organization and access to the Internet through a VSAT or a leased line would reduce the cost of connectivity drastically and result in improved and enhanced connectivity to the internet. Although the design and installation of the above system can be done by a commercial service provider, its day-to-day operation and maintenance would require professional ICT personnel. A simple cost analysis would actually show the cost effectiveness of installing a LAN based Internet service, in the long run.

5.4 DATA SHARING AND EXCHANGE ACTIVITIES

Research advances depend on availability of diverse and rich databases from multiple public and private sources, and their openness to easy recombination, search, and processing. The overall principle is that full and open exchange of scientific data—the "bits of power" on which the health of the scientific enterprise depends—is vital for advancing progress and maximizing social benefits accruing from science worldwide (CODATA, 1997).

Intellectual property laws in most countries have never allowed protection of data, and countries like the United States even have laws that specify that government data are in the public domain. Indeed, although a long sociological tradition exists among scientists to share and disseminate data, great pressures to protect data nonetheless exist. Some in the field even among the scientists still consider data a source of potential revenue to be exploited, rather than a public good to be shared. Recently at a meeting entitled "Science, Technology and Innovation for the 21st Century", OECD ministers recognized the value of sharing publicly-funded research data, and adopted a declaration entrusting the OECD to work towards commonly agreed principles and guidelines on access to research data from public funding. The Meeting of Experts convened by GBIF to discuss biodiversity data, databases, and intellectual property rights produced a white paper with several recommendations among them a policy of making data openly accessible to all, and in this way addresses the issue of data repatriation in the most positive manner (Muller, 2004). A GBIF study on primary biodiversity data sharing with countries of origin (Canhos *et al.*, 2004) concluded that proper attribution, custodianship (i.e., each contributing museum retains ownership of its records), acknowledgement, and control of data delivery can be much more important to biological collections than considerations of intellectual property rights.

The major restrictions to open data-sharing are now coming mainly from developing countries, based on interpretations of CBD terms regarding access and benefit-sharing (Chavan and Krishnan, 2003). For historical reasons (collecting expeditions, museum facilities, technological developments), primary datasets, both biological and environmental data are housed mainly in developed countries. Vast amounts of biodiversity information are not sensitive, and can be shared to the benefit of all. It is important to document the benefits of sharing data to scientists and to institutional administrators and policy makers. Access to primary biodiversity data enables scientific to carry out sophisticated studies and assessments on a regional or global scale which would otherwise not be possible Thomas *et al.* (2004).

In another workshop by European Network for Biodiversity Information in December 2005 at the Royal Botanical Gardens, Kew. The meeting was termed the Advanced Workshop: Biodiversity information and the law: balancing freedom of access and rights of providers. The purpose was to bring participants together with a group of international experts to discuss the opportunities, problems, legal and financial concerns with biodiversity information as it increasingly becomes available electronically. In their deliberations they came up with guidelines on which two parties may establish data sharing agreements as follows:

1. Define terms used
2. State agreed uses of data

Normally, the purpose for which data is supplied is expected to be at the level of nonexclusive use. In certain circumstances exclusive use may apply e.g. over a stated period of time where publication of data by the originating authors is required before release of data. Permitted uses or exclusions should be clearly stated. They might include commercial use, rights to redistribution, rights to display etc.

3. Provider and users rights

Provider should assert any rights for itself or third parties e.g. IPR over the data.
Any further rights granted under the agreement to either the Provider or the User should be explicitly stated e.g. User to receive data updates at regular intervals or Provider to receive specified feedback on data use.

4. Type of acknowledgement

Data providers should be acknowledged or cited when data is used. Data providers should indicate the preferred form for the style and content of any acknowledgement or citation of the Provider or data origin.

5. Assessment of sensitive data

There are usually restrictions on the supply or use of sensitive data (e.g. precise localities of commercially vulnerable species). As well as having moral and sometimes legal responsibilities towards such data, data providers are best placed to assess what information is sensitive and what level of detail can be released. If sensitive data are to be withheld this should be agreed and clearly indicated prior to any supply.

6. Disclaimer of liability

Disclaimers of liability for events or consequences following the use of data by users or third parties should be included.

7. Validity of data

The Data Provider may wish to include some statement on the level of validity of the data. This is likely to be on a case-by-case basis and may need to be a peer review system.

8. Modifications of provided data

If modifications of data are to be allowed this should be stated, along with the mechanism(s) for agreeing to such modifications between the parties (such as citations for origin of data).

9. Monitoring

Any required monitoring of data use should be stated, along with the mechanisms for achieving this.

10. Feedback

Any required or requested feedback on data use should be stated, along with the mechanisms for achieving this.

11. Dissemination/transfer

Any issues relating to agreed dissemination or transfer of data should be explicitly stated. You may wish any dissemination to be subject to the original terms and conditions.

12. Termination strategy

There should be some statement of termination strategy in any agreement for on-going provision of data, including the consequences following termination due to breaking of the agreement.

5.5 MANPOWER RESOURCES

The challenge in ensuring the collections in our herbaria and museums are fully databased and digitized are interlinked, however the main ones are associated with lack of resources comprising of funding, hardware and software needs, sociological needs and interactions between providers and users of information.

Most institutions, which carry out collections and herbaria work, are primarily national institutions. By virtue of their being national, they often suffer from lack of exchequer funding due to the competing demands of economies of developing countries. Therefore as the task of databasing and digitization is an enormous one given the size and vastness of collections, the process will require recruitment of additional manpower both ICT professionals, para-taxonomists and data entry staff.

According to Verschelde and Adriaens (2005) of the Ghent University Zoological Museum, their databasing efforts were compromised by two main problems: man power and facilities. They had to rely on one curator and limited support staff. The second problem of facilities was related to a very small budget, small infrastructure and computer shortage. Over a period of eight years they had only been able to archive 8,600 specimens out of a total of 20,000 specimens. In their study they were able to solve the manpower problems by recruiting additional staff, support by students as part of their training and lay volunteers. With funding support from the Belgium Biodiversity Information Facility they were able to procure additional equipment and pay for the additional staff. They report that with this added support they were able to archive 5,900 specimens in one month. In their conclusion, they emphasise the importance of external funding of database and digitization work to facilitate accessibility to biodiversity data by scientists and researchers.

6. RECOMMENDATIONS

Generally the area of ICT application to Taxonomy needs a major injection of effort to bring it up to an acceptable level. In each country there is some work in application of ICT to taxonomy in a handful of institutions. This is noted in Kenya and Uganda and to a much lesser extent in Ethiopia and Tanzania. The need to get all members of BOZONET up-to-speed in ICT application to Taxonomy is very urgent and should be carried out hastily. Happily though, there is expertise within the region and also within each country, therefore those institutions which need help will be able to get it locally and regionally at the very least.

6.1 ICT HARDWARE AND RELATED EQUIPMENT

- Clearly most institutions lack ICT equipment such as computers (desktops and laptops), printers, scanners, digital imaging equipment and Geographical Information Systems tools. Basic hardware items should be procured and distributed to institutions according to the evaluated need and ability to manage and utilize the equipment.

6.2 ICT DATABASES AND SOFTWARE TOOLS

- It is quite possible to design a database from first principles using a high level programming language such as C++ or using a database such as Microsoft ACCESS. However this would take time and resources, instead of re-inventing the wheel, one can select from a range of already designed databases suitable for the work at hand.

- The BRAHMs or more appropriately the Botanical Research and Herbarium Management System has been developed and used over the years at the National Museums of Kenya and it has undergone numerous testing and refinements and is now a stable software. Being a locally developed software, it has its advantages in that there is an abundance of resources in knowledge, training and experience.

- For zoological collections, the Software known as SPECIFY would make a suitable choice.

SPECIFY is freeware downloadable from the web and has been specifically designed for collections management. Presently SPECIFY is being used extensively by the National Museums of Kenya to manage the zoological collections and has itself equal to the task of managing the collections data.

- Other software are Microsoft Access, Excel, Word for Windows, and PowerPoint. Adobe Photoshop has also been useful in digitization of specimens. GIS software, which would aid in biogeographical analyses such as ArcGIS should be added to the toolkit, however such software facilities would be suitable for institutions with sufficient professional ICT manpower

6.3 ICT MANPOWER RESOURCES

- Since numerous institutions do not have sufficient staff to carry out the computerization work, a two-pronged approach should be used to develop the human resource capacity of the organization.

- Because ICT manpower is lacking in most institutions and because such manpower has high turnover, it may be prudent to explore other alternatives for establishment of databases within regional institutions. What has worked is to identify motivated research scientists and laboratory technicians (para-taxonomists) and train them in ICTs and database management functions. The resultant staff would be more relevant with specialization in both taxonomy and ICTs.

6.4 ICT NETWORKING AND WEB ACCESS

- Internet is a critical tool which facilitates reliable, cheap and fast communication between parties. Its uses are multipurpose and it makes it possible to access taxonomic information easily available from various websites such as GBIF (www.gbif.org), International Plant Names Index (IPNI) (www.ipni.org) that can be used to update names and the like. There are numerous other databases that are available at the Royal Botanic Gardens Kew (UK), Missouri Botanical Garden (USA) and many avenues to access these online. Online Access to Research in Environment (OARE) is an international public-private consortium coordinated by the United Nations Environment Programme (UNEP), Yale University, and leading science and technology publishers with the aim of enabling developing countries to gain access to one of the world's largest collections of environmental science literature. Institutions can register and every scientist within the institutions can have free access to reputable international journals (www.oarescience.org). For researchers, access to journals, books and relevant publications is of high priority, the Internet provides an

- At local and regional level, reference databases can be made available for access by taxonomist. The databases can be hosted at selected focal institutions. Other tools and documentations such as newsletters, species checklist, maps, photographs, guidebooks, identifications keys can also be made accessible over the web.

- Networks add critical value to situations where resources are limited. They allow entry of data from distributed stations into one database. They also facilitate sharing of printers and access to the internet through one single point and shared by all the persons on the network. A local area network (LAN) would be an important component to have within a setting where taxonomic data need to be captured and a group of scientist need to access distributed resources.

- It is recommended that institutions with large specimen collections should establish small to medium sized networks with a fileserver to be the repository of the data. The network will

facilitate quicker data capture through multiple entries by several data entry staff.

6.5 DATA SHARING AND EXCHANGE ACTIVITIES

- The survey revealed that most institutions surveyed do not have policy for data sharing and exchange and operate on ad hoc arrangements or generalized MOUs to facilitate exchange and sharing. Although the object of having a policy document should not be to constrain sharing/exchange of information rather the aim should be to facilitate it and to ensure that the shared information is given a stamp of value and the owner is acknowledged. It is recommended that institutions formally develop a data sharing/exchange policy document based on the guidelines stated earlier.

- To facilitate information sharing and exchange BOZONET should establish national and regional websites on which regional specimen and taxonomic databases as well as useful taxonomic tools can be uploaded and made easily accessible to members of the network. Such a website can also be used to host various documentation, scientific literature and magazines for members of the network to access freely. For limited access to members of the Network, a regional portal is recommended where specialized information products, sensitive databases and various communications can be hosted.

6.6 ESTABLISHMENT OF NATIONAL AND REGIONAL FOCAL POINTS

- There is need to establish National Centers of Reference or focal points where national institutions to act as support and referral centers in ICT work. Already within each country there are specific national institutions which have shown themselves strong in the areas of Biodiversity databases, GIS systems, Internet and Web based tools. Specific areas of interest are plant databases systems and zoological databases systems. There cases where these may be one and the same institution and sometimes they are different institutions. Also these institutions are already playing a leading supportive role and only need to be recognized as providing leadership nationally and perhaps regionally as well. The following are suggested national reference centers for ICT within each country and regionally:

INSTITUTION MOST SUITED TO BE ICT REFERRAL CENTRE					
AREA OF SECIALISATION	**ETHIOPIA**	**KENYA**	**TANZANIA**	**UGANDA**	**REGIONAL**
PLANT DATABASES	ETH, AAU	EAH (NMK)	UDSM AND MUSEUM	MHU	EAH (NMK)
ANIMAL DATABASES	ZNHM, AAU	DIZ (NMK)	UDSM AND MUSEUM	NBDB	DIZ (NMK)

6.7 ICT NEEDS ASSESSMENT STUDY

- To this end a needs assessment study should be carried out to identify the ICT needs and to explore the various options that are available at local levels. Such a study would assess ICT manpower needs within institutions, assess available capacity in in-country training resources and make recommendations for manpower acquisition and development. The study would also assess the ICT capacity needs and requirements and assess the available ICT resources within the country make recommendations.

6.8 The need for a Regional Harmonisation Office (with ICT reference centre)

- In regional projects such as BOZONET, there are numerous activities which cut across the whole region. The demand, depth and complexity of these activities are often not envisaged at the outset, however they often become apparent once the project is underway. Often projects

make the common mistake of lumping regional planning into a national office as an extra responsibility and also do it on the cheap by allocating a minimal budget to the office. As the project commences there is late realization for the critical requirement for a strong regional office.

- Based on the lessons learnt in the SABONET project, planning and establishing a regional office will be critical to the success of the BOZONET. The need to harmonise activities between countries, to compile regional reports and to bring together regionally based effort towards achievement of regional and national goals are clear pointers towards the value and usefulness of a regional office. In cases where the national office is unable to put its case to the national governments and organisations, the regional office will be able to do so effectively as it is seen as an independent entity. These are some of the benefits of a strong regional office.

- The regional office should have several critical areas of interest. SABONET's regional office played a crucial role in its success by organizing and facilitating regional meetings, training activities, management and distribution of funds, ensuring regional harmonization, development of regional ICT systems, regional website, development of regional taxonomic products, communication through the internet and regional publications etc. The regional office helped the various SABONET institutions to stay in touch and these led largely to the success of the project.

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Project Development Workshop for the Global Taxonomy Initiative in Africa

Organised by: CBD Secretariat & BioNET

MEETING REPORT

The Workshop Participants (Photo: NMK)

National Museums of Kenya, Nairobi, Kenya
16th- 18th November 2009

CONTENTS

ABBREVIATIONS

CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPB	Cartagena Protocol on Biosafety
CSP	GEF Country Support Programme
DGEF	Division of GEF Coordination
GEF	Global Environment Facility
GISIN	Global Invasive Species Information Network
GTI	Global Taxonomy Initiative
I3N	IABIN Invasives Information Network
IABIN	Inter American Biodiversity Information Network
IAS	Invasive alien species
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IUCN	World Conservation Union
IYB	International Year of Biodiversity
M&E	Monitoring and evaluation
MEA	Multilateral Environmental Agreement
NBSAP	National Biodiversity Strategy and Action Plan
NCSA	National Capacity Needs Self Assessment for Global Environmental Management
NFAP	National Forestry Action Programme
NGO	Non Governmental Organisation
NHM	Natural History Museum (UK)
PDF-B	Project Development Facility, Block B (GEF project development grant)
POPs	Persistent organic pollutants
RAF	Resource allocation framework (GEF)
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice (of the CBD)
SCBD	Secretariat of the Convention on Biological Diversity
SDC	Swiss Agency for Development and Cooperation
SGP	GEF Small Grants Programme (implemented by UNDP)
STAP	Scientific and Technical Advisory Panel (of the GEF)
UNCCD	UN Convention to Combat Desertification
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

The Secretariat of the Convention on Biological Diversity (CBD) convened a project development workshop 16 – 18 November 2009 in response to paragraph 15 of CBD decision VIII/3. The aim was to promote country-driven projects under the Global Taxonomy Initiative (GTI).

The technical aspects of the workshop were organised by the Secretariat of BioNET, the Global Network for Taxonomy (BioNET-Sec) with support from the Natural History Museum, London (NHM) and the Global Invasive Species Information Network (GISIN) with logistics being organised by BioNET-EAFRINET through its regional coordinating organisation the National Museums of Kenya (NMK).

The principal objective of the workshop was to develop concept notes for fundable projects that implement the GTI with a focus on invasive alien species (IAS) and protected areas. A subsidiary but still important function of the workshop was to train participants in the art of proposal writing.

Potential workshop participants from all over Africa submitted project outlines that addressed taxonomy and invasive species to the workshop organising committee in September 2009. Project participants were selected according to the clarity, logic and feasibility of their project outlines as well as the relevance of these project outlines to IAS and taxonomy, protected area management, and national, regional and international developmental priorities. 21 project outlines were submitted of which the following 12 were selected for further development at the workshop:

1. Establishing an IAS monitoring database for ecologically sensitive areas in East Africa.
2. The taxonomic infrastructure to support invasive species management: building the short-term and long-term solutions.
3. Building capacity to mine data from botanical collections in order to monitor changes in alien invasive species and possible climate change.
4. Development of an identification guide for alien weeds and invasive plants for East Africa.
5. Diversity and sustainable use of macrofungi in selected forest reserves of Ghana.
6. Management of invasive alien plants in agriculture, forestry and rangeland from prevention to control.
7. The effect of the invasive *Prosopis* spp on indigenous plant-pollinator interactions in Lake Bogoria National Reserve.
8. Community engagement in marine IAS, taxonomy and marine protected area management.
9. Assessment and mapping of invasive alien plants in the Serengeti Ecosystem: Case study of Ngorongoro, Serengeti and Ikorongo-Grumeti Reserves, Tanzania.
10. Integrated invasive species management and protected area development.
11. Mainstreaming pro-poor urban and rural community forest conservation to restore mangroves ecosystem.
12. Capacity building to support research and extension programs for sustainable management of invasive fruit fly species in West Africa.

Twenty workshop participants from Western, Eastern and Southern Africa were selected

Participants were supported by four international resource persons representing the Secretariat of the CBD (SCBD), BioNET-Sec, NHM and GISIN, who were available throughout the workshop. In addition the Executive Director of the Global Invasive Species Programme (GISP) and the IUCN Global Coordinator for Invasive Species and donor representatives from UNEP/GEF and JICA were available as resource persons on Day 1. In addition to the international resource persons, many of the participants also brought with them considerable project development and project implementation experience. Together with the resource persons, the participants provided a valuable source of peer review which helped to expose the project ideas to critical appraisal early in their gestation.

The workshop programme was a mix of presentation, plenary discussions and breakout sessions. Training in proposal writing was principally "learning by doing" but supplemented by presentations on key areas such as donor priorities, background on invasive species issues in Africa, the role of taxonomy in invasive species management, the project development process, the GTI and the mechanics of proposal writing, notably a session on the logical framework process. Plenary sessions served to introduce participants and their project ideas to the group, elicit overall feedback on the submitted project outlines and to gather and crystallise ideas generated and discussed during the breakout sessions. The bulk of the workshop was spent in the breakout sessions where project ideas were developed by project proponents working together with their peers and the resource persons.

The 12 project outlines were grouped into four "project clusters" - groups of projects with common themes – as follows: 1) collections and databases; 2) IAS management; 3) agro-biodiversity; and 4) protected areas. Participants worked together with others whose project was grouped in the same project cluster when developing their project ideas in the breakout sessions in order to facilitate peer review and if possible inter-project synergies. Project development guidelines, compiled by BioNET-Sec, had been circulated to participants prior to the workshop. These guidelines, which outlined the components of a typical project proposal, were used as a basis to evaluate and refine project outlines into project concepts during the breakout sessions.

It was emphasised that subjecting the project ideas to critical analysis at this stage would save a great deal of time and heartache later on. The following four possible outcomes for project ideas as a consequence of this critical review were outlined: 1) ideas maintained; 2) ideas revised; 3) ideas merged; and 4) ideas abandoned. Eight of the twelve project ideas were maintained, two were revised and two were merged.

The participants agreed that the workshop had been a very encouraging first step towards success, i.e. translating ideas into projects that would ultimately have tangible impacts. To maintain the momentum built by this workshop the following "next steps" were agreed:

- Refine project ideas into fully fledged project proposals following a consultative process including contacting relevant national authorities.
- Continue to subject proposal iterations to critical review by selected workshop resource people.
- Identify and approach potential donors and keep abreast of calls for proposals.
- Utilise national, regional and global plans, initiatives, organisations and meetings as vehicles through which to promote project ideas and proposals. e.g. NBSAPs, AFRICOM, BioNET-Sec and the African BioNET LOOPs (NAFRINET, WAFRINET, SAFRINET and EAFRINET) and the CBD notably through the 2010 SBSTTA and COP meetings (notably through the post 2010 strategic plan and targets) and through events to celebrate the International Year of Biodiversity (IYB 2010).

BioNET-Sec is facilitating the follow up work in the context of, among others, The UVIMA Project with support of workshop resource persons.

Travel and subsistence costs for the workshop were provided by the Government of Spain with additional support being provided by the Swiss Agency for Development and Cooperation and the US National Biological Information Infrastructure, through its partnership with the Polistes Foundation.

INTRODUCTION

This workshop was convened in line with paragraph 15 of decision VIII/3 the Conference of the Parties to the Convention on Biological Diversity (CBD) which requested the Executive Secretary to convene, with support from relevant organisations and donors, a project development seminar aimed primarily at those countries who have already identified taxonomic needs or that have submitted proposals for pilot projects under the Global Taxonomy Initiative (GTI), to promote formulation of country-driven projects based on identified taxonomic needs and to explore potential benefits of developing new, and enhancing existing, regional or global projects to address common taxonomic needs that have already been identified.

The technical aspects of the workshop were organised by the Secretariat of BioNET-INTERNATIONAL, the Global Network for Taxonomy (BioNET-Sec) with logistics being organised by BioNET-EAFRINET through its regional host organisation the National Museums of Kenya (NMK).

The Government of Spain has made a contribution to support the travels of experts from developing countries, CBD Parties and Parties with economies in transition to participate in this workshop. Additional financial support was provided by SDC (Swiss Agency for Development and Cooperation) and the US National Biological Information Infrastructure, through its partnership with the Polistes Foundation.

In kind support was provided by BioNET-Sec, BioNET-EAFRINET, NMK, the UK Natural History Museum (NHM) and the Secretariat of the Convention on Biological Diversity (SCBD).

The principal objective of the workshop was to develop concept notes for fundable projects that implement the GTI with a focus on IAS and protected areas. A subsidiary but still important function of the workshop was to train participants in the art of proposal writing. The training was principally "learning by doing" but this was supplemented by formal presentations on key areas such as donor priorities, background on invasive species and the GTI and the mechanics of proposal writing, notably a session that sought to demystify the logical framework process.

A key part of this workshop was the preparatory process. Potential participants were contacted and asked to produce an outline of a project that addressed taxonomy and invasive species. This document was to be a maximum of 400 words (excluding any supporting documentation). The following were suggested headings: project title; aims and objectives; outputs; duration; estimated overall budget; links to existing projects; possible co-funding sources; possible executing institutions; suggested donors and participating countries/region/sub-region. The project outlines were evaluated according to the following criteria: clarity and logic, feasibility; degree to which IAS issues were addressed; the degree to which taxonomy featured; the degree to which proposals addressed protected area concerns; and the degree to which projects mainstreamed development issues. Those scoring the highest overall marks were selected. This process served to select participants who were seriously committed to developing fundable projects and helped potential participants clarify their thinking prior to the workshop. 21 project outlines were submitted of which 12 were selected for further development at the workshop. The selected participants were given a short document *Guidelines for Project Development* prior to the workshop that summarised the project development process (Appendix E).

Workshop resource persons were selected in consultation with the GTI Coordination Mechanism, taking into account regional and sectoral participation. Four international resource persons, all with considerable project development experience, were available throughout the workshop. In addition the Executive Director of the Global Invasive Species Programme (GISP) and the IUCN Global Coordinator for Invasive Species and donor representatives from UNEP/GEF and JICA were available as resource persons on Day 1. Many of the participants also brought with them considerable project development and project implementation experience. Together with the resource persons, the

participants provided a valuable peer review resource which would help expose the project ideas to critical appraisal early in their gestation.

The programme (Appendix A) was a mix of presentations, plenary discussions and breakout sessions. The presentations provided the participants with an overview of invasive species issues in Africa, the role of taxonomy in invasive species management, the project development process, donor priorities and other key background issues. Plenary sessions served to introduce participants and their project ideas to the group, to elicit overall feedback on the submitted project outlines and to gather and crystallise ideas generated and discussed during the breakout sessions. The bulk of the workshop was spent in the breakout sessions where project ideas were developed by project proponents working together with their peers and the resource persons.

DAY 1

Opening and Introductory Session

Opening Address: Dr. Geoffrey Mwachala (Head of Botany, NMK, Kenya)

Dr. Mwachala opened the workshop and in so doing made the following points:

- There is intricate linkage between biodiversity conservation and livelihoods
- The realization of the world that effective and sustainable biodiversity is undermined by taxonomic barriers gave rise to the GTI, requiring parties to undertake certain activities aimed removing such barriers.
- There needs to be an understanding that knowledge begins with calling things with their right and distinctive names. For instance, distinguishing a pollinator from a pest is the first important step towards getting a solution for pest control and improved agricultural production.
- The most important step therefore towards attainment of sustainable biodiversity conservation and economic developments is to remove taxonomic barriers taking into account national, regional and global needs.

Dr. Mwachala singled out the present workshop as being an opportunity to develop projects that can help to remove these taxonomic barriers.

Introduction, logistics, adaptive agenda workshop objectives & self-introduction of participants: Dr. John Mauremootoo (Regional Partnerships Officer, BioNET Secretariat)

The principal workshop objective was reiterated as was the process whereby participants were selected for participation. The fact that this was very much a workshop and not a talking shop was emphasised. It was hoped that the workshop would develop the participant's capacity to successfully develop projects but it was not a training workshop in the traditional sense. The emphasis was very much on 'learning by doing'. It was therefore essential to keep presentations and discussions to time so that enough time was available for the development of project outlines in breakout sessions.

The workshop participants and facilitators introduced themselves, their proposed projects and their expectations for the workshop. The following list is a summary of the participant's expectations:

- The production of fundable project proposals (which the majority of participants cited as an expectation).
- Improved understanding of the project development process.
- To learn of successful approaches to IAS management undertaken by or known to other participants.
- The strengthening of networks and general networking for various reasons including:

- Strengthening of IAS management capacity.
- Improvement of information.
- The documentation of heritage.

John reiterated the fact that participation in this workshop does not mean that the participant's proposed project will be funded. Rather the workshop provides an environment in which the proponents will have the opportunity to sharpen their thinking in the area for which they are seeking funds. Critical but supportive feedback from resource people and fellow project proponents should help to refine project ideas so that an external reviewer can clearly see that the project proponent is using taxonomy to address development priorities including those of the CBD. The workshop also provides a significant platform to promote the potential project. The seminar report, CBD meetings and the CBD and BioNET Secretariats can be used as promotional vehicles for these concepts, notably at SBSTTA 14 which will be held in Nairobi, Kenya in May 2010. In the final analysis, however, the return generally depends upon the investment. Project development is often a long and frustrating process and a great deal of the workload inevitably falls upon the project proponent.

The Global Taxonomy Initiative and the IAS Programme of Work of the CBD: Dr. Junko Shimura (Programme Officer, Taxonomy and Invasive Species, Secretariat of the CBD)

The presentation began with a short overview of the Convention on Biological Diversity (CBD) which commits governments to: take appropriate measures to conserve biological diversity; ensure the sustainable use of biological resources; and to promote the fair and equitable sharing of benefits arising from the use of genetic resources. Under the CBD governments agree to: prepare national biodiversity strategies and action plans; identify genomes, species and ecosystems crucial for conservation and sustainable use; monitor biodiversity and factors that are affecting biological systems; establish effectively managed systems of protected areas; rehabilitate degraded ecosystems; exchange information; conduct public information programmes; and implement various other activities to meet the objectives of the CBD.

The Global Taxonomy Initiative (GTI) is a cross-cutting programme under the CBD. The GTI aims to remove the taxonomic impediment (the fact that in most countries in the world, there is too little taxonomic expertise, information and infrastructure available to enable them to work with their biota in the way they need). The GTI was developed by the Parties (to the CBD) to:

- Identify taxonomic needs and priorities;
- Develop and strengthen human capacity to generate taxonomic information;
- Develop and strengthen infrastructure and mechanisms for generating taxonomic
- information, and for facilitating sharing of and access to that information; and
- Provide taxonomic information needed for decision-making regarding the conservation of biological diversity, sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources (the three objectives of the CBD).

The programme of work for the GTI has 18 planned activities under 5 operational objectives:

- **Operational objective 1:** Assess taxonomic needs and capacities at national, regional and global levels for the implementation of the Convention.
  - *Planned Activity 1:* Country-based taxonomic needs assessments and identification of priorities.
  - *Planned Activity 2:* Regional taxonomic needs assessments and identification of priorities.
  - *Planned Activity 3:* Global taxonomic needs assessments.
  - *Planned Activity 4:* Public awareness and education.

- **Operational objective 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.
  - *Planned Activity 5*: Global and regional capacity building to support access to and generation of taxonomic information.
  - *Planned Activity 6*: Strengthening of existing networks for regional cooperation in taxonomy.
- **Operational objective 3:** Facilitate an improved and effective infrastructure/system for access to taxonomic information; with priority on ensuring countries of origin, gain access to information concerning elements of their biodiversity.
  Target under operational objective 3: A widely accessible checklist of known species, as a step towards a global register of plants, animals, microorganisms and other organisms.
  - *Planned Activity 7:* Develop a coordinated taxonomy information system
- **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.
  - *Planned Activity 8*: Forest biological diversity.
  - *Planned Activity 9*: Marine and coastal biological diversity.
  - *Planned Activity 10*: Dry and sub-humid lands biodiversity.
  - *Planned Activity 11*: Inland waters biological diversity.
  - *Planned Activity 12*: Agricultural biological diversity.
  - *Planned Activity 13*: Mountain biological diversity.
  - *Planned Activity 13b*: Island biological diversity.
- **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.
  - *Planned Activity 15*: Invasive alien species.
  - *Planned Activity 16*: Support in implementation of Article 8 (j).
  - *Planned Activity 17*: Support for ecosystem approach and CBD work on assessment including impact assessments, monitoring and indicators.
  - *Planned Activity 18*: Protected areas.

Taxonomy can offer services in all areas relevant to the CBD such as climate change : adaptation and mitigation landscape change ; invasive alien species; pollution; over exploitation; agricultural development; food security; human health and access and benefit sharing.

With regard to this workshop, Junko emphasised the fact that doing taxonomy for taxonomy's sake was unlikely to get funded by most donors. Taxonomy had to provide the tools for the achievement of the ultimate objectives of the CBD – conservation of biological diversity and the fair and equitable sharing of its benefits.

The *impact of invasive species in Continental Africa – and some Taxonomic Issues: Dr. Geoffrey Howard (Global Invasive Species Coordinator, IUCN)*

Continental Africa comprises mainly of tropical countries with many neighbours (up to 8); all have cross-border ecosystems and porous borders; most have limited capacity for biosecurity.

Mainland Africa has very few vertebrate invaders. Alien mammals are very few in tropical Africa. IAS are restricted to the Black rat (*Rattus rattus*). The coypu (*Myocastor coypus*) is established but is rare, feral dogs and domestic cats are absent. In temperate Africa there are some established mammals - deer and foreign ovids. The cane toad (*Bufo marinus*) is present and invasive in Egypt

(temperate Africa) and has the potential to move up the Nile (South) to the tropics. There are some invasive bird species in tropical Africa e.g. the Indian house crow (*Corvus splendens*) and the Indian minah (*Acridotheres tristis*) but the major group of invasive vertebrates are the fish (e.g. Nile tilapia *Oreochromis niloticus* and the common carp *Cyprinus carpio*) which have been intentionally introduced and spread naturally. Geoffrey touched briefly on invertebrates, giving some information on exotic crayfish which are reported to be spreading in Africa. He did not discuss invasive insect species and other arthropod groups.

The most prominent invasive species are plant invaders. There are many alien invasive plants in Africa that cause extensive damage to biodiversity as well as to human development, health, food production and livelihoods. Many of these species come from tropical America, Asia and Australia. These are probably the most harmful exotics in continental Africa as they are widespread, and continuing to expand in terms of their distributions and impacts - yet they remain largely un-noticed and so ignored – to the future peril of Africa. Alien invading plants in mainland Africa presently include Water hyacinth, *Eichhornia crassipes*, and other aquatics (and semi-aquatics) such as *Pistia stratiotes*, *Salvinia molesta*, *Azolla filiculoides*, *Hydrilla verticillata*, *Limnocharis flava*, *Mimosa pigra*, *Mimosa invisa*, *Arundo donax*; shrubs such as *Lantana camara*, *Chromolaena odorata*, *Calotropis procera*, *Senna didymobotrya*, *Senna hirsuta*, *Thevetia peruviana*; climbers such as *Cryptostegia grandiflora*, *Cardiopspermum grandiflorum*, *Rubus* spp., *Solanum seaforthianum*; trees such as *Acacia mearnsii*, *Prosopis* spp., *Cedrela odorata*, *Broussonetia papyrifera*, *Senna spectabilis*, *Azadarachta indica*, *Leucaena leucocephala*, *Parkinsonia aculeata*, *Calliandra houstoniana* and many grasses and herbs such as *Chromolaena odorata*, *Parthenium hysterophorus*, *Canna indica*, *Striga* spp., *Ageratum* spp., *Solanum incanum*, *Tithonia diversifolia*, *Tithonia rotundifolia* and *Montanoa hibiscifolia*.

The example of the spread of *Parthenium hysterophorus* as an expanded problem in Africa was outlined. The species rapidly spreads along roads and can cause problems in pastures, crops, in peri-urban areas and in protected areas. For example parthenium threatens crops unless weeded at regularly, but people get sick while weeding with respiratory problems and eczema.

Some important practical taxonomic issues related to appreciation, prevention and management of biological invasions in mainland Africa are:

1. Recognition of actual or potential invasives e.g. related species may or may not be invasive and it is important to know the difference.
2. Correct identification of suspect species. e.g. people frequently report the presence of the Indian house crow when in fact it is the native crow they have seen.
3. Correct reporting of actual invasions. e.g. many fresh water plant invasions are reported as being water hyacinth when they are not. This has management implications (see point 5).
4. The possibility of likely invasibility in related species. Invasiveness may have taxonomic underpinnings so knowing that a close relative of an invasive is present should encourage further investigation of that species.
5. Specificity of possible biocontrol agents. When seeking reliable biocontrol agents for invading species, we need to look at the susceptibility of related species – especially those in the same family and with similar plant habits

Donor Perspectives & Successful Project Development Approaches

Presentations by JICA and UNEP/GEF were given during this session. A planned presentation on the LifeWeb Initiative was postponed until Day 3.

JICA's Cooperation in Forestry and Nature Conservation: John Ngugi (JICA)

JICA’s mission and policy, strategy for forest and nature conservation and an overview of JICA’s approach to biodiversity were outlined.

JICA's mission is as follows*: We, as a bridge between the people of Japan and developing countries, will advance international cooperation through the sharing of knowledge and experience and will work to build a more peaceful and prosperous world.* JICA's overseas development charter (2003) sets out four priority issues: poverty reduction, sustainable growth, addressing global issues and peace keeping. JICA's overseas cooperation consists of bilateral support through grants and loans and multilateral support through contributions to international organisations.

JICA's project sites in the area of nature conservation and forest management were shown. Eight of these are in Africa. These include sites in Burkina Faso, Mali, Gabon, Ethiopia, Madagascar and Malawi. JICA's strategy of forest and nature conservation is based upon addressing the vicious circle of poverty, excessive human activity and the destruction of the natural environment which means focusing on the human activity – natural environment nexus to achieve harmony between nature and human activities. This is to be achieved by understanding systems (research, study and community awareness), protection (policy/institutional improvement, capacity and technology development) and use (community-based livelihoods and natural resource use and sound forest management). These have been translated JICA's three major intervention areas: sustainable use of natural resources by communities, biodiversity conservation and sustainable forest management. Current overarching issues that affect these issues include: governance for forestry and nature conservation, climate change, corporate social responsibility and multilateral framework building.

Details of the process of preparing project proposals for JICA were outlined and are summarised in figure 1 below:

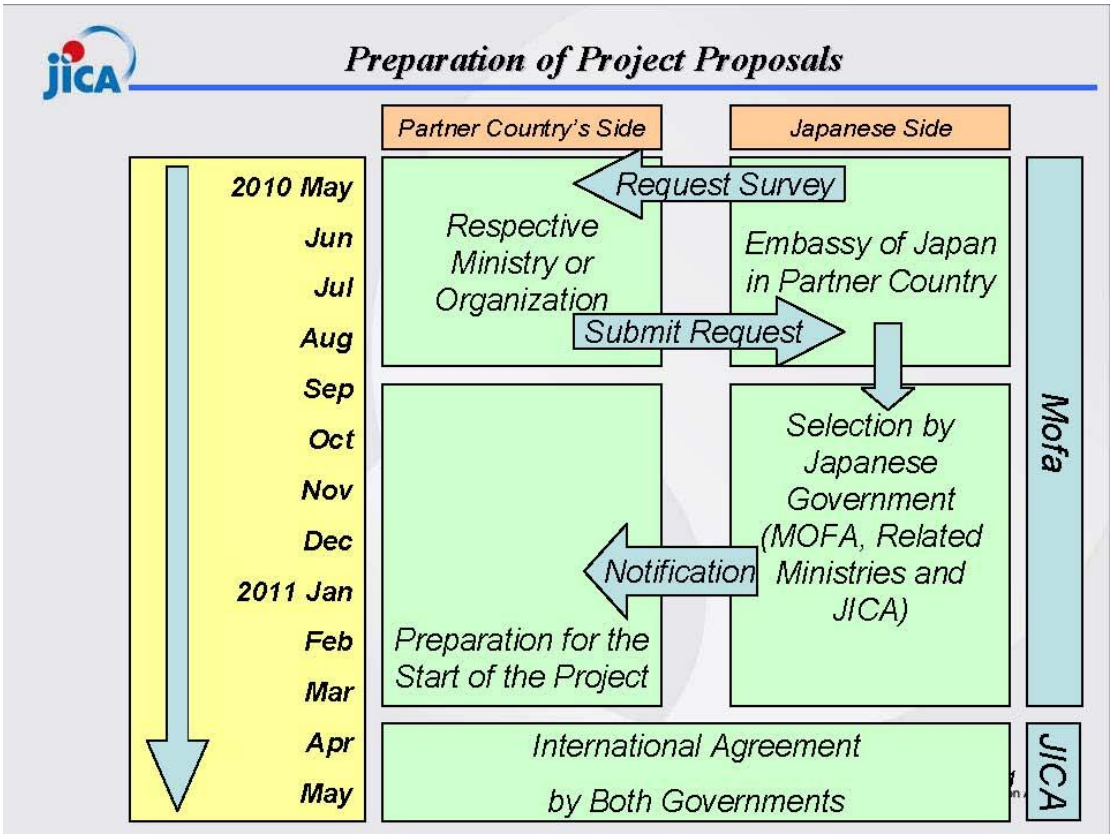


Figure 1. Schematic outline of the process of submitting project proposals for JICA funding

The presentation closed by highlighting the areas that are in JICA's opinion the most important common problems in biodiversity and ecosystem conservation that need to be addressed: land management (loss of wildlife habitats, fragmentation of natural forests / ecosystems, etc.); habitat quality (logging, pollution - water quality, soil condition air quality, etc.) and species / population issues (poaching, invasive species, heavy commercial harvesting, etc.). A common overarching issue

is a lack of coordination between agencies and weak cooperative governance processes. It was recommended that efforts are made to develop a mechanism to link multiple agencies and consolidate conservation efforts by different institutions under an integrated conservation framework (a cross-sectoral approach). JICA could support such efforts through bilateral cooperation.

Overview of the GEF: Stephen Twomlow (Senior Programme Officer, UNEP/DGEF)

Stephen began the presentation with a brief overview of the Global Environment Facility (GEF) and its origins.

GEF is the mechanism for financing "incremental costs" of new "global environmental" actions by developing countries. Incremental costs can be defined as the difference in scenarios between the "baseline" or "what would happen without GEF intervention" and an "alternative". The GEF intervention constitutes the new "global environmental" actions that will result in that "alternative" scenario, the cost of which will be borne by GEF.

GEF is the designated financial mechanism for: the CBD, United Nations Framework Convention on Climate Change (UNFCCC), the Stockholm Convention on Persistent Organic Pollutants (POPs) and it is a financial mechanism for the United Nations Convention to Combat Desertification (UNCCD)

GEF also closely cooperates with other international agreements and treaties with common global objectives (on international and transboundary water systems and the Montreal Protocol on Substances that Deplete the Ozone Layer).

The GEF Council is the main governing body of the GEF with primary responsibility for developing, adopting, and evaluating GEF programs. The Council meets every 6 months to review and approve all projects. The GEF Assembly is composed of all (168) member countries. It meets every 3 years to review general policies, operations, and amendments to the GEF Instrument. The GEF Secretariat, based in Washington, D.C, coordinates the formulation of projects included in the annual work programme, oversees the implementation of this programme, and makes certain that operational strategy and policies are followed. GEF projects are managed through its implementing agencies, which include UNEP. The STAP (Scientific and Technical Advisory Panel) provides objective scientific and technical advice on GEF policies, operational strategies, and programs, conducts selective reviews of projects in certain circumstances and at specific points in the project cycle, and maintains a roster of experts. Each country receiving GEF assistance has designated government officials responsible for GEF activities: a political focal point who coordinates matters related to GEF governance and an operational focal point who oversees project related matters. These focal points help ensure that projects arise from their country's own priorities. The GEF governance framework is depicted schematically in Figure 2.

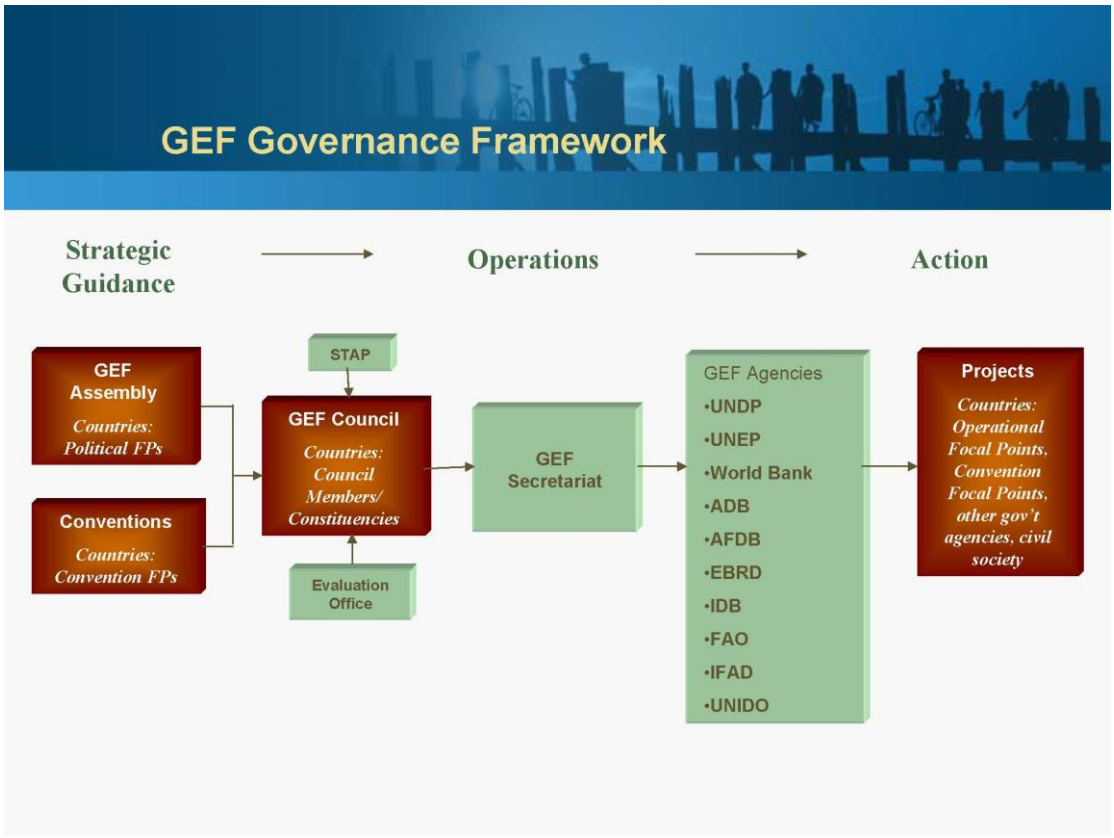


Figure 2. Schematic representation of the GEF governance framework

Stephen outlined the financial history of the GEF and the relative allocations to its different focal areas (biodiversity, climate change, international waters, land degradation, multi-focal areas, ozone depletion and POPs). Biodiversity and climate change received approximately equal allocations in 2007 (approximately 30% each of total GEF disbursements).

The allocation of scarce GEF resources to all eligible countries is based upon a resource allocation framework (RAF). Allocations are based on global environmental benefits in each focal area and country level performance. In the Biodiversity focal areas for GEF 4 countries receive individual allocations or countries have joint access to group resources.

The GEF agencies are requested to focus their involvement in GEF project activities within their respective comparative advantages. UNEP is the only GEF Agency whose core business is the environment. UNEP plays a key role in assisting countries assessing GEF funds through supporting the development and execution of GEF projects that fit within its comparative advantage:

- Regional and Global initiatives
- Assessments
- Capacity Building
- New approaches such as field scale development of payments for ecosystem services (PES) approaches, the assessment of below ground Biodiversity and the status and trends in pollination services.

The GEF project cycle, from development of a concept paper to project completion and evaluation was outlined. This process holds for GEF 4 but may change slightly for GEF 5 although the essence is likely to be unchanged. A key stage early in the project cycle is the endorsement of the National GEF Operational Focal Point. Following this the GEF agencies work with countries on three major phases: project preparation & approval; project implementation; and project closing & evaluation. The

details of the project cycle vary between the type of GEF project under consideration. Projects under the Small Grants programme (SGP) are approved by the UNDP country programme office. The project cycle for a full size project and that for a medium size project are shown in Figures 3 and 4. Full size projects are subjected to a more complex review and approval process.

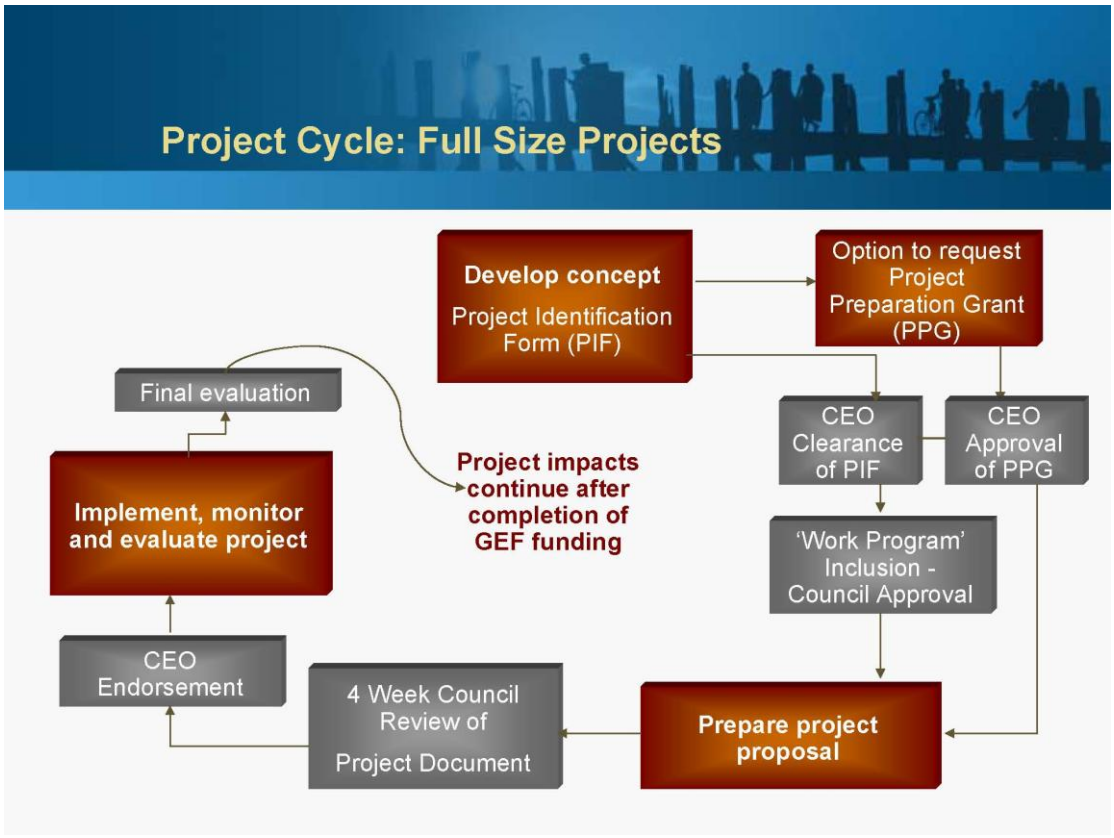


Figure 3. The GEF project cycle for a full size project

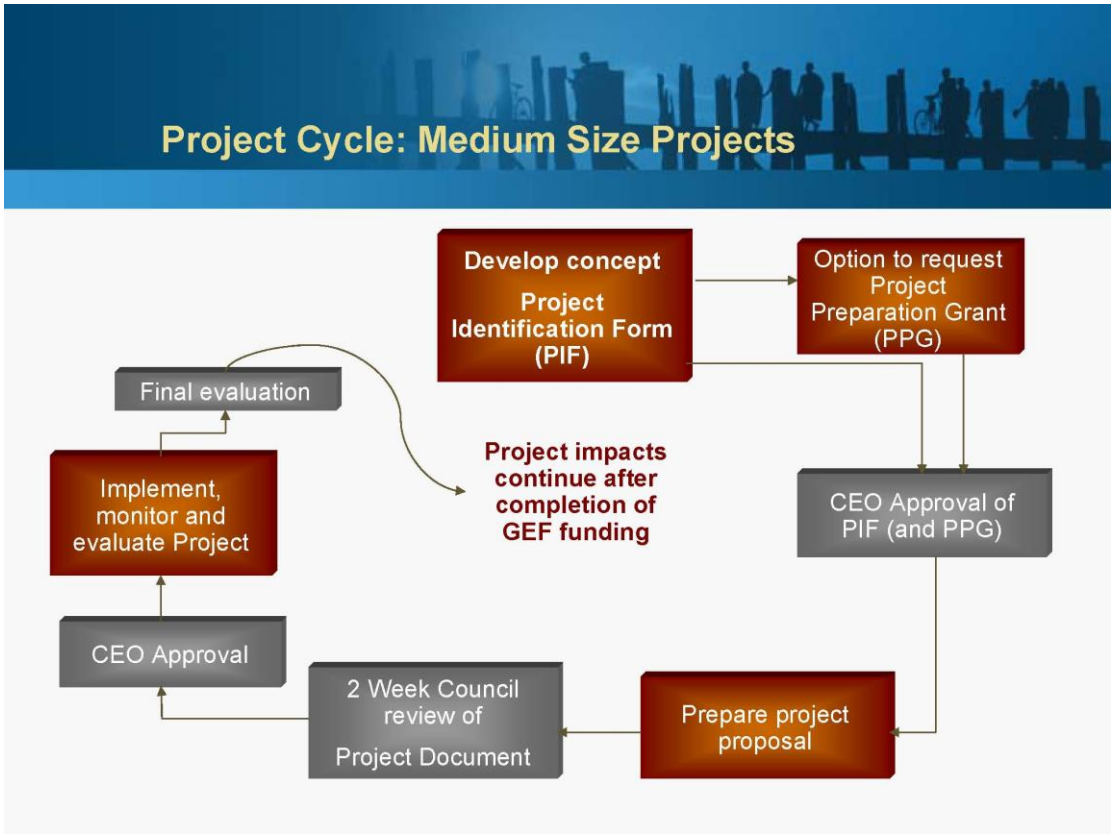


Figure 4. The GEF project cycle for a medium size project

The vital role of countries in identifying national priorities for GEF funding, developing a comprehensive and coherent GEF strategy in consultation with key stakeholders and in integrating GEF priorities within broader national environment and sustainable development frameworks was emphasised.

Any project not yet in the GEF pipeline will be submitted for funding under GEF 5. Replenishment negotiations have recently begun and will be completed in early 2010. Biodiversity funds will be allocated according to four objectives:

- Objective One: Improve Sustainability of Protected Area Systems
  - Increase Financing of Protected Area Systems
  - Expand Ecosystem and Threatened Species Representation within Protected Area Systems
  - Improve Management Effectiveness of Existing Protected Areas
- Objective Two: Mainstream Biodiversity Conservation and Sustainable Use into Production Landscapes/Seascapes and Sectors
  - Strengthen the Policy and Regulatory Framework for Mainstreaming Biodiversity
  - Implement Invasive Alien Species Management Frameworks
  - Produce Biodiversity-friendly Goods and Services
- Objective Three: Build Capacity for the Implementation of the Cartagena Protocol on Biosafety (CPB)
  - Single-country projects
  - Regional or sub-regional projects
  - Thematic projects
- Objective Four: Build Capacity on Access to Genetic Resources and Benefit Sharing (ABS)
  - Still under negotiation

In terms of things that can be achieved following this workshop for those seeking to develop a project for GEF funding Stephen recommended the following:

- Identify national/regional/global priorities for GEF and other donor funding.
- Develop a comprehensive and coherent strategy/program in consultation with key stakeholders that meet GEF and other donor requirements.
- Develop novel ideas.
- Get GEF National Operational Focal Points endorsements.

Successful development of invasive species projects – lessons from Latin America: Silvia Ziller (Institute Horus)

Silvia introduced the Global Invasive Species Information Network (GISIN) as a network for invasive species management with the following functions among others: a way of summarising dispersed and difficult to access information; a way of assessing knowledge gaps; a tool for better forecasting; a means of enhancing understanding of the IAS problem and a way of catalysing local actions.

GISIN is a distributed network that provides a framework that allows invasive species databases to be accessed by other servers, facilitates the use of data from a variety of providers and standardises and integrates data.

The first GISN product was an online list of IAS systems created in 2004. GISIN then conducted a global IAS information needs assessment. There were a great number of knowledge gaps. e.g. 50% of respondents did not know what level of web services their organization provides and/or uses and 80% did not know what existing protocols are appropriate for IAS information management. There were equally large data gaps. Only 30 of 194 countries had online IAS databases and while plant databases are relatively common, those relating to invertebrates/others were not.

GISIN has laid out principles for information sharing:

- Fill information gaps
- Provide easy info access
- Integrate data from all partners
- Facilitate incorporation of data into global networks
- Enhance the public's understanding of the problem

GISIN has also laid out rules for (invasive species) information sharing:

- Interpret scientific data so that it is useful to the non-scientist
- Maintain provider-controlled data
- Respect intellectual property rights
- Provide open access to information

Silvia presented the work of I3N, the Invasives Information Network of IABIN (Inter American Biodiversity Information Network) as an example of the development of an information network based on GISIN's principles.

There were common problems related to biological invasions in the Americas: a lack of data; a lack of knowledge; and a lack of perception. Following the 2004 GISIN workshop in Baltimore the I3N database was developed and a negotiation and awareness process was undertaken with IABIN focal points and I3N leads. Training workshops were held in 19 countries in the Americas between 2005 and 2009. Between 2004 and 2009 the following tools were developed: national invasive species databases; species risk assessment modules (plants, terrestrial vertebrates, fishes); and a vectors and pathways assessment module. These tools are available in English, Spanish and Portuguese. The network has the following advantages:

- The results of risk assessments can serve other countries under similar conditions.
- Vectors and pathways assessments can benefit from information available throughout the continent and especially in neighbouring countries.

- Information from neighbouring countries can be used in prevention efforts.
- Information available for multiple countries can trigger joint efforts against IAS.

Silvia presented the example of Brazil in which the I3N work has helped to stimulate activity on invasives. State programmes for IAS have utilised official lists based on the I3N information; control of invasives is compulsory in protected areas and invasive seedlings are forbidden in public nurseries. There is also increased work at the municipal level with invasive species being removed from some city parks and invasive street trees being replaced by natives in some municipalities.

Plenary Session – Presentation and Preliminary Review of Project Ideas

Each participant or spokesperson for a group of participants presented their project ideas (Appendix C). Preliminary discussions of the project ideas focused on the following evaluation criteria: feasibility, relevance, effectiveness, efficiency, impact and sustainability. The projects were grouped into "project clusters" - groups of projects with common themes. Participants would work together with others in the same project cluster when developing their project ideas in the following days to facilitate peer review and if possible inter-project synergies. The project titles, project proponents and the thematic areas into which they were grouped are given in Table 1.

Table 1. Project outlines, project proponents and common thematic areas.

Project title	Project proponents	Project Cluster
Establishing an IAS monitoring Database for Ecologically Sensitive areas in East Africa.	Bernard Risky Agwanda	Collections and databases
Diversity and sustainable use of macrofungi in selected Protected Area forest reserves of Ghana.	Mary Apetorgbor	IAS management
Community engagement in marine IAS, taxonomy and MPA management.	Adnan Awad & James Kairo	Protected areas
Management of Invasive Alien Plants in Agriculture, Forestry and Rangeland from Prevention to control.	Oumar Balde	IAS management
Capacity building to support research and extension programs for sustainable management of invasive fruit fly species in West Africa	Aimé Bokonon-Ganta	Agro-biodiversity
Assessment and mapping of invasive alien plants in the Serengeti Ecosystem. Case study of Ngorongoro, Serengeti and Ikorongo-Grumeti Reserves, Tanzania.	Hamza Kija	Protected areas
The effect of the invasive Prosopis spp on indigenous plant-pollinator interactions in Lake Bogoria National Reserve.	Wanja Kinuthia & Chris Odhiambo	IAS management
The taxonomic infrastructure to support invasive species management: Building the short-term and long-term solutions.	Chris Lyal	Collections and databases
Integrated invasive species management and protected areas development.	Melckzedeck Osore & Soud Juma	Protected areas
Mainstreaming pro-poor urban and rural community forest conservation to restore mangroves ecosystem	Melckzedeck Osore & Soud Juma	Protected areas
Building capacity in order to mine data from botanical collections in order to monitor changes in alien invasive species and possible climate change.	Tebogo Rampho	Collections and databases
Development of an identification guide for alien weeds and invasive plants for East Africa.	Arne Witt	Collections and databases

DAY 2

The day began with two presentations followed by working group sessions in which the participants continued to refine their projects.

Presentations

The many roles for taxonomy in invasives management: Dr. Christopher Lyal, British Natural History Museum

Chris presented the results of a taxonomic needs assessment for invasive species management conducted by the British Natural History Museum and BioNET with support from GISP.

This was the first global level assessment of the taxonomic support needed to manage invasive alien species.

The results of this assessment confirm and help explain why taxonomy is a critical tool for combating the threats from invasives. Results and recommendations are based on analyses of selected documentary and expert sources. They provide a reference and framework for action for agencies and authorities responsible for invasives management; for taxonomic institutions; and for networks, funders, coordinating and policy bodies.

Three broad types of need were identified:

I end-users: taxonomic outputs and service's needed by non-taxonomists for invasives management

II within institutions: taxonomic capacity, information resources and prioritisation within institutions in order to deliver those services

III across institutions: activities and prioritisation of needs at a level above individual institutions, to enable them to implement the changes required.

The main needs are:

- Lists of names of invasives, including taxonomic names, synonyms and vernacular names, to be created, maintained and made available.
- Pathway and distribution mapping and modelling, and threat assessment, to be facilitated by specimen- and observation-based data on invasives captured and made available through a global system.
- Modelling tools to be developed and made available.
- Sustainable identification services for invasives at appropriate geographical levels facilitated and supported.
- Identification tools in appropriate format and language, including high numbers of images, created and their availability improved.
- Reference collections established and maintained at appropriate institutions nationally or regionally.
- Improvement of understanding of taxonomic needs associated with management of invasives by all parties.
- Access to taxonomic information to be considered at the planning stage of management and control programmes and measures to ensure this built into plans.

Innovation in delivering taxonomy to end-users is essential to respond to the threat posed by invasives with necessary urgency, making best use of available capacities. Much can be achieved by promoting, mobilising and packaging existing information according to user needs.

GISIN and the use of I3N tools to share standardized invasive species information (Silvia Ziller)

Silvia gave a follow-up presentation – a walkthrough of the I3N IAS database developed between 2004 and 2005. She showed the front screen and different ways of searching for information such as by species name and other levels in the taxonomic hierarchy, by vectors, pathways and diet. Other searches that could be done, for example for experts, projects, bibliography and controlled vocabulary were also presented. Processes for inputting data and quality control were outlined. The I3N tools for risk analysis for species introductions and vectors and pathways were also introduced.

More information is available on:

- www.gisin.org
- http://i3n.iabin.net
- www.gisp.org

Putting Flesh on the Bones – Working Group Sessions (Continued)

Before participants went into the small group session they were asked to consider the possible outcomes for their project ideas in the coming two days. These include the following:

- Crystallisation of ideas which will be developed into a full project proposal following this workshop
- Changed concept that will be developed into a full project proposal following this workshop
- Merging of project ideas with other participants into a new project idea will be developed into a full project proposal following this workshop
- Abandoning of the project idea after subjecting it to critical analysis.

It was re-emphasised that subjecting the project idea to critical analysis at this stage could save a great deal of time and heartache later on. Participants were encouraged to ask questions such as the following that could aid this analysis:

- What are the ultimate problems you are addressing? e.g. causes of poverty, mitigation of climate change, enhancement of key ecosystem services, etc.
- Does your project provide the solution or part of the solution to the problem you are addressing?
- Where do you want your system to be in 20 years?
- How can your project outcomes be sustained?
- What are your assumptions and are any of these killer assumptions?

Based on critical analysis in the breakout groups eight of the project ideas were maintained, two were revised (*management of invasive alien plants in agriculture, forestry and rangeland from prevention to control*, and *the effect of the invasive Prosopis spp on indigenous plant-pollinator interactions in Lake Bogoria national reserve*) and two were merged (*The taxonomic infrastructure to support invasive species management and building the short-term* and *long-term solutions and Establishing AIS monitoring Database for Ecologically Sensitive areas in East Africa*).

DAY 3

The day began with three presentations followed by a working group session in which the participants continued to refine their projects and produced ideas for steps to take following this workshop. These next steps were discussed at the final plenary session.

Presentations

Project development, the International Year of Biodiversity & SBSTTA: Junko Shimura

Junko introduced two high profile events that could serve to highlight the project ideas developed during this workshop. The United Nations has declared 2010 to be the International Year of Biodiversity (IYB). The purpose of the International Year is to raise public awareness of the importance of biodiversity and the consequences of its loss. It will also seek to promote the engagement of the public and other actors for the implementation of the Convention on Biological Diversity. The Year will also celebrate successes in realising the target of achieving a significant reduction in the rate of biodiversity loss by 2010. The objective is to obtain a commitment by the global community to reinforce the implementation of the CBD.

The CBD Secretariat (SCBD) together with its partners will be organising many high profile events to celebrate IYB. Junko encouraged participants to work within their institutions and with other institutions to ensure that their activities are publicised during IYB and that any relevant events are linked to IYB. This linkage can serve to increase the profile of the particular institution and of the practice and utility of taxonomy. Anybody can use the IYB logo on relevant material but it would be greatly appreciated if those using the logo could inform the CBD Secretariat.

The forthcoming CBD SBSTTA meeting scheduled to take place between 10 and 21 May 2010 represents a strategic opportunity to promote the project concepts developed before, during and after this workshop to a wider audience. If it is possible it would be excellent for participants to be present at the meeting for them to be able to present their ideas, as part of networking or through formal presentations, for example at side meetings. If it will not be possible to be present at SBSTTA it would be opportune to discuss the proposed projects with national representatives who will be present and could promote the projects in the manner suggested above.

The LifeWeb Initiative: John Mauremootoo (on behalf of Jason Spensley of LifeWeb)

The LifeWeb initiative was established following CBD COP9 Decision IX/18 to support the implementation of the CBD Programme of Work on Protected Areas. There was a German commitment of €40 m in 2008 and a commitment to fund at least this amount each year up to 2012, up to a total of $500 million. Spain's commitment is €5 million Euro over 2 years and there is growing interest from various other donors. LifeWeb has a small coordination office which was established in the CBD Secretariat in June 2009.

LifeWeb's goal is: to catalyze new and additional funding for the creation and management of protected areas; and its purpose is: To strengthen the use of protected areas as tools to conserve biodiversity, address climate change and achieve the millennium development goals, as well as advance implementation of the Convention on Biological Diversity Programme of Work on Protected Areas.

LifeWeb provides a clearing house of protected area funding needs to support donor decision-making; communicates recipient priorities and funding opportunities, including co-convening meetings to articulate highest priority needs and support donor coordination; and actively encourages and recognises donor support for protected area solutions to the climate crisis, biodiversity conservation, and sustainable livelihoods.

LifeWeb works as follows:

1. Recipients submit expressions of Interest based on national priority setting (e.g. ecological gaps, management effectiveness needs, sustainable finance plans, etc.)1.
2. Donors identify short list of projects based on their interests.
3. Bilateral agreement reached.
4. Funds flow directly between donors and recipients.
5. Additional opportunity: Co-convene donor coordination.

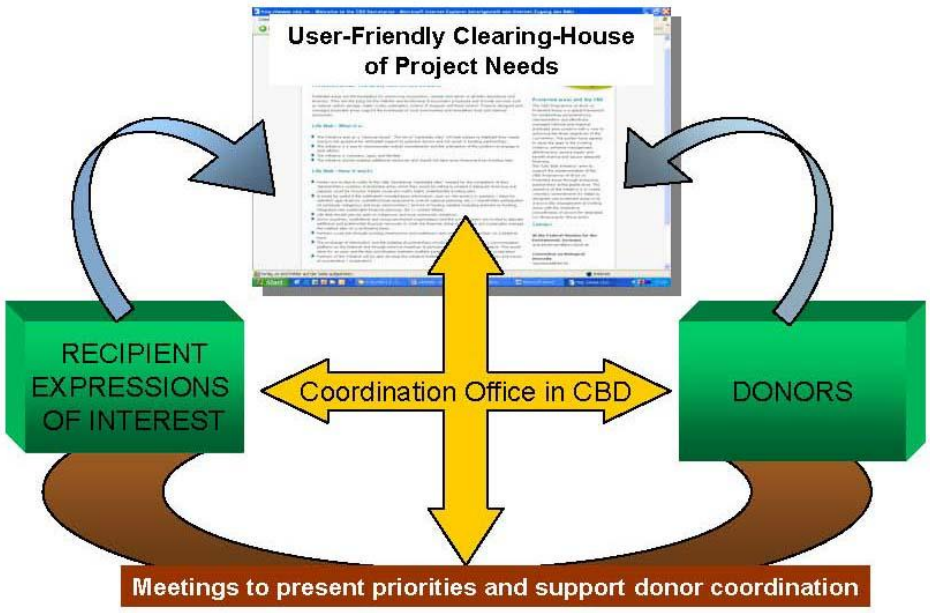
Completed national priority setting products (ecological gaps, management effectiveness, finance plans, etc) can be compelling fundraising tools to:

- Illustrate strategic prioritisation for maximum impact.
- Demonstrate government leadership and stakeholder collaboration.
- Provide platform or high level government presentation of needs to donors.
- Enable and attract donor coordination.

Getting one or two donors on board can also be a factor for success as it can challenge others to become involved also. LifeWeb can then support by inviting and attracting donor commitment.
The coordination office in the CBD does the following:

- Manage the electronic clearing house.
- Encourage and support development of recipient Expressions of Interest.
- Actively encourage and recognise donor support for Expressions of Interest.
- Informally communicate needs and opportunities to donors and recipients.
- Formally co-convene donor coordination meetings.
- Support development and dissemination of tools for protected areas to address climate change mitigation and adaptation.
- Ensure implementers have best and most up to date tools and guidance materials available for implementing planned activities.
- Report on progress made in association with this initiative to implementation of the CBD Programme of Work on Protected Areas.

The role of the coordination office as a hub is illustrated in Figure 5.



1 Available at www.cbd.int/lifeweb/submit

Figure 5. Schematic representation of the interactions that underpin the LifeWeb Initiative.

The logical framework approach (Chris Lyal)

The Logical Framework Approach

In this presentation Chris attempted to demystify the logical framework approach and embed it into the project development and project management framework – as a management tool and not just as an onerous obligation to donors.

The logical framework approach is a set of open-ended management tools, practiced differently by different organizations, although the principles are the same. Some form of logical framework approach is needed by all major donors but logframes have value beyond this. If well formulated, they can help to: organise your thinking; relate activities to expected results; set performance indicators; allocate responsibilities; and communicate project information concisely.

The logical framework approach is embedded in the project cycle (see 2.2.2.) from project conception to evaluation. The project logframe is constructed during project planning which is part of the project design phase but it is informed by outputs from the project analysis phase which precedes the project planning phase, although generally project design is an iterative process. Three key elements of the planning phase are stakeholder analysis, problem analysis and risk analysis.
Stakeholders are People **affected** by the impact of an activity and people who can **influence** the impact. Stakeholders include the following:

- user groups - people who use the resources or area.
- interest groups - have an interest or opinion or who can affect the use of a resource or area.
- winners and losers.
- Beneficiaries.
- Intermediaries.
- those involved in or excluded from the decision-making process.

Stakeholders can be primary stakeholders – Those who benefit from or are adversely affected by an activity. They are usually wholly dependent on resource or area for survival, with few options when faced with change or secondary stakeholders - all other people and institutions with a stake or interest or intermediary role in resource or area. Stakeholders can be summarized in a stakeholder table with a list of stakeholders, their interests (hidden or open) in relation to the project, a preliminary assessment of likely impact of project on each stakeholder's interests (+, -, +/-, ?) and the relative priority the project should give to meeting interests of each stakeholder (e.g. 1-5; 1 is highest). An example of a stakeholder table is shown below.

Table 2. A hypothetical stakeholder table

Project: Carrying out baseline survey to see if area should be given protected area status			
Stakeholders	Interests	Impact	Priority
Primary			
1. Local villagers making a livelihood from area	○ Potential loss of livelihood through exclusion from area	-	1
Secondary			
2. Parks Authority	○ Extending area of authority ○ Potential management capacity shortfall	+ / -	
3. National conservation group	○ Meets campaign objectives	+	1
4. Ministry of Tourism	○ Potential for additional tourist attraction	+	2

Stakeholders can then be grouped into a simple matrix with columns indicating their importance to the project in terms of satisfying their needs and rows indicating their influence over the project (Table 3).

Table 3. A stakeholder analysis matrix

Box A Stakeholders of high importance but low influence ○ Require special initiatives to protect interests	**Box B** Stakeholders of high importance and high influence. ○ Need to construct good working relationships to ensure effective coalition of support for the project
Box D Stakeholders of low importance and low influence. ○ May need limited monitoring	**Box C** Stakeholders of low importance but high influence: ○ Can affect outcomes ○ Interests are not project target ○ May be source of risk ○ Relationships need careful monitoring ○ May be able to block the project

Importance

Influence over project

This information determines levels of participation in the proposed project. Actions can be classified as: Action FOR - being informed or set tasks. Others set the agenda and direct the process.
Action FOR/WITH - being consulted; others analyse and decide course of action
Action WITH - partnership; work with others to set priorities and course of action.
4. **Action BY** - control; little or no input by others.

This information can be summarized in a participation matrix. An example of a participation matrix is shown below.

Table 4. The format of a participation matrix

Type of participation	Inform	Consult	Partnership	Control
Stage in project				
Identification				
Planning				
Implementation				
Monitoring & evaluation				

Problem analysis can aid project design in: crystallising the overall issue addressed into individual problems; analyse negative aspects of the project situation; establish causal relationships; help gather information through stakeholder consultation, etc. The first step in problem analysis can be undertaken by constructing a problem tree. A 'starter problem' is selected and placed centrally, problems directly causing the starter problem are placed below it, problems which are direct effects of starter problem are placed above it and problems that are neither a cause or effect are placed at the same level. Figure 6 shows the form of the problem tree and figure 7 shows a hypothetical problem tree relating to the starter problem of a limited knowledge of the biota in Nairobi National Park, Kenya.

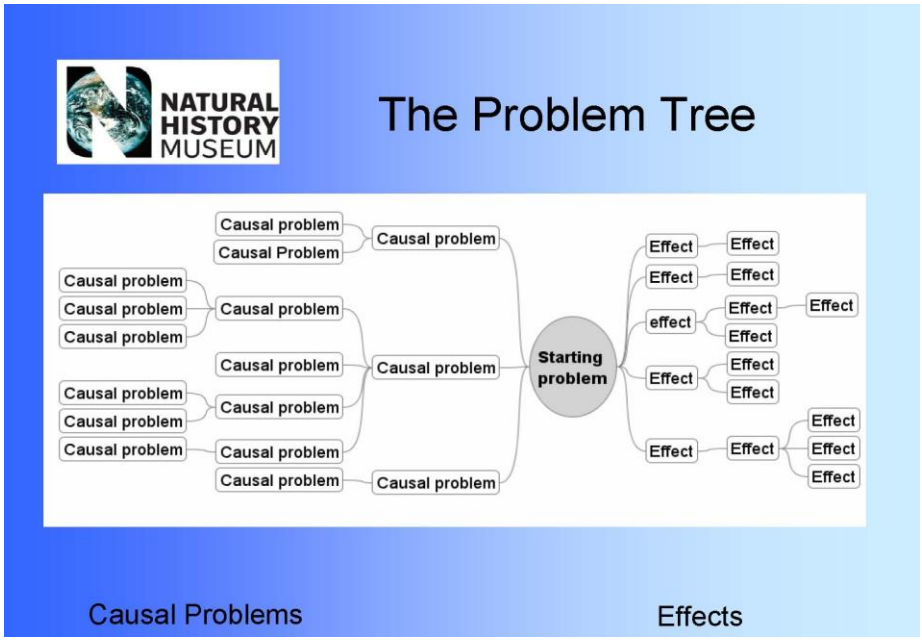


Figure 6. The problem tree format

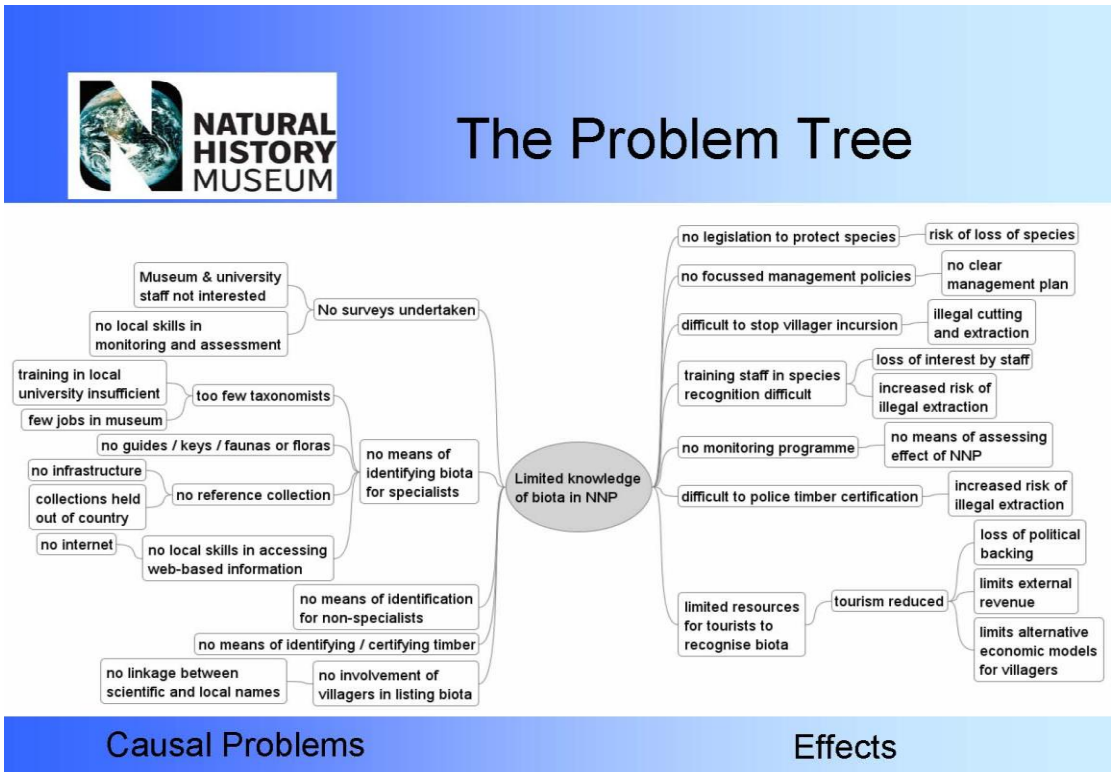


Figure 7. A hypothetical problem tree

A problem tree can then be converted into an 'objectives tree'. This is sometimes simplistically achieved through a simple rewording: 'lack of sufficient water becomes 'provide sufficient clean water.' The resultant objectives tree then shows a 'means-ends' relationship. The theory is that, by tackling each objective in the project and converting each problem into a new, positive state our intervention should turn the core-problem around. These objectives in the tree then provide a basis for project and program definition. An example of an objectives tree derived from the hypothetical problem tree is shown in Figure 8.

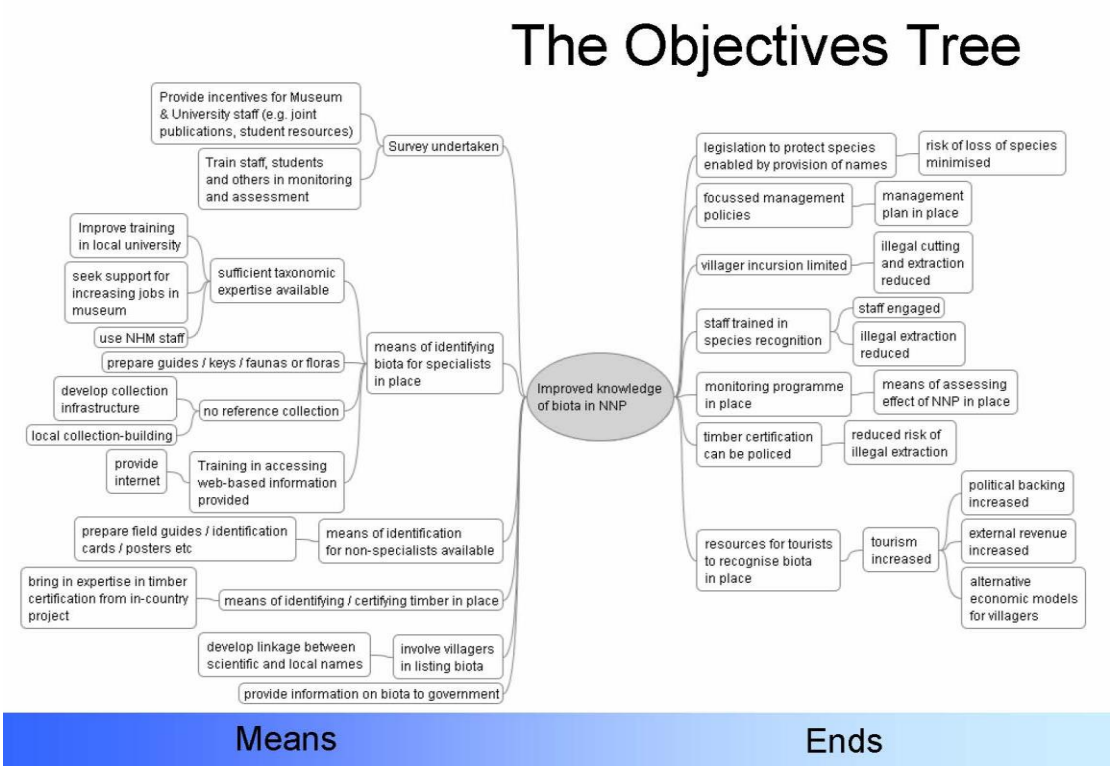


Figure 8. An objectives tree derived from the hypothetical problem tree shown in figure 6.

Risk assessment examines the potential for unwanted happenings or consequence which at worst can result in project failure. Risk assessment and management must be built into project design. There are three main phases of risk assessment: Identification - what are the risks? Estimation - what is their likely probability? And evaluation - what is their likely impact? For every identified risk one must identify risk management measures.

THE LOGFRAME

The above is essential background for the production of a logframe. A logframe is presented as a matrix with: the project summary (goal, purpose, outputs and activities); indicators of performance; means of verifying the indicators; and important risks and assumptions (Table 5).

Table 5. The logframe format

Project Summary	Measurable indicators	Means of verification	Important assumptions
Goal 'Greater why'			
Purpose 'Why'			
Outputs What?			
Activities How?			

Project summary objectives should be SMART: **specific** (to avoid differing expectations), **Measurable** (to monitor and evaluate progress), **Appropriate** (to the problems, goal & organisation), **Realistic** (achievable, challenging & meaningful and **Time-bound** (with a specific time for achievement). A completed action should be used to describe the objective (e.g. train = the activity, trained = the objective). Strong action verbs should be used e.g. decrease/increase instead of provide, strengthen instead of produce, etc.

The project goal is a higher order objective, perhaps of a programme or a sector, is outside the control of project team and may require several projects for its achievement. The project purpose is why the project is being done. It summarises the expected impact of project. There is one purpose per project and it is inside the control of the project team. Outputs describe what project will deliver (measurable end results). They should be necessary and sufficient for the purpose to be met. There is likely to be more than one output per purpose. Activities define how the team will carry out the project. There may be several main activities for each output.

The logframe structure is based on cause and effect; if something is achieved, then something else will result. So, if certain activities are carried out, then one can expect certain outputs. The same 'if/then' relationship holds between output and purpose.

There should be clear logical links between statements in the project summary column. However, external factors may break links. Assumptions are statements about the uncertainty factors -external factors you cannot control or factors you choose not to control. These may have been identified in the preceding risk analysis.

Measurable indicators define in measurable detail the performance levels required by the objectives in project summary column. Measurable indicators demonstrate results and tell us how to recognise the accomplishment of objectives. Measurable indicators are stated in terms of quantity, quality and time, e.g. "4 staff trained to PhD level by year 5". Output level indicators establish terms of reference for the project and indicate deliverables for which project team is accountable.

Means of verification are sources of information to demonstrate what has been accomplished. Specific activities, e.g. surveys may be needed to gather the necessary information. Indicators chosen must be verifiable. They may include publications, surveys, project notes, minutes, reports and records; photographs, tapes, videos etc.

In summary the logical framework approach depends on clarity, honesty, recognition of all salient factors, flexibility and rigour.

Working Group Sessions (Continued)

Project concepts were subjected to final review by the resource persons and fellow participants during this session. Measures to be taken to continue the project development process were also discussed during this session.

Workshop evaluation

Workshop evaluation sheets were completed. The results were very positive with the vast majority of participants finding the workshop useful and leaving with their expectations fully met. Some reservations were expressed about facilities though most were satisfied and two participants encountered transport problems. A full analysis of the workshop evaluations is presented in Appendix D.

Plenary session: Define the process to take proposal development forward

The participants agreed that the workshop had been very valuable in many ways (Appendix D) but the "proof of the pudding" would be the success with which the project ideas introduced at this workshop were translated into projects and ultimately the degree to which these projects resulted in actual on the ground impact. It was therefore critical that the momentum generated by this workshop process was maintained.

One of the first steps was to refine any project ideas further where necessary, ideally into fully fledged project proposals. One part of this process will be consulting relevant documentation including each country's NBSAP. It was agreed that the groups would continue to circulate their project concepts for comment from the workshop resource people. Because of time constraints

detailed review would not be possible but overall comments and suggestions could be made. Resource people were assigned to review projects belonging to particular project clusters as follows: Collections and databases – Chris Lyal; management– John Mauremootoo; agricultural biodiversity – John Mauremootoo; and protected areas – Jason Spensley (of the LifeWeb Secretariat). Project proponents would also further refine their concepts within their own organisations.

These internal discussions would form part of the consultative process. Following within-organisation consultation, the project proponents would conduct outside consultations with relevant stakeholders. In some cases this could be done through existing projects and programmes. Among those stakeholders would be those affected by the project, potential project partners and relevant focal points. Among the key stakeholders would be relevant national authorities (CBD National Focal Points and others).

During the course of the workshop several but not all of the projects targeted particular donors. Evidently it is essential to find a suitable donor and proponents would all need to do some background work on which donors are funding which types of project in order to target their approaches intelligently. Such work would be useful even for those project proponents who had already identified an apparently suitable donor as, of course, this identification is no guarantee of funding! The consultative process may help in identifying suitable donors.

It was agreed that the project ideas could be usefully promoted through regional and global initiatives and organisations. The NEPAD Secretariat could prove a useful vehicle through which to promote projects as could AFRICOM which is a Pan-African organisation. The BioNET Secretariat and the African BioNET LOOPs (NAFRINET, WAFRINET, SAFRINET and EAFRINET) can also be very useful in promoting project initiatives. The CBD can help this process as well, notably through the SBSTTA meeting in Nairobi and through IYB activities as outlined by Junko Shimura in the morning session (Section 4.1.1). Project proponents were encouraged to develop their projects as far as possible so that they could be showcased at CBD SBSTTA 14 which would be very valuable for their profile.

One highlight at COP10 (to be held in October 2010 in Japan) will be Strategic Plan of post 2010 and the post 2010 targets which will be both 'global targets' and 'national targets'. The latter will be decided by the national authority. Funding opportunity may exist in this area. The national authorities will be obliged to report on their NBSAPs to SCBD in 2012 and the Parties will be encouraged to report based on national biodiversity status data at COP10. It is possible that help that the project proponents can offer their own government in the reporting process will bring about opportunities for the participants to receive national funds and endorsement for GEF or other donors.

Many projects are funded through a response to calls for proposals. It is therefore, essential that project proponents "keep their ears close to the ground" so that they are able to respond to such calls. Deadlines for such calls are often very tight so having a ready-made proposal in place can be a great asset. Of course, the proposal will have to be amended so that it fits with the donors' proposal format but this is likely to be much faster than writing a proposal from scratch. Often the greatest obstacle to getting a proposal ready for submission in time is the need for official approval from project partners. In such cases the prior consultation process undertaken following this workshop is likely to be of considerable value. The BioNET Secretariat regularly circulates calls for proposals to LOOP partners and the workshop participants will be added to the Secretariat's mailing list.

One possibility for follow up was to catalyse a regional approach to invasive species by following the approach outlined by Silvia Ziller for the Americas whereby an information network has increased the profile of invasive species issues in the region and resulted in on the ground action.

Ultimately though, as emphasised throughout, it will be the project proponent's responsibility to develop their own projects though it was strongly felt that this workshop and the preparatory

process had given the participants a great deal of help towards achieving their goal of the development of successful projects.

Workshop Closure: Geoffrey Mwachala

Dr. Mwachala thanked the participants and resource persons for their energy, enthusiasm and commitment throughout the workshop. He reiterated his commitment to develop projects and programmes that utilise taxonomy to help resolve major global challenges such as food security, biodiversity loss and climate change and looked forward to seeing many of the participants again in Nairobi for the forthcoming SBSTTA meeting.

Appendix A: Workshop Agenda

Monday 16th Nov 2009	**Activity**	**Principal Resource person (s)**
8.30 – 9.00 a.m.	Registration	Jane Barasa, NMK, Kenya.
9.00 – 9. 15 a.m.	Opening	Dr. Geoffrey Mwachala Head of Botany, NMK, Kenya
9.15 – 9.30 a.m.	Introduction, logistics, adaptive agenda and workshop objectives	John Mauremootoo
9.30 – 10.15 a.m.	Self introduction of participants – participants' interests and their expectations from this workshop	John Mauremootoo
10.15 – 10.30 a.m.	The Global Taxonomy Initiative and the IAS Programme of Work of the CBD	Junko Shimura
10.30 – 11.00 a.m.	**COFFEE BREAK**	
11.00 - 11.30 a.m.	The impact of invasive species in Africa	Geoffrey Howard
11.30 – 11.45 a.m.	Discussion	
11.45 a.m. – 1.00 p.m.	Donor priorities and the project development cycle – presentations from UNEP – GEF and JICA	Representatives of donors
	JICA's Cooperation in Forestry and Nature Conservation	John Ngugi
	Overview of the GEF	Stephen Twomlow
1.00 – 2.00 p.m.	**LUNCH BREAK**	
2.00 – 2.30 p.m.	The Global Invasive Species Network: information sharing for informed decision making	Silvia Ziller
2.30 – 3.30 p.m.	Plenary session – presentation of submitted project ideas and preliminary review: *Will it fly? What areas could be strengthened? What donors might it appeal to, etc.*	John Mauremootoo
3.30 – 4.00 p.m.	**COFFEE BREAK**	
4.00 – 6.00 p.m.	Plenary session – presentation and preliminary review of project ideas (continued)	John Mauremootoo
6.30 – 8.00 p.m.	**COCKTAIL RECEPTION**	

Tuesday 17th November 2009	**Activity**	**Principal Resource person (s)**
9.00 – 9.30 a.m.	The many roles for taxonomy in invasives management	Chris Lyal
9.30 – 9.45 a.m.	Discussion	
9.45 – 10.45 a.m.	GISIN and the use of I3N tools to share standardized invasive species information	Silvia Ziller
10.45 – 11.15 a.m.	**COFFEE BREAK**	
11.15 a.m. – 5.30 p.m.	*Putting Flesh on the Bones* Working group sessions: Development of project ideas into concept papers	Facilitation Team (John Mauremootoo, Silvia Ziller, Chris Lyal, Junko Shimura)

Wednesday 18th November 2009	**Activity**	**Principal Resource person (s)**
9.00 – 9.15 a.m.	Project development and IYB & SBSTTA:	Junko Shimura
9.15 – 9.30 a.m.	The LifeWeb Initiative	John Mauremootoo
9.30 – 10.15	The logical framework approach	Chris Lyal
10.15 – 10.45 a.m.	**COFFEE BREAK**	
10.45 a.m.– 12.15 p.m.	Working group session: Development of concept papers (continued)	Facilitation Team
12.15 – 12.30 p.m.	Workshop evaluation	Facilitation Team
12.30 – 1.30p.m.	*Next Steps* Plenary session: Define the process to take proposal development forward	Facilitation Team
1.30 – 2.00 p.m.	Closing of the Meeting	Dr. Junko Shimura & Dr. Geoffrey Mwachala
2.00 p.m.	**LUNCH**	

Appendix B: List of Participants and Resource Persons

	NAME	ORGANIZATION	POSITION	ADDRESS	COUNTRY	Workshop role
1	Dr. John Mauremootoo	BioNET Secretariat	Regional Partnerships Officer	E: jmauremootoo@gmail.com C:+44 (0) 784 6219689 O: +44 (0) 1934 876565 P: BioNET Secretariat Bakeham Lane, Egham, Surrey	UK	Resource person
2	Dr. Chris Lyal	The Natural History Museum	UK GTI Focal point, Research Taxonomist	E: c.lyal@nhm.ac.uk O: +44 (0) 207 942 5113 C: +44 (0) 7944099902 P: Cromwell rd, London SW7 5BD	UK	Resource person
3	Dr. Junko Shimura	Secretariat of the Convention on Biological Diversity	Programme Officer	E: junko.shimura@cbd.int O: +1 514 287 8706 P: 413 Ste – Jacques Street suite 800 Montreal QC H2Y 1N9	Canada	Resource person
4	Dr. Silvia Ziller	The Horus Institute, Brazil Global Invasive Species Information Network (GISIN)	Executive Director/ Collaborator	E: sziller@institutohorus.org.br O: +55 48 3338 2856 C: +55 48 9161 8994 P: Servidao Cobra Coral, 111 Campeche Florianopolis – SC 88063-513	Brazil	Resource person
5	Dr. Geoffrey Howard	IUCN	Global Coordinator for Invasive Species	E: geoffry.howard@iucn.org O: +254 20 890605 / 12 P: 68200, Nairobi	Kenya	Resource person (Day 1)
6	Dr. Sarah Simons	Global Invasive Species Programme	Executive Director	E: S.simons@gisp.org O: +254 20 7224461 P: 633-00621, Nairobi	Kenya	Resource person (Day 1)
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	NAME	ORGANIZATION	POSITION	ADDRESS	COUNTRY	Workshop role
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	NAME	ORGANIZATION	POSITION	ADDRESS	COUNTRY	Workshop role
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27	Dr. Melckzedeck K. Osore	WIOMSA	Research Coordinator	E: mosore@wiomsa.org O: +255 784 845195 P: 3298 Zanzibar	Tanzania	Participant

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Appendix C. Project Outlines for Development into Concept Papers

Establishing AIS monitoring Database for Ecologically Sensitive areas in East Africa: Bernard Risky Agwanda

Introduction

Amount of threat posed by alien and invasive species in ecosystems, habitats and species and therefore human livelihoods is well globally recognised and CBD decision on it in Article 8(h) (CBD VII/13). Its multidisciplinary nature is also well understood spanning WFO, WTO CITES among others. However national responsibilities in Eastern Africa have not been well taken due to lack of documenting systems which underpin monitoring.

An inventory accompanied with database system dedicated to storing, reporting occurrence, seizure and management of alien and invasive species is vital to the mitigation of its effects in the regions economy. Ecologically sensitive areas are vulnerable to these heinous species. This include coastal systems (where ships and boats docks, wetlands, parks and reserves protected because of species of conservation concern and other unique ecosystems.

Aim

To establish a regional inventory and database for monitoring alien and invasive species in Eastern African ecologically sensitive areas based on experts and staffs working on entry border points.

Specific objectives

1. Identify key ecological sensitive areas using objectively agreed criteria
2. Develop an inventory
3. Establish a regional database that can be updated online
4. Integrate decision support system to port entry point staff

Methods

i. Field work
ii. Stakeholder/expert working sessions
   - Develop criteria for identifying ecologically sensitive areas/systems
   - Share responsibilities
   - needs assessment and prioritizations
   - management system required
iii. Expert consultations
   - Inventory and distribution of AIS
   - Tools and infrastructure required
   - Associated species and contributing factors
iv. Desktop work
   - establishment
v. Communication

Duration: two and a half years

Scope: All species of AIS in Kenya Uganda and Tanzania

Diversity and sustainable use of macrofungi in selected Protected Area forest reserves of Ghana: Mary M. Apetorgbor

Project Coordinator: Dr (Mrs) Mary M. Apetorgbor (Forestry Research Institute of Ghana)

Expected Project Duration: 2 years

Expected Budget: USD 68,640

Collaborators: Three scientists (two from Ghana and one from Germany) are expected to participate in the project.

Background

Forest vegetation is home to probably fifty per cent of the world's species, making them an extensive library of biological and genetic resources. In addition, this vegetation helps to maintain the climate by regulating atmospheric gases and stabilizing rainfall, protect against desertification, and provide numerous other ecological functions (FAO, 1990).

However, these precious systems are among the most threatened on the planet. Although the precise area is debatable, each day at least 32,300 ha of forest are degraded. Along with them, the planet loses several hundreds of plant and animal species to extinction, the vast majority of which have never been documented (FAO, 1990).

Ghana once had a vast forest cover of 8.2 million hectares but that has changed drastically. Since 1981 the annual rate of deforestation has been 2.5% per annum. The intact forest is estimated at between 10.9 and 11.8% of the original cover and 6.9% of the country's total area which is declining at a rate of 1.3% per annum (MES, 2002). The primary forests are therefore being replaced by less diverse plantations and secondary forests (FAO, 1989).

There is a fairly good knowledge and information base on the species diversity of plants and animals and ecological processes within the terrestrial habitats. However, very little is known about the microbial diversity of terrestrial and aquatic ecosystems in the country. Some macrofungi grow in association with indigenous trees that are sought after for wood in forest reserves, off reserves and fields under fallow. As the native forests dwindle due to over-exploitation of timber, mining, bush burning and the establishment of plantations with exotic species among others, the diversity of these macrofungi also reduces with time.

In general, information on the diversity, abundance and distribution of macrofungi especially the ectomycorrhizal, edible and medicinal species and their variations with disturbance regimes such as invasive alien species in natural forests and transition zones of Ghana remain unidentified and understudied. Such information is crucial to assess the impact of forest on macrofungi such as the ectomycorrhizal that are needed to colonize germinating seedlings for proper growth as well as utilization of others for food and medicine by rural communities.

Rammeloo and Walleyn (1993) published a bibliography on the use and importance of edible fungi in the diet of local populations in sub-Saharan Africa. Various ethnomycological studies have been conducted on mushroom germplasm and their uses by the fringe communities in the Bia Biosphere

reserve of Ghana (Obodai and Apetorgbor, 2001). Other surveys were carried out on indigenous knowledge and utilization of edible mushrooms in parts of Southern Ghana (Apetorgbor *et al*., 2006).

The goal of this project is to generate a comprehensive list of plant and fungal species in forest reserves of Ghana and relate this with their overall management especially against invasive alien species.

OBJECTIVES

The specific objectives of the study are to:

1. document macrofungi currently harvested for use by forest fringe communities in two ecological zones (dry semi-deciduous and moist semideciduous forest zones) in Ghana.
2. identify the economic macrofungi (ectomycorrhizal, edible and medicinal) and facilitate germplasm conservation for further research.
3. determine the composition, species richness and distribution of macrofungi in the two ecological zones of Ghana.
4. examine management effects from control of Invasive Alien Species in the distribution of macrofungi.

OUTPUT AND ACTIVITIES

Output 1: Indigenous knowledge of economic macrofungi

Activities: An ethnomycological survey would be carried out to provide data on the socio-economic status of people in the fringe communities of the forest reserves. The survey would be undertaken randomly on people living in fringe communities around eight forest reserves in dry semi deciduous zone and two in the moist semi deciduous forest zone. An interview schedule with structured questionnaires would be used to obtain information from the fringe forest communities to document indigenous knowledge and utilization of macrofungi.

From these activities, species of economic macrofungi collected from the reserves by fringe forest communities would be known.

Output 2: Macrofungal species diversity in the reserves

Activities: A stratified random sampling design would be employed to locate five 1-hectare plots for the study in each reserve. The plots would be demarcated with the help of a field compass and the edges marked with pegs. Each plot would be further divided into sub-plots of 50m x 50m. The subplots within each hectare plot would be systematically surveyed to collect macrofungi in the two rainy seasons, April-June and September-November. The fruit bodies of the macrofungi would be photographed, described in the fresh condition and subsequently air-dried. Fungal collections that could not be identified in Ghana with the available literature would be packaged and sent to experts in Germany for identification. Voucher specimens would be preserved in the laboratory at the Forestry Research Institute of Ghana. The composition and density of macrofungi (ectomycorrhizal, edible and medicinal mushrooms) in the reserves would be known. There might be edible or medicinal macrofungi identified in an area but not known to be edible to the local people. These would be introduced to them to be included in their diet. Attempts would be made to domesticate some of the edible and/or medicinal mushrooms to be identified in the areas and the people taught how to cultivate them on local substrates.

Output 3: Macrofungal associations with plant species in the vegetation

Activities: Clumps of trees, shrubs and herb species (specifically ectomycorrhiza) under which sporocarps of macrofungi are collected would be marked and identified with the help of a plant taxonomist. The basal area of these plants in the clump would be estimated per hectare plot. Superficial roots of these juvenile and mature plants would be excavated after tracing larger roots from the stem collar of target plants. Ectomycorrhizal roots are easily recognised by the presence of surface features (swollen root tips) but these would be confirmed in the laboratory by observing the Hartig net of fine roots in transverse section. The mycorrhizal status of plants in the vegetation would be known. Economic timber trees that cannot develop without mycorrhizal associations may be identified. Any invasive alien species so encountered would be identified and its effects on the vegetation determined. Seeds of these plants would be collected and attempts made to cultivate their seedlings with the specific fungi and help the local people grow the plants in agroforestry systems.

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Community engagement in marine IAS, taxonomy and MPA management: Adnan Awad & James Kairo

The International Ocean Institute provides training and technical support for project implementation throughout the 25 operational centres around the world. In Africa, centres in South Africa, Kenya, Egypt and Nigeria have a regional forum, currently coordinated by the Southern Africa operational centre, aiming to increase the extent and success of regional and sub-regional projects within Africa.

Through various recent projects and collaborations (IOI, IMO/GloBallast, GISP, UNEP, IUCN) several short training courses have been conducted on marine invasive alien species (IAS) management for the countries of the West and Central African Region (WACAF) and the Eastern and Southern African Region (including Western Indian Ocean Island States), as well as some of the countries along the Mediterranean North African Coast. Also a pilot marine taxonomy training course was developed and run for the WIO region. While these courses provide a good introduction to these priority issues, more practical and applied follow-up is required to adequately engage the appropriate coastal communities. The project outline below is intended to build on the groundwork already done, and on the existing network of partnerships and contacts throughout Africa concerned with addressing these issues.

Please note this concept covers a broad range of issues and areas. It could be easily tapered for application to more specific concerns and/or areas, as has been done in the past. This merely provides a basis for further discussion on a theme currently facing marine conservation efforts in Africa.

Project: Community engagement in marine IAS, taxonomy and MPA management

Goals:
- Provide training in marine invasive alien species management & taxonomy to local scientific community, MPA managers, ocean and resource users
- Community involvement in identifying and managing key invasive species, with particular emphasis on MPA management strategies
- Establishment of long-term community based monitoring programmes

Approach:
- To be collaborative in nature (including funding), aimed at engaging existing operational structures and support (e.g. IOI network, LME programmes/commissions)
- Series of sub-regional training workshops and hands-on community sessions coordinated through sub-regional hubs and associated partnerships
- Strategic design and management workshops for MPA management/establishment, aiming to increase taxonomic understanding within the region, and manage key threats, including IAS and climate change
- Conduct pilot surveys & develop ongoing monitoring for IAS in existing MPA's, thereby introducing appropriate survey techniques and protocols
- Where possible, incorporate taxonomic analysis of MPA vulnerability to IAS (Risk Assessment)
- Incorporation of impacts and benefits to both communities and ecosystems associated with tourism and eco-tourism

Target areas:
- WACAF region
- Countries of the Western Indian Ocean Region
- North African Region

Institutions:
- IOI-SA, IOI-Kenya, IOI-Egypt, IOI-Nigeria, IOI-HQ (Malta)
- Global Invasive Species Programme (GISP), Nairobi
- Mediterranean Action Plan - RAC-SPA, Tunisia
- IMO – GloBallast Programme
- Interim Guinea Current Commission, Benguela Current Commission, Agulhas & Somali Current Large Marine Ecosystem Programme, Canary Current LME

Nairobi and Abidjan Conventions, UNEP (Secretariat)
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Management of Invasive Alien Plants in Agriculture, Forestry and Rangeland from Prevention to control:
Oumar Balde

Objectives and AIMS: To revert the invasive status of alien invasive woody plants affecting agriculture, forestry and rangeland back to assets and to prevent of control future invasions.

Outputs

a. Inventory of the distribution and extend of invasions by the selected alien plant invaders and accompanying databases.

b. Valuation of the economic (ecological systems, social, biodiversity) impacts of these invasions and search for ways to resolve the conflict of interest issue.

c. Identification and application of best management practices for controlling/ managing the main woody plant invaders considering the conflict of interest issue (matching benefits of their existence with the cost of not controlling them).

d. projects to control the invasive alien in areas of optimal returns on investment within the IGAD sub-region,

e. Resultant benefits (e.g., use of productive land, food production, livestock maintenance, forest products, livelihood enhanced, additional water available, jobs created, poverty reduced),

f. Increased and coordinated capacity and policy environment for the sustainable management of the main existing alien plant invasions and methodologies to prevent new invasions.

Duration

A five year sub-regional programme to be established in the seven countries of IGAD with the intention of using the fifth year to spread the lessons learned to other regions within Africa. This program will build upon several other interventions in this sub region to spread the process to all seven countries ant to generate more specific projects for alien invasive plants that are more local in impact within Africa.

Total cost US $ 25 million. This would involve local, national and sub*regional activities as well as eventual dissemination of findings and tools to other sub- regions of Africa.

Links to existing frameworks

The programme relates to the Convention on Biological Diversity (CBD), the International Plant Protection Convention (IPPC), the Global Invasive Species Programme (GISP), the UN Convention to combat desertification (CCD) and include five countries of the Nile River Basin (and associated Nile basin Initiative) as well as IGAD. It will build upon a developing GEF project" Removing barriers to Invasive plant Management in Africa" which will work in Uganda, and Ethiopia and expand from the IGAD sub-region and climatic zone in Africa through GISP and the networks of CAB International and IUCN.

Possible co-funding

Concerned countries will provide son in-kind contributions to make the project operational and related project could contribute too. IGAD can contribute too. Private sector involved with agriculture, livestock and forest products; NGOs, Research organizations,

Executing Agencies:

IGAD, GISP, CAB, International and Governments of IGAD States.

Suggested donors

ADB, World Bank, IUCN, GEF

Participating countries

IGAD member countries

Capacity building to support research and extension programs for sustainable management of invasive fruit fly species in West Africa: Aimé Bokonon-Ganta

AIMS & OBJECTIVES

Bactrocera invadens (Diptera: Tephritidae) was recently reported in Africa as causing serious damage to fruit and vegetable species. The invading pest rapidly spread in several countries including the 12 WAFRINET countries. *B. invadens* is known to breed in various environments and under a wide range of agro ecologies, therefore adding to the already important level of direct and indirect impact of the flies on a wide range of plants, cultivated and wild including several fruit and vegetable species.

AIM: THE AIM OF THIS PROJECT IS TO DECREASE FRUIT AND VEGETABLE LOSSES DUE TO INVASIVE FRUIT FLY PESTS IN WEST AFRICA.

OBJECTIVES

1. TO STRENGTHEN COLLABORATIVE LINKAGES WITHIN WAFRINET COUNTRIES BY DEVELOPING STANDARDIZED MONITORING SYSTEMS FOR BOTH INDIGENOUS AND INVASIVE TEPHRITID FLY SPECIES;
2. TO INCREASE AWARENESS OF THE EXISTENCE OF NATURAL INDIGENOUS CONTROL AGENTS AND ESTABLISH BIOLOGICAL CONTROL AS KEY COMPONENT FOR MANAGEMENT OF FRUIT FLY SPECIES;
3. To build capacity for detection, identification and management of tephritid fly species through training of 30 National Agricultural Research Service (NARS) scientists and 340 regional agricultural extension agents and small scale farmers for sustainability at project exit.

ACTIVITIES

1. ORGANIZE ONE TRAINING WORKSHOP AT IITA-BENIN FOR THE 12 WAFRINET COUNTRIES TO INFORM, EDUCATE, AND DISSEMINATE BETTER KNOWLEDGE OF FRUIT FLY PESTS AND THEIR MANAGEMENT. THE TARGET GROUP WILL BE NARS RESEARCH AND EXTENSION SCIENTISTS. THE WORKSHOP WILL INCLUDE BOTH THEORETICAL AND PRACTICAL ASPECTS OF FRUIT FLY IPM WITH BIOLOGICAL CONTROL AS THE MOST EFFICIENT AND SUSTAINABLE PEST CONTROL METHOD;
2. ORGANIZE IN EACH OF THE 12 WAFRINET COUNTRIES 2-DAY WORKSHOP SESSIONS TARGETING REGIONAL EXTENSION AGENTS AND SMALL SCALE FARMERS.
3. PRODUCE AND PUBLISH IN VARIOUS LANGUAGES LEAFLETS AND POSTERS ON BETTER KNOWLEDGE AND MANAGEMENT OF FRUIT FLY PESTS.

OUTPUTS

WE PLAN TO TRAIN 30 NARS RESEARCH AND EXTENSION SCIENTISTS DURING THE FIRST PHASE OF THIS PROJECT. THE SECOND PHASE TARGETS A TOTAL OF 340 PARTICIPANTS FROM REGIONS OF THE 12 COUNTRIES.

- **DURATION:** 1 YEAR
- **Estimated overall budget**: US$ 240,600.00
- **Links to existing projects**

The project will complement existing fruit fly management projects including the WAFFI, the ICIPE BMZ Fruit fly control project

- **Possible co-funding sources :** To be identified eventually
- **Possible executing institutions:** IITA
- **Suggested donors:** FAO, UNDP, USAID
- **Participating countries/region/sub-region:** 12 WAFRINET countries

Assessment and mapping of invasive alien plants in the Serengeti Ecosystem. Case study of Ngorongoro, Serengeti and Ikorongo-Grumeti Reserves, Tanzania: Hamza Kija

Project summary: The Serengeti ecosystem is among the most biologically diverse and productive ecosystems in the world. Currently, little is known about the extent of IAP, especially its current and future distribution, the use of remote sensing and GIS techniques coupled with extensive ground field work may offer unique opportunity to measure the extent of these invasive over the ecosystem. Basically we aim to use ground-based vegetation sampling to classify the remote sensing data, in order to map the current extent and predict invasive species that may then be used to address the ecological vulnerability of ecosystem. This study initially will focus on Ngorongoro Conservation Area, Serengeti National Park, and Ikorongo-Grumeti game reserves.

Project aims and objectives: The purpose of this study is to examine some of the landscape-scale ecological relationships by quantifying the extent and pattern of invasive/aggressive plant species and testing for substantive relationships with local landscape disturbance in the past.

Project rationale: The proposed study will be identifying and mapping IAP for the aim of appropriate measures to control or eradicate the problem, and will be used as a model to help conservation managers in the Serengeti ecosystem and in other protected areas in combating the IAP to take appropriate measures (e.g. through rapid response) to control or eradicate invasive plant species.

Project expected outputs: The proposed project aims to deliver the following

- Taxonomy identification of invasive alien plant species in the ecosystem
- Mapping the current spatial distribution of invasive plant species in the ecosystem
- Predicting the spatial distribution of invasive plant species in the ecosystem

Project duration: Two years project

Estimated overall budget: U$ 23,585

Links to existing projects: There is a project in the Ngorongoro Conservation Area for eradicating the IAP species, and there is a proposed project between TAWIRI, Wildlife Division and Grumeti Reserves on the same issue, however, in both projects the mapping component is missing.

Possible co-funding sources: Lacking, see under suggested donors.

Possible executing institutions: The proposed project partners Tanzania Wildlife Research Institute (TAWIRI), Tanzania National Parks, Wildlife Division, and Grumeti Reserves.

Suggested donors: No funding has been secured yet; however, there is available man kindly contribution and resources from the proposed partners in Tanzania. However, partial funding of the proposed project can be requested from partners.

The Effect of the Invasive Prosopis Spp on Indigenous Plant-Pollinator Interactions in Lake Bogoria National Reserve; Wanja Kinuthia & Chris Odhiambo

Pollination and Food Security

Pollination is a valuable environmental service that is critical to fruit and seed production in flowering plants. The vast majority of plants rely on external vectors for pollination, such as wind or animal pollinators. Over one third of global food crops grown for human and livestock consumption are dependent on animal mediated pollination. Thus large-scale loss of pollination services would affect important components of food security. For instance, foods pollinated by animals especially vegetables and fruit supply a large proportion of essential micronutrients. Scarcity in supply of food rich in vitamins and mineral can lead to poor health among local communities. It is therefore essential to ensure steady production and the role of pollinators in food production and ecosystem service . Over the last decade, there has been a significant decline in pollinator populations leading to a 'global pollination crisis'. Any deterioration of pollination services will have an impact on the food security and livelihoods of many rural communities. Our proposal therefore aims to monitor pollinator populations in agro-ecosystems and to create awareness to improve food security, rural incomes and thus community livelihoods.

1.

Aims & objectives

The aim of the project is to assess the impact of Prosopis spp on reproductive output of the indigenous acacia species in a semi-arid savanna.

The specific objectives will be to;

1) Determine pollinator diversity, abundance and visitation period on Prosopis spp vs the indigenous Acacia spp.
2) Assess seed quantity and quality in Prosopis spp and the indigenous Acacia spp
3) Develop public awareness manuals

1)

Output

The expected outputs;

1) Complete checklist of pollinator species of Prosopis spp vs. Acacia spp.
2) Document seed production of Prosopis and Acacia
3 a) Publicity manuals/booklets
3 b) Reports and publications in peer review journals

1.

Duration

Two years

Estimated overall budget

	Item	USD
1	Transport (Car Hire)	19000
2	Equipment and consumables	10000
3	Accommodation and Subsistence (2 scientist, 1 student and 2 technicians)	20000
4	Literature search	2000
5	Reports	1000
6	Papers	3000
7	Publicity Booklets/Manuals	5000
8	Community Workshops	4000
9	Meetings/Conference	10000
10	Communication	5000
11	Miscellaneous (10% total)	6900
	Total	**85900**

Links to existing projects
UNEP/GEF-funded Global Pollination Project
"Conservation and Management of Pollinators for Sustainable Agriculture through an Ecosystem Approach") in Kenya

Possible co-funding sources
1) UNEP/GEF-funded Global Pollination Project
2) ASARECA
3) UVIMA data basing component
4) BIOTA Pollination Component

Possible executing institutions
Lead institution: National Museums of Kenya (NMK),
Collaborating institutions: KARI, Ministry of Agriculture and Livestock Development

Suggested donors
IDRC, SIDA, CIDA, Rockefeller foundation, USAID

Participating countries/region/sub-region.
Start with Kenya
Phase II extend to Tanzania

The taxonomic infrastructure to support invasive species management: Building the short-term and long-term solutions: Chris Lyal

Introduction

Invasive species (IAS) are a major issue in Africa as elsewhere. In a recent global taxonomic needs assessment in the context of IAS, Smith et al (2008) identified taxonomic needs not only at the user level but also at two levels above that, in the institutions that deliver the taxonomic information required, and in the policy / supervisory level above that. The challenge to be addressed in this project is to deliver taxonomic information and support in a timely manner in the short term, and also to build a sustainable infrastructure to deliver it in the long-term, capitalizing on the knowledge gained and contacts made in short-term solutions.

Many parts of Africa lack the requisite access to specialists who can provide requisite taxonomic advice or identifications sufficiently rapidly to meet the needs of intercepting, monitoring or identifying Invasive Species. These species, by their nature, will not appear in handbooks, guides and collections, should they even exist, of the countries or districts in which they are found, making their identification more difficult than that of indigenous species. Provision of information from outside Africa is difficult because, among other reasons, the specialists may be difficult to contact or may not have time to identify the specimens. To solve this problem in the short term communication with international specialists must be facilitated and their ability to respond to calls for assistance improved, but in the long term the capacity throughout Africa must be improved and the reliance on more distant specialists reduced whilst maintaining contacts.

It is important to clarify what is meant by 'capacity'. This includes i) skilled staff; ii) collections of specimens, literature, DNA, information etc; iii) communications links to obtain information; iv) economic stability to ensure the work can be carried out; v) workflow management to ensure suitably rapid response.

The aims of the project are therefore:

1. Build a rapid-response identification and information-provision system using African and global expertise, facilitated through a European exchange.
2. Build human capacity in Africa through training and distance mentoring.
3. Build information bank on invasives identified (including literature, DNA sequences, specimens, images, web pages), ensuring access throughout African partners.
4. Build cost-effective identification and information system in Africa, maximizing involvement of current actors, with the aim of phasing out European and other information supply and replacing it with support.

It must be emphasized that no part of this project is intended to replace current information and identification services operating in Africa, but the project will seek to involve them as partners if moved beyond the current concept phase.

Outline Programme of Work

Phase 1: Review of current capacity and building project team

This will start before any proposal is submitted, and will continue with decreasing intensity. The current activity and actors must be the foundation on which any additional capacity is built. Moreover, new systems work best if they are adopted as part of the workflow of existing actors, and thus current

workflow is important to understand. If capacity for any groups or environmental sector is adequate, it will be enhanced but not supplanted. The review will take place both within African partners and outside Africa, particularly Europe, the latter making use of the EDIT project and CETAF, in both of which the Natural History Museum is a partner. The information-sharing system of GISIN and GBIF will be evaluated to ensure maximum interoperability of any informatics system built.

Phase 2: Interim provision of information and identifications

This will fill gaps in current coverage by making use of experts in institutions both within Africa and outside, particularly Europe. An exchange will be set up to capture requests for information and identifications and direct them to the appropriate supplier. This will involve an office but a virtual system will be built to supplement it and to investigate to determine how effective it is. As a part of this virtual system an invasive species 'scratchpad' will be set up, facilitating collaborative work, sharing of information, images and data, and providing a mechanism for rapid publication both in scientific journals and as web pages

The identification system will only work if the suppliers have an economic model to support it. This might involve payment per identification (as is generally the case currently) but other benefits to those organizations and individuals will be sought, including authorship of invasive species web pages, authorship of joint or single-author papers on the species discovered, agreed Performance Indicator supply (e.g. identifications performed, economic significance, user-base). Partners will be encouraged to seek economic sustainability for the activity and share lessons learned.

Phase 3: Capacity-building

Training will be provided by expert partners in the project in identification techniques. This might include training courses (delivered in appropriate countries), distance learning through the Internet, and one-to-one mentoring. A component of the project will be fellowships in partner organizations.

Provision of guides created as a part of the identification process. Each guide is likely to be multi-author.

Provision of voucher specimens to all countries within the partnership so that local and national collections can be built up.

Provision of DNA barcode sequences through BOLD and other suitable mechanisms. Barcodes will be captured as a matter of course in the identification process.

As capacity is built partnerships between non-African and African partners will be fostered, with the intent that the work will be passed from one to the other.

Building a sustainable system within Africa will require a sustainable business plan, and this will be developed with African partners during the project. For this reason the cost-effectiveness of any identification or information provided will be evaluated through the project, as evidence to support business cases, to determine the most cost-effective means of information provision, and to evaluate how (and if!) the information bank build makes the work cheaper and more efficient.

Integrated Invasive Species Management and Protected Areas Development: Melckzedeck Osore & Soud Jumah

Aims & objectives

Enhance the integration of invasive species management and development of Protected Areas of Zanzibar.

Objectives

- Assess the identity, distribution, abundance and impact of invasive species in PAs
- Review the policy and legislation on patterning the management of invasive species.
- Digitizing the taxonomic information and create a comprehensive database for invasive species and PAs.
- Develop guidelines that would institute the manner to which the invasive species will be monitored, maintained or eradicated
- Improve the capacity of the institution and personnel participating in management of invasive species and general plant and animal taxonomy.
- Create awareness on management strategies.
- Improve skills and capabilities in the management of plantations, coral rag forests and coastal resources base including mangrove ecosystems and islets.

Outputs

- List of invasive species established
- The damage caused by invasive species and its coverage in the PAs is identified
- The socio-economic and environmental impact of invasive species to PAs identified
- The comprehensive database of invasive species in relation to other ecological resources base is established
- The list of institutions and personnel participating in invasive species management is established
- The standards, tools and guidelines on managing invasive species developed
- The capacity of participating institutions and personnel in invasive species management and general taxonomy is enhanced
- Awareness at different level is increased
- The management strategies including monitoring and eradication of invasive species is developed and implemented
- Survey report and map of all PAs and their associated invasive species developed

The Project duration

The project will be accomplished in two years

The estimated overall budget

Approximately US $ 100,000

Links to existing projects

Marine Coastal Environment Management Project (MACEMP) that supports the management of coastal resources including mangroves and eradication of fruits flies and Indian house crows in Zanzibar.

Coastal Forest Project that support development of protected areas in Zanzibar. This is estimated to start next year. Other small activities include butterflies farms at Pete.

Possible co-funding sources

UNDP and the Global Biodiversity Facility (GBF)

Possible executing institutions
Western Indian Ocean Marine Science Association (WIOMSA),
Department of Commercial Crops, Fruits and Forests (DCCFF),
Zanzibar Fisheries Department
Department of Environment

Local NGOs include the Society for Natural Resources Conservation and Development, Tanzania Foresters Association (TAF), Zanzibar Zoological Society and Zanzibar Farmers and Fishermen Association (ZAFIDE)

Participating countries

The participating countries: Tanzania, Kenya and Uganda

Mainstreaming pro-poor urban and rural community forest conservation to restore mangroves ecosystem:
Melckzedeck Osore & Soud Jumah

Goal

To improve pro-poor community conservation to reduce deforestation and degradation in Zanzibar's protected areas and mangroves ecosystem, and sensitize income activities that will provide direct and equitable incentives to communities to conserve forest resources and utilize them sustainably.

Objectives

- Encourage ownership by involving the local communities in promoting good forest governance that will facilitate sustainable and equitable forest conservation and management of community forest areas;
- Conduct survey of selected community forests to document their potential conservation status;
- Work with the local communities to prepare policy and legal tools that will help to manage their designated community forest areas;
- Up-scale the use of alternative energy sources including improvement of production and utilization to wood fuel technology so as to reduce pressure on demand of wood fuel;
- Promote incentives by supporting environmentally friendly alternative income activities in conservation initiatives;
- Support the local coastal communities to develop a leakage avoidance/reduction strategy and community-based monitoring to assess effectiveness of this strategy
- Design and implement monitoring and evaluation systems to assess progress against expected results and objectives of the project.
- Clarify and formalize land and forest tenure arrangements for women and men in the communities undertaking pro-poor community forest management (COFMA)

Outputs

- Comprehensive data base on the resources base of various community forests, including the available flora and fauna with their conservation status established.
- Replicable, equitable and cost effective training modules, manuals and related support materials produced to reduce degradation and deforestation and to control leakage.
- Awareness on good forest governance, and advocacy processes raised, with particular emphasis on social equity, and experience/lessons disseminated to a wider audience.
- Local Community Management Plan (for COFMA) developed for community adjacent to PAs
- Local communities practicing forest conservation initiatives in selected communities trained
- Gender sensitive COFMA manual for Zanzibar are developed
- Gender differentiated institutional capacity assessment of leading institution and selected local government organization and CSOs/NGOs to identify strengths, weaknesses and capacity gaps related to pro-poor gender equitable COFMA are conducted and training plan designed accordingly
- Publications (guidelines, peer-reviewed publications and articles in local newspapers) to document and disseminate experiences and lessons learnt within Zanzibar and to the wider international audience
- Business plan established for all community adjacent to PAs to support conservation initiatives

The Project duration

The Project will be accomplished within four years

The estimated overall budget
US $ 150,000

Links to existing projects

- The project is associated with the different activities implemented under the Marine Coastal Environment Management Project (MACEMP)
- The Project of Good forest governance. Implemented under NFP in selected villages.
- UVIMA project implemented by EAFRINET

Possible co-funding sources
WIOMSA through the MASMA Programme, UNDP, FAO etc

Possible executing institutions
WIOMSA, DCCFF, Fisheries Department, and the Department of Environment. The relevant Non-government organisations including Society for Natural Resources Conservation and Development (SONARECOD), Tanzania Foresters Association (TAF), Zanzibar Zoological Society (ZAZOSO), Ngezi-Vumawimbi Natural resources Conservation Organisation (NGENARECO) and Jozani-Chwaka Bay Conservation Association (JECA).

Suggested donors
UNDP, SwedBio, Global Biodiversity Facility, GBIF, etc.

Project Title: Building capacity in order to mine data from botanical collections in order to monitor changes in alien invasive species and possible climate change: Esther Rampho

Aims and objectives: To initiate capacity in order to be able to:

- Improve the integrity of databased collections while adding the collections not yet databased and linking all data. This includes starting with alien invasive to provide data on these plants such as growth-form as an indicator for invasiveness.
- Show the spread of alien invasives.
- Use the botanical data sets collected over a few centuries (1 052 623 databased specimens from Herbaria and 961 434 from FSA region) to estimate the rate of possible climate change. This includes monitoring the presence or absence of species over time.
- Map the dominant species / rarest species for all biomes / centres of endemism looking for patterns.
- Ground truth old photographs to indicate life expectancy of plants together with age and growth rate.
- Map the expansion /contraction of Karoo using botanical data base.

Duration: Three years, April 2010-March 2013
Estimated budget: $ 100 000.00
Links to existing projects:

- Climate Change.
- Global Invasive Species Programme.
- Management of protected areas.

Project linkage to national priorities, action plans and programmes:
In terms of the National Environmental Management: Biodiversity Act (Number 10 of 2004) (NEMBA), SANBI is mandated to perform certain functions in Biosystematics (see Table 1 below). These functions typically relate to biosystematics research, taxonomy, collections management, data basing and the dissemination of biodiversity information. This mandate is recognized as part of the strategic priorities for SANBI as set out in the Corporate Strategic Plan (CSP).

	Primary function from Act
11 (a)	Monitor and report regularly to the Minister on: (i) biodiversity (ii) conservation status of all threatened or protected species and listed ecosystems; and (iii) status of all listed invasive species
11(c)	Act as an advisory and consultative body on matters relating to biodiversity to organs of state and other biodiversity stakeholders
11(d)	Co-ordinate and promote the taxonomy of South Africa's biodiversity

	Primary function from Act
11(f)	Establish , manage, control and maintain herbaria and collections of dead animals
11(g)	Must establish research facilities
11 (h)	May establish, maintain, protect and preserve collections of plants in herbaria
11 (i)	Establish, maintain, protect and preserve collections of animals and micro-organisms
11 (j)	Collect, generate, process, co-ordinate and disseminate information about biodiversity and sustainable use of indigenous biological resources and maintain databases
11 (k)	Regulate and provide services to public at the gardens, herbaria and other places under SANBI control
11 (l)	Undertake and promote research on indigenous biodiversity and its sustainable use
11 (p) (i), (iv)	Advise the Minister on any matter regulated in terms of this Act, including (i) implementation of this Act and any international agreements affecting biodiversity which are binding on the Republic (iv) the management and conservation of biological diversity
50	The Minister must promote research done by SANBI and other institutions on biodiversity conservation, including the sustainable use, protection and conservation of indigenous biological resources

Possible co-funding sources: GEF, UNDP, BioNET International.
Participating countries/region/sub-region: South Africa & SADEC region.

Development of an Identification Guide for Alien Weeds and Invasive Plants for East Africa: Arne Witt

Aims & objectives: There are currently no comprehensive and/or collated lists of invasive or potentially invasive plant species in Ethiopia, Tanzania, Kenya, Rwanda, Burundi or Uganda. Not one of these countries has an Identification Guide to assist people, who want to make a contribution to alien invasive plant species inventories, in identifying these species. Data provided by people in the field will also allow policymakers and others to monitor the expansion of existing invasions and implement management strategies. An Identification Guide will also contribute to the detection of new invasions leading to the increased probability of their early eradication.

Invasive Alien Species (IAS) have been identified as one of the main drivers of biodiversity loss and pose a significant threat to food security globally. These impacts will be exacerbated by global warming because IAS posses traits favoured by the predicted climate changes. Managing IAS to protect biodiversity and enhance food production have therefore become global imperatives. It is widely recognized that the main barriers to effective IAS management in Africa are the lack of effective policies, unavailability of critical information, shortage of capacity and inadequate implementation of prevention and control.

Policymakers, planners and managers need information on the alien plant species present and their current status, but there is little such information available. This makes it impossible to assess the impacts that invasive plant species may be having on a particular country's biodiversity, pasture/crop production, water resources and human health. The lack of tools to identify these invasive plants means that those who could be collecting this information are unable to do so. To this end it is proposed that an authoritative Guide to the Identification of Alien Weeds and Invasive Plants in East Africa be developed. It will include information on invasive plants in Ethiopia, Kenya, Tanzania, Rwanda, Burundi and Uganda. Surveys be undertaken to determine which invasive and potentially invasive species are present in each country and how they can be identified. This will also provide baseline information for decision makers.

Outputs:

- The majority of invasive plant species localities (infestations) recorded in Ethiopia, Kenya, Tanzania, Rwanda, Burundi, and Uganda;
- Data on all localities made available to all stakeholders to allow for the production of distribution maps;
- The development of an Alien Weeds and Invasive Plants Identification Guide for East Africa;
- Increased awareness amongst all stakeholders and beneficiaries as to the invasive plants present in the region and the threats that they pose to economic development,
- Information will contribute to the management of invasive plants in the region and as a result contribute to poverty alleviation and food security.

Duration: 18 months

Estimated overall budget: US$110 000.00

Links to existing projects: The GEF/UNEP Project, "Removing Barriers to Invasive Plant Management in Africa" is active in Uganda, Ethiopia, Ghana, and Zambia. In each country an enabling policy environment is being promoted through establishment of appropriate institutional arrangements to ensure that IAS strategies are mainstreamed; stakeholder awareness of IAS issues is being raised and

access to necessary information provided; prevention and control programmes are being established, including ecosystem management plans at pilot sites where IAS threaten biodiversity; and capacity for sustainable IAS management is being built. Lessons learnt will be disseminated for replication in other countries in Africa. Some IAS surveys have been undertaken in Ethiopia and Uganda and casual IAS surveys have already been undertaken in Tanzania and Kenya and the information collated.

Possible co-funding sources: NPPO's

Possible executing institutions: CABI in collaboration with NPPO's

Suggested donors: FAO, GEF, USAID, CBD, SWEDBIO, DANIDA, International Companies active in region.

Participating countries/region/sub-region: Ethiopia, Kenya, Tanzania, Burundi, Rwanda, Uganda.

Appendix D. Workshop Evaluation

Fifteen evaluation forms were submitted anonymously at the end of the workshop. The results, summarized below, comprise of quantitative summaries and verbatim comments.

Responses to the workshop evaluation form

WORKSHOP UTILITY, OBJECTIVES AND EXPECTATIONS				
Was the workshop useful to you?	**Yes**	**Maybe**	**No**	**No response**
	14	1	0	0
What was the most useful part of the workshop for you?				
Chris and Junko's and Silvia's presentations				
Presentations of individual concept notes and the discussion sessions				
Presentations by organisers (particularly logframe work) and that of other colleagues				
All were useful but mostly presentations on donor expectations				
Learning more about GEF and funding opportunities				
Various presentations, especially the logframe				
Logframe analysis				
Logical framework work				
Project development appraisal by Chris and others				
Project proposal evaluation				
Helping people test their proposals				
Breakout session to fine tune the proposals				
Project concept note formulation				
Other people's proposals				
Other people's mistakes				
The roles of taxonomy in invasives management				
I have met more partners working on IAS. Thus I saw a better idea of the work done on IAS in Africa				
Networking				
Discussions with individuals				
What was the least useful part of the workshop for you? (10 no responses)				
None				
Everything was very useful				
GTI background				
CBD background				
Time to await slide presentations				
How would you rate the event overall?	**Excellent**	**Fair**	**Poor**	**No response**
	14	1	0	0
Were your expectations met?	**Fully met**	**Nearly met**	**Not met**	**No response**
	14	1	0	0
Was the objective of the workshop met?	10	4	0	1
Any comments on the achievement of the workshop objectives?				
Exceeded the expectations				
Putting meat to our draft proposals				
I think the workshop improved some clarity in project writing				
Learned a lot about project development and collaborations				
The workshop was good, in neat time! Emphasis should be given to project cycle management				

LOGISTICS				
	Excellent	**Fair**	**Poor**	**No response**
Facilities	7	6	1	1
Workshop organisation	13	1	0	1
Quality of pre-workshop information & preparation	11	3	0	1
Duration of workshop	11	3	0	1
	Yes	**Maybe**	**No**	**No response**
Did you have any language difficulties?	0	0	11	4
Did you encounter any problems with regard to travel arrangements, payments, accommodation arrangements, etc.?	2	0	9	4

CLOSING COMMENTS
Should there be repeat workshops of this nature? Do you have any suggestions for such future workshops?
Yes
Yes - need to be repeated
Yes - it helps to meet often and check with each other
Yes but with more preparations / notification of participants of their proposals beforehand
Yes - different regions
Yes, More focused on actual projects being achieved. i.e. DRAFT PROPOSALS
Provide as a model of well-written concept note (of course) including a good model of logical framework
Yes - do discuss and work more proposals on taxonomy
Yes - focusing on system-wide application to biodiversity conservation
Yes - another project development workshop focusing on climate change
Yes - in addition to helping in proposal writing may also provide information on current funders and global trends in taxonomy and biodiversity
Yes to promote the development of projects on control and biocontrol and prevention of IAS
Everything was perfectly organised
Involve more donors
Any other comments?
There is the need to do it again to see the development process of the projects developed
It would have been useful to make participants aware of proposals to be reviewed - to provide opportunity for regional / institution consultations and merging
Food quality during lunch time has to be improved. Indeed, most of the participants had diarrhoea problems during the second night of the workshop
Create network and exchange information
The workshop also provided opportunities fro networking with colleagues in the same field both African and those from outside Africa
Congratulations to John, to BioNET, CBD and the National Museums of London and UK, well done to the Kenyan local organisations

Appendix E: Useful References and Websites

The Global Taxonomy Initiative

Guide to the Global Taxonomy Initiative, 2008, CBD Technical Series No 30, 105pp. Published by the Secretariat of the Convention on Biology Diversity. See http://www.cbd.int/gti/

GEF links

GEF Homepage **www.gefweb.org**

GEF Country Support Programme (CSP) Knowledge Facility for GEF Focal Points **www.gefcountrysupport.org**

GEF RAF http://www.gefweb.org/interior_right.aspx?id=82

Links to relevant BioNET resources

H. Davies, N. King and R. Smith (eds.), 2004, Taxonomy: targeting invasives. BioNET-INTERNATIONAL. ISBN 0-9538748-2-6:
http://www.bionet-intl.org/opencms/opencms/resourceCentre/library/library.jsp

Smith, R.D., Aradottir, G.I., Taylor, A. and Lyal, C. (2008) Invasive species management – what taxonomic support is needed? Global Invasive Species Programme, Nairobi, Kenya.
http://www.gisp.org/publications/reports/index.asp

GISIN Links

Technical documentation: http://www.gisin.org

Reports and publications: http://www.gisinetwork.org/pubs.html

Results of Needs Assessment Survey: http://www.gisinetwork.org/pubs.html

Project development guidelines circulated to participants in advance of the workshop

BioNET Secretariat (2009). Guidelines for project development for the participants in the project development workshop for the Global Taxonomy Initiative. BioNET-Secretariat, Egham, Surrey, UK.

Links to other project development resources are contained in the above publication.

ANNEXES

ANNEX I: QUESTIONNAIRE ON NATIONAL ICT STATUS

BOZONET
Botanical and Zoological Taxonomic Networks for Eastern Africa
Linking Taxonomy to Conservation

DRAFT QUESTIONNAIRE ON ICT STATUS

Introduction

The purpose of this questionnaire is to obtain an overview of the national ICT status with a view to identifying the human and infrastructural capacities, strengths, weaknesses and areas of need in ICT. Because ICT capacities were not covered in sufficient detail within the national consultant's reports and due to time constraints – this questionnaire is being directed to National Project Coordinators so as to expedite the process.

Note: In order to have flexibility in space for writing, it was recommended that this questionnaire be filled directly on the computer.

COUNTRY: _____

A) ICT MANPOWER CAPACITY

1. Indicate estimates of National percentages of institutions that are sufficient in staff who are ICT literate.

Sufficient ICT staff who are highly trained in taxonomic databases	Sufficient ICT staff highly trained in ICT but not exposed to taxonomic databases	Insufficient ICT staff, highly trained in ICT and taxonomic databases	Insufficient staff with very basic training in ICT	No staff in ICT
%	%	%	%	%

Comments: _____
_____

2. In your view what are the estimated proportions (%) of institutions have ICT personnel with the following levels of training:

Training Level in ICTs	Percentage of Institutions
PhD.	
MSc.	
BSc.	
Diplomas	
Certificate	

3. Please state any constraints in recruiting qualified ICT personnel?

_____
_____

_____

B) ICT STATUS

1. In your view what is the percentage of institutions which have ICT systems (computers, software, databases) for databasing? _____%

2Comments: _____
_____

2. Please provide an estimate of the percentage of the institutions which have ICT facilities that are current, old and which have none?

Types of ICT facilities available in national institutions		
Current	Old	None
%	%	%

3. Select five or more main organizations representing several taxonomic areas and tabulate information about 10 main databases below *(use the rows provided below each database to **briefly** comment on the institution's experiences and constraints in establishing and managing their database/s - use as much space as necessary)*****

Name of institution: _____

	National Institution	**Database name**	**Software**	**Purpose and status (current/dead)**	**Number of records**
1					
Comments/experiences in establishing this database:					
2					
Comments/experiences in establishing this database:					
3					
Comments/experiences in establishing this database:					
4					
Comments/experiences in establishing this database:					
5					
Comments/experiences in establishing this database:					
6					
Comments/experiences in establishing this database:					

	National Institution	Database name	Software	Purpose and status (current/dead)	Number of records
7					
Comments/experiences in establishing this database:					
8					
Comments/experiences in establishing this database:					
9					
Comments/experiences in establishing this database:					
10					
Comments/experiences in establishing this database:					

*Note: Where available please provide any documentation or publication on databases that have been established and are operational presently.

C) SHARING AND EXCHANGE MECHANISMS

1. In your view what proportion of institutions exchange/share data with each other locally _____%; Regionally _____%: Internationally____%

2. Comment on the sharing/exchange mechanisms used to share data locally.
   _____
   _____

3. Comment on which institutions data is shared with and the sharing/exchange mechanisms used regionally.
   _____
   _____

4. Comment on which institutions share data and the sharing/exchange mechanisms used to share data internationally?
   _____
   _____

5. In your view what is the proportion (%) of institutions have developed formal data sharing/exchange mechanisms such as a policy document? _____%

D) INTERNET ACCESS

1. In your view what is the percentage of organizations which have access to email? _____%
   Comments: _____
   _____

2. At a national level, what types of Internet connectivity do institutions have in percentage terms?

Excellent, fast and reliable (leased line/VSAT)	Fair speed and reliable	Fair speed but unreliable	Slow speed and unreliable	Poor or no connectivity
%	%	%	%	%

Comments: _____
_____

3. In percentage terms, how many institutions have developed and manage their own website? _____%
(Please list the web addresses of these websites as an annex to this questionnaire)
Comments: _____
_____

4. What percentage of institutions has taxonomic databases accessible through their websites? _____?
Comments: _____
_____

E) CONSTRAINTS

1. Please scan the following list of constraints provided and rank them in order of most important to the least important constraints in managing taxonomic data. Give status of 1 to the most important and status of 11 to the least important. Use the space provided for further comment.

_____ Office or dedicated space for ICT equipment
Comment: _____
_____

_____ Computer Hardware facilities
Comment: _____
_____
_____

_____ Database Management Software
Comment: _____
_____

_____ Printing Facilities
Comment: _____
_____

_____ Skilled IT personnel
Comment: _____
_____

_____ Local Area Network of Computers
Comment: _____
_____

_____ Facilities for digitizing specimens
Comment: _____
_____

_____ Personnel to undertake digitization
Comment: _____
_____

_____ Personnel to enter taxonomic data into the computer
Comment: _____
_____

_____ Personnel to record taxonomic data on questionnaires
Comment: _____
_____

_____ Personnel with Geographical Information Systems (GIS) training
Comment: _____
_____

_____Other please specify: _____
Comment: _____
_____

F) WAY FORWARD

What general and/or specific solutions would you recommend for establishing or enhancing biodiversity databases within national institutions in the following areas?

Hardware Systems: _____
_____

Software Systems: _____
_____

Geographical Information Systems: _____
_____

Internet Connectivity: _____
_____

Website based access: _____

Computer Networks: _____
_____

Infrastructure/buildings/office_____
_____

Any other area/s: _____
_____

ANNEX II: NAMES AND INSTITUTIONS OF PERSONS E-MAILED OR SPOKEN TOO

Name	Institution
Ethiopia	
Ensemu Kelbessa	National Coordinator, BOZONET Ethiopia National Task Force
Dr. Zemede Asfaw	National Consultant, Addis Ababa University
Dr. Bezabih Emana	National Consultant, Agricultural Economist
Dr. Abebe Getahun	National Consultant, Zoological Natural History Museum
Kenya	
Dr. Beatrice Khayota	Centre for Biodiversity, National Museums of Kenya
Dr. Siro Masinde	National Museums of Kenya, EAH, NMK
Dr. David Mwachala	National Museums of Kenya, Dept of Zoology, NMK
Dr. C. Warui	National Museums of Kenya, Dept of Zoology, NMK
Mr. Jack Murauri	National Museums of Kenya, Dept of Zoology, NMK
Mr. Collins Handa	National Museums of Kenya, Wetlands Dept., NMK
Mr. Jonathan Ogweno	National Museums of Kenya, EAH, NMK
Dr. Catherine Lukhoba	National Project Coordinator, University of Nairobi
Dr. George M. Siboe	School of Biological Sciences, University of Nairobi
Tanzania	
Dr. Joseph N. Otieno	National Coordinator, BOZONET Tanzania, National Task Force
Adelaide E. Sallema	University of Dar es Salaam, Tanzania
Ernest Mauya	TAFORI
	Institute of Traditional Medicine, Muhimbili University College of Health Sciences
Prof. Robert S. Machang'u	Sokoine University of Agriculture
Uganda	
Stephen Kigolo	National Project Coordinator, Makerere University, IENR
Dr. Frank Kansiime	Makerere University, IENR

ANNEX III: SUPPLEMENTARY INFORMATION: DATABASES, NETWORKS AND WEB SYSTEMS

The objective of this exercise is to remove the current barriers to the flow of relevant taxonomic information from networked centers of expertise, and make it readily available to the various end users of the information. This will greatly help by being a bold step towards sustainable conservation of biodiversity through the process of inventory, description, monitoring and dissemination of electronic information.

After thorough study of the PDF–B Project documents and all other documents prepared by the National Consultants of the four countries, several issues were very clear. These are: -

1. More than 70% of respondents indicated poor or no access to ICT infrastructure, denying them access to taxonomic services such as electronic books, journals and up to date data information.

2. Most users especially in the rural areas expressed lack of interest in electronic data and made preference to information availed in hard copies. As a result, this trend impedes electronic data sharing. This may be attributed to lack of adequate Internet connectivity (good Internet bandwidth), lack of proper interaction and exposure with various electronic and interactive software tools.

For institutions to fully enjoy ICT systems and the benefits that come with having digitized and databased taxonomic information, several issues need to be addressed: -

1. Development of data sharing policies and mechanisms so that information can legally and freely flow amongst institutions dealing with information that is relevant and useful to each other. This will aid in avoiding duplication of projects.
2. Development of Data standards to maintain the quality of data produced.
3. Ensure interoperability of different data systems used in the various institutions so that data can talk to each other. It is of great importance that the various databases that exist in the different institutions are in a position to process data from partner institutions.
4. Development of expertise in data handling, databasing, specimen databasing and imaging and database management. These will ensure the data quality standards developed and the database systems are maintained, as this will bring together the Taxonomic professional and IT professional.
5. Support the installation of ICT hardware and software in institutions to support the vast amount of data already available and also data generated by the databasing and imaging work. Most if not all institutions have the will and drive to establish and maintain state of the art databases and imaging projects. This is greatly hampered by lack of the necessary equipments, ranging from computer systems, good Internet connection (good bandwidth) to imaging equipment. Infrastructure in some institutions can be enhanced so that they will act as resource centers for their localities.
6. Provision of an enabling environment to facilitate specimen, data and information exchange.
7. Encourage and facilitate institutional policies and mechanisms for data and information sharing.
8. Address the pivotal issue of Intellectual property rights and copyright matters.
9. Capacity building in collection, observing, recording and identification of relevant phenomena
10. Capacity building in use and maintenance of the equipments available.

Data sharing and information finding can be very well tackled with the development of a database.

Depending on the use, location and other factors, databases can be defined in various ways. The term 'database' is used in reference to electronic and non-electronic databases. We will focus on electronic databases.

We can define a database as: -

1. A collection of data arranged for ease and speed of search and retrieval.
2. A collection of records stored in a computer in a systematic way, so that a computer program can consult it to answer questions. The items received in answers to queries become information that can be used to make decisions, and/ or be a foundation for something else.
3. A collection of related records.

Many professionals would consider a collection of data to constitute a database only if it has certain properties e.g. if the data is managed to ensure its integrity, performance, and quality, if it allows shared access by a community of users, recovery from hardware and software failures e.t.c.

Electronic databases greatly speed up information retrieval while simultaneously reducing unnecessary handling of herbaria specimens thereby enhancing conservation of specimens. They also enable remote information sharing, thus facilitating collaborative work.

Most practical databases attempt to enforce a database transaction model that has desirable data integrity properties. Ideally, some of the rules are summarized below.

1. **ATOMICITY**. Either all the tasks in a transaction must be done, or none of them. The transaction must be complete, or else it must be rolled back (undone). This aids in software recovery after a hardware or software failure.
2. **CONSISTENCY**. Every transaction must preserve the integrity constraints of the database It cannot place the data in a contradictory state.
3. **ISOLATION**. Two or more simultaneous transactions cannot interfere with one another. Intermediate results within a transaction are not visible to other transactions.
4. **DURABILITY**. Complete transactions cannot be aborted later or their results discarded. They must persist through restarts of the database even in the event of recovery and updating.

Modern approaches to Flora writing are increasingly being built around database technology. Databases allow for greater flexibility in the range of questions asked of the Flora and consequently greatly enhance the utility of the Flora in the core roles of identification of species and nonmenclatural queries. There are however a few examples where floristic works have been converted into database format, so that much of our legacy of floristic texts still rests in the form of printed pages.

Databases are used in many applications, spanning virtually the entire range of computer softwares. Databases are the preferred method of storage for larger multi-user applications, where coordination between many users is needed. Even individual users find them convenient.

Digitization offers great potential as a solution to the problems faced both by the producers of large-scale floristic works and their end users. Digital information can be distributed much more widely and cheaply than printed pages and offers greater flexibility in its re-use. Digitization offers new ways of using floristic information and has the potential to draw in a different, if not a wider readership than the traditional audience. Digitization of the legacy of printed floras is now a practical reality.

Some of the benefits of digitization and databasing include: -

1. Up-to-date records of collections.

2. A complete list of taxa and specimens are generated.
3. Electronic management of specimens.
4. Quick access to records of the collections.
5. Easy to get references of related materials.
6. Reduces wear and tear, as the original specimens are not handled.
7. Electronic management of the specimens acts as a backup and security incase the specimen gets lost, damaged or are destroyed by natural or man-made forces.
8. Easy linkage to end users through Internet databases.

When planning for a database, it is imperative that the institution or organisation settles for a database system that will clearly and optimally represents the expected output, content material and the visioned end-user of the databased information.

There are several options for an IT system, namely,

Stand alone system. In this system, the database software is installed, updated and maintained from one single computer system. This is the common scenario found around and most individuals and even some institutions prefer it. It is very common mainly because of lack of the necessary equipments to set up a dedicated database system. Some of its advantages are-

1. Cheaper to setup and to maintain as only one computer system is in use.
2. Fewer technical personnel are needed to carry out data input.

Some of its disadvantages are-
1. In the case of an institution, databasing moves slowly as there is a lot of data and only one system.
2. There are no instances of data sharing and this system is not connected to any other using any media.
3. Data security is low as mostly the machine is also used for other services. Not a dedicated system.
4. Very difficult and expensive to update many database softwares as most updates are free if downloaded online and purchased when put on other media like CD's.
5. Probability of a database that is not conclusive is high because the database is only open to very few individuals who will only add fields relevant to their scope of work. At the end of the day a lot of data about a specific flora is left out.
6. Without a proper backup system, it is easy to loose data in the event of hardware or software failure.

LAN/Networked system. In this case, several workstation computers and one or two computer servers for administrative duties are configured into one computer network. Database software is installed on the primary server and data entry is done from the dedicated data entry workstations. Issues dealing with network management like permissions, levels and times of access, backup and software updates are done from the server. Depending on the size of the network and availability of the second server, it is used as a mirror to the first one and it automatically assumes the position of the primary server when the main server is down for repair, periodic maintenance e.t.c. This system is mostly used by larger institutions, as they set-aside dedicated IT hardware equipment, personnel and workspace for this.

Advantages.

1. Effective data sharing, but limited to the local network.
2. Dedicated systems, hence data security. The machines are only used for data entry, data retrieval and research on the database material.
3. Dedicated/specialized personnel dealing with the database and network hence faster recovery when the system goes down.
4. Dedicated personnel hence output and quality of work is higher.

5. The system can cover a larger scope of data as you can have several professionals working in different fields working together.
6. With the server system in place, data security is possible. You can schedule periodic backups, as often as possible, assign usernames and passwords, access times and all precautions to make sure that only authorized personnel have access to the database and can make substantial changes. Security is also enhanced, as there is dedicated workspace for the databasing systems.

Disadvantages.
1. Expensive to set up and maintain as this entails acquisition of several computers and the establishment of a LAN (Local Area Network).
2. More costly as more personnel are needed for data entry, database maintenance, IT equipment maintenance and network support.
3. Without proper standards, checks and balances, there may be duplication of work.

WAN (Regional) Systems. Here, LAN's are established in various institutions in a given region. This is very useful when several institutions in one region are working on the same or related specimen e.g. Uganda, Kenya and Tanzania can work on a similar or same project involving fish in Lake Victoria. This can greatly enhance data quality, as information from various angles concerning the given subject is made available. To avoid duplication, shared resources, information and pool manpower, a regional database is of vital importance. This can also be used by different institutions in the same country or even in the same city working towards a common goal, but with different inputs.

Advantages:
1. Quick access to data from the regional database.
2. With proper structures, data duplication is avoided.
3. More in-depth data is available easily as you can get more information on the same species of fish from Kenya, Tanzania and Uganda, hence concrete judgment can be made on issues affecting the region.
4. Data on a large scale can be got easily and on a shorter period of time, as data is collected and entered simultaneously by different institutions in different countries at the same time.

Disadvantages:
- Expensive to establish as this involves setting up of different LAN's in different locations then linking them using media e.g. satellite, underground fiber optic cable, leased lines from telecommunication companies e.t.c.

- With the establishment of WAN (Regional) systems, we need to address the issue of establishing resource centers to administratively manage the systems. These resource centers will act as taxonomic information hubs.

Some of the factors to consider when developing a taxonomic information hub include: -

1. Interoperability. The various databases, if users are having different database software systems should be in a position to allow data transfer amongst them. For this to be successful there has to be common standards amongst all the users, so that the data can communicate to one another.
2. Software stability.
3. Language.
4. Systems security, both hardware and software.
5. Common standards.
6. It should be structured to capture data from a diverse group of organisms.

7. There should be diverse output as represented by the diverse needs, e.g. charts, graphs, maps, and tables. The hub should also have the necessary equipments and manpower needed.

Web Based (Internet) systems. These are databases whose information can be accessed from the Internet. These databases are run from a server system that has the functions of a web server. Having the database as a website, users can get access by typing the web address, through website links or through search engines. Once on the site, users navigate to the desired information using internal database links and an internal search engine designed for the database navigation. In this system, the information on the database is made available to all Internet users. This introduces the use of a web server. A web server interacts in a more formal way with remote clients (computers) on the Internet. With special types of middleware softwares, database servers could process data transmitted back from the remote Internet client computers.

As the Internet grows in scope, technology, and speed, emerging technological concepts such as web services are changing the way that software development is done. They are structured to allow sharing of computing power and software know-how across the global community. Web services allow the global communities get access to data instantly. They enable application-to-application interaction making functions written to deal with specific tasks available to programs running on any machine connected to the Internet. This technology can play an important role in the area of biodiversity software production in a cooperative way as it makes existing know-how available to other groups.

ANNEX IV: DATABASE MANAGEMENT SYSTEM

A database management system (DBMS) is a system or software designed to manage a database, and run operations on the data requested by numerous clients like a database on the web.

Description:
A DBMS is a complex set of software programs that controls the organization, storage and retrieval of data in a database. A DBMS includes:

1. A modeling language to define the schema of each database hosted in the DBMS, according to the DBMS data model.
   The three most common organizations are the hierarchical, network and relational models. A database management system may provide one, two or all three methods. Inverted lists and other methods are also used. The most suitable structure depends on the application and on the transaction rate and the number of inquiries that will be made.

   The dominant model in use today is the ad hoc one embedded in SQL, a corruption of the relational model by violating several of its fundamental principles. Many DBMSs also support the Open Database Connectivity API that supports a standard way for programmers to access the DBMS.

2. Data structures (fields, records and files) optimized to deal with very large amounts of data stored on a permanent data storage device (which implies very slow access compared to volatile main memory).
3. A database query language and report writer to allow users to interactively interrogate the database, analyze its data and update it according to the users privileges on data.
   It also controls the security of the database.
   Data security prevents unauthorized users from viewing or updating the database. Using passwords, users are allowed access to the entire database or subsets of it called sub-schemas. For example, an employee database can contain all the data about an individual employee, but one group of users may be authorized to view only payroll data, while others are allowed access to only work history and medical data.
   If the DBMS provides a way to interactively enter and update the database, as well as interrogate it, this capability allows for managing personal databases. However, it may not leave an audit trail of actions or provide the kinds of controls necessary in a multi-user organization. These controls are only available when sets of application programs are customized for each data entry and updating function.
4. A transaction mechanism, that ideally would guarantee the ACID properties, in order to ensure data integrity, despite concurrent user accesses (concurrency control), and faults (fault tolerance).
   It also maintains the integrity of the data in the database. The DBMS can maintain the integrity of the database by not allowing more than one user to update the same record at the same time. The DBMS can help prevent duplicate records via unique index constraints; for example, no two customers with the same customer numbers (key fields) can be entered into the database. The DBMS accepts requests for data from the application program and instructs the operating system to transfer the appropriate data.

When a DBMS is used, information systems can be changed much more easily as the organization's information requirements change. New categories of data can be added to the database without disruption to the existing system.

Organizations may use one kind of DBMS for daily transaction processing and then move the detail onto another computer that uses another DBMS better suited for random inquiries and analysis. Overall systems design decisions are performed by data administrators and systems analysts. Detailed database design is performed by database administrators.

Database servers are specially designed computers that hold the actual databases and run only the DBMS and related software. Database servers are usually multiprocessor computers, with RAID disk arrays used for stable storage. Connected to one or more servers via a high-speed channel, hardware database accelerators are also used in large volume transaction processing environments.

DBMS's are found at the heart of most database applications. Sometimes DBMSs are built around a private multitasking kernel with built-in networking support although nowadays these functions are left to the operating system.

Features and Abilities:
One can characterize a DBMS as an "attribute management system" where attributes are small chunks of information that describes something. For example, "color" is an attribute of a car. The value of the attribute may be a color such as "red", "blue", "silver", etc. Lately databases have been modified to accept large or unstructured (pre-digested or pre-categorized) information as well such as images and text documents. However, the main focus is still on descriptive attributes.

DBMS roll together frequently needed services or features of attribute management. This allows one to get powerful functionality "out of the box" rather than program each from scratch or add and integrate them incrementally. Such features include:

1. Persistence - Attributes are permanently stored on a hard-drive or other fast, reliable medium until explicitly removed or changed.
2. Query Ability - Querying is the process of requesting attribute information from various perspectives and combinations of factors. Example: "How many 2-door cars in Nairobi are green?"
3. Concurrency - Many people may want to change and read the same attributes at the same time. If there are not organized, predetermined rules for sharing changes, then the attributes may grow inconsistent or misleading. For example, if you change the color attribute of car 7 to be "blue" at the very same time somebody is changing it to "red", then you may not see your change when you go to view the attributes of the car you thought you just changed. DBMS provide various tools and techniques to deal with such issues. "Transactions" and "locking" are two common techniques for concurrency management.
4. Backup and Replication - Often copies of attributes need to be made in case primary disks or other equipment fails. A periodic copy of attributes may also be created for a distant organization that cannot readily access the original. DBMS usually provide utilities to facilitate the process of extracting and disseminating attribute sets.
5. Rule Enforcement - Often one wants to apply rules to attributes so that the attributes are clean and reliable. For example, we may have a rule that says each car can have only one engine associated with it (identified by Engine Number). If somebody tries to associate a second engine with a given car, we want the DBMS to deny such a request and display an error message. (However, with new technology such as hybrid gas-electric cars, such rules may need to be relaxed. Ideally such rules should be able to be added and removed as needed without significant data layout redesign.)
6. Security - Often it is desirable to limit who can see or change which attributes or groups of attributes. After all, you don't want anybody on the street to be able to change your license plate number in government automobile databases.

7. Computation - There are common computations requested on attributes such as counting, summing, averaging, sorting, grouping, cross-referencing, etc. Rather than have each computer application implement these from scratch, they can rely on the DBMS to supply such calculations.
8. Change and Access Logging - Oftentimes one wants to know who accessed what attributes, what was changed, and when it was changed. Logging services allow this by keeping a record of access occurrences and changes.
9. Automated optimization - If there are frequently occurring usage patterns or requests, some DBMS can adjust themselves to improve the speed of those interactions. In some cases the DBMS will merely provide tools to monitor performance, allowing a human expert to make the necessary adjustments after reviewing the statistics collected.
10. Meta-data Repository - Meta-data is information about information. For example, a listing that describes what attributes are allowed to be in data sets is called "meta-information".
11. Modeling Tool - A DBMS can also act as a modeling tool. It can be used to model various nouns found in the environment by describing the attributes associated with such nouns and how the nouns and attributes relate to each other.

Note that a DBMS does not necessarily have all of these features to qualify as a DBMS. However, to qualify as a DBMS, a tool should have a good portion of them.

History:
Databases have been in use since the earliest days of electronic computing. Unlike modern systems which can be applied to widely different databases and needs, the vast majority of older systems were tightly linked to the custom databases in order to gain speed at the expense of flexibility. Originally DBMSs was found only in large organizations with the computer hardware needed to support large data sets.

ANNEX V: WEB SERVER

The term Web server can mean one of two things:
1. A computer that is responsible for accepting HTTP requests from clients, which are known as Web browsers, and serving them HTTP responses along with optional data contents, which usually are Web pages such as HTML documents and linked objects (images, etc.).
2. A computer program that provides the functionality described in the first sense of the term.

Common features:
Although Web server programs differ in detail, they all share some basic common features.
1) HTTP responses to HTTP requests: every Web server program operates by accepting HTTP requests from the network, and providing an HTTP response to the requester. The HTTP response typically consists of an HTML document, but can also be a raw text file, an image, or some other type of document; if something bad is found in client request or while trying to serve the request, a Web server has to send an error response which may include some custom HTML or text messages to better explain the problem to end users.
2) Logging: usually Web servers have also the capability of logging some detailed information, about client requests and server responses, to log files; this allows the Webmaster to collect statistics by running log analyzers on log files.

In practice many Web servers implement the following features too.

1. Configurability of available features by configuration files or even by an external user interface.

2. Authentication, optional authorization request (request of user name and password) before allowing access to some or all kind of resources.
3. Handling of not only static content (file content recorded in server's file system(s)) but of dynamic content too by supporting one or more related interfaces (SSI, CGI, SCGI, PHP, ASP, ASP .NET, Server API such as NSAPI, ISAPI, etc.).
4. Module support, in order to allow the extension of server capabilities by adding or modifying software modules which are linked to the server software or that are dynamically loaded (on demand) by the core server.
5. HTTPS support (by SSL or TLS) in order to allow secure (encrypted) connections to the server on the standard port 443 instead of usual port 80.
6. Content compression (i.e. by gzip encoding) to reduce the size of the responses (to lower bandwidth usage, etc.).
7. Virtual Host to serve many web sites using one IP addresses.
8. Large file support to be able to serve files whose size is greater than 2 GB on 32 bit OS.
9. Bandwidth throttling to limit the speed of responses in order to not saturate the network and to be able to serve more clients.

Origin of returned content:
The origin of the content sent by server is called:

- Static if it comes from an existing file lying on a file system;
- Dynamic if it is dynamically generated by some other program or script or API called by the Web server.

Serving static content is usually much faster (from 2 to 100 times) than serving dynamic content, especially if the latter involves data pulled from a database.

Performance:

Web servers (programs) are supposed to serve requests quickly from more than one TCP/IP connection at a time. The main key performance parameters (measured under a varying load of clients and requests per client) are:

- Number of requests per second (depending on the type of request, etc.).
- Latency time in milliseconds for each new connection or request.
- Throughput in bytes per second (depending on file size, cached or non-cached content, available network bandwidth, etc.).

Above three parameters vary noticeably depending on the number of active connections, so a fourth parameter is the concurrency level supported by a Web server under a specific configuration. Last but not least, the specific server model used to implement a Web server program can bias the performance and scalability level that can be reached.

Load Limits:
A web server (program) has defined load limits, because it can handle only a limited number of concurrent client connections (usually between 2 and 60,000, by default between 500 and 1,000) per IP address (and IP port) and it can serve only a certain maximum number of requests per second depending on:

- Its own settings;

- The HTTP request type;
- Content origin (static or dynamic);
- The fact that the served content is or is not cached;
- The hardware and software limits of the OS where it is working.

When a web server is near to or over its limits, it becomes overloaded and thus *unresponsive*.

Overload Causes:
At any time Web servers can be overloaded because of:

- Too much legitimate Web traffic (i.e. thousands or even millions of clients hitting the Web site in a short interval of time);
- DDos (Distributed Denial of Service) attacks;
- Computer worms that sometimes cause abnormal traffic because of millions of infected computers (not coordinated among them);
- Internet web robots traffic not filtered / limited on large web sites with very few resources (bandwidth, etc.);
- Internet (network) slowdowns, so that client requests are served more slowly and the number of connections increases so much that server limits are reached;
- Web servers (computers) partial unavailability, this can happen because of required / urgent maintenance or upgrade, hardware or software failures, back-end (i.e. database) failures, etc.; in these cases the remaining web servers get too much traffic and of course they become overloaded.

Anti Overload Techniques:
To partially overcome above load limits and to prevent the overload scenario, most popular Web sites use common techniques like:

- Managing network traffic, by using:
    - Firewalls to block unwanted traffic coming from bad IP sources or having bad patterns;
    - HTTP traffic managers to drop, redirect or rewrite requests having bad HTTP patterns;
    - Bandwidth management and Traffic shaping, in order to smooth down peaks in network usage;
- Deploying Web cache techniques;
- Using different domain names to serve different (static and dynamic) content by separate Web servers, i.e.:
    - http://images.example.com
    - http://www.example.com
- Using different domain names and / or computers to separate big files from small and medium sized files; the idea is to be able to fully cache small and medium sized files and to efficiently serve big or huge (over 10 - 1000 MB) files by using different settings;
    - Using many Web servers (programs) per computer, each one bound to its own network card and IP address;
- Using many Web servers (computers) that are grouped together so that they act or are seen as one big Web server, see also: Load balancer;
- Adding more HW resources (i.e. RAM, disks) to each computer;
- Tuning OS parameters for HW capabilities and usage;
- Using more efficient computer programs for Web servers, etc.;
- Using other workarounds, especially if dynamic content is involved.

ANNEX VI: BACKUP SYSTEMS

Selecting Proper Backup Devices:

When looking for a backup device today you will find that there are many different types of devices utilizing different technologies on the market today. Selecting the correct device will prevent unnecessary upgrades later on. In the complex world of computing, the most important item on a computer system is the data stored within. Whether the data on a computer system is used for business purposes, research purposes, or if the data has significant personal value, backing up data is extremely important.

Just as selecting the proper backup software is important, selecting the proper device is extremely important. When selecting the storage device, important features are the size of the media, the portability of the media, and the durability of the media.

When selecting the proper backup devices, care should be taken to select a device that will exceed your current average backup file size. The reason that this is important is because backup files that are only 100 MB today will easily become double that size within a year. As hard drives become larger, and faster, more computer users are storing more data on these devices. This data will only grow larger and larger as time progresses. Often, selecting backup devices that are at least double the current backup file size will allow future expandability.

Another important feature of selecting a proper backup media is the portability of the backup device, or the backup media. Storage devices and media are often available in many different sizes and shapes, ranging from flash drive that measure three square inches, removable zip drives and to removable hard drives which weigh up to five pounds. If the backup media is often carried off-site (if a data backup is left off-site, this allows rapid recovery in the event of a fire or natural disaster), the size of the device or media should be considered.

Removable hard drives, for instance, offer a great bargain in up-front cost compared to traditional backup tapes. However, these drives are rather bulky and heavy compared to the traditional backup tapes. Besides the ease of transportation off-site, some remote data backup storage facilities charge their rates by the square inch or foot. If a backup is larger than another type of backup device, the money saved at the initial purchase may be lost in monthly charges to one of these services.

Perhaps the second most important feature of external backup gears is their durability. What good is a data backup, if the device fails before the data is restored? By selecting quality backup media, the chances of a device failing during a restore are lower. For instance, solid-state devices (devices that have no moving parts) such as flash drives are by design more durable than traditional devices with regard to shock. In contrast, removable hard drives are perhaps the most fragile type of storage device, with regard to excess shock. When selecting the proper backup device, always make sure to compare the durability of available devices.

Whether you are selecting large capacity tape drives, or durable flash media drives, selecting the external backup media depends on the personal needs of your backup solution. No two devices for backup are the same, and many backup devices have their own disadvantages and advantages over other available devices. Bearing these important needs in mind will enable you to select a proper backup device for your backups, as well as to prevent future troubles.

Tape Backup Drives Solutions:

By storing data on backup tapes you are protecting data cost effectively and safely.

Before you set up any form of tape backup drives on your system you must decide what backup strategy to use and what tape drive system best suits your needs. What requirement do you have? Is it for a LAN server, a PC or is it for a network at a large corporation? Do you need scalability for you're the backup drives you want to use? Will the tape standard live on in coming versions or will it be outdated by new technologies? One also needs to look at different backup software solution to be used with tape drives!

Using a Tape backup drive will allow backup of large volumes of data for companies and individual users. The tape backup solution method is today the one, which is often used, despite that it takes longer time than to copy the data directly to a backup disk.

Tape backup technologies have to keep up with the ever-increasing capacity of disk drives, which is an alternative and attractive way to backup and secure data with.

High capacity solutions for businesses are often based on backup tape libraries. Still, by using tape drives you have an easy and convenient way to backup server data for small and medium sized companies. Tape backup drives are use one of two different computer bus interfaces, SCSI or IDE

SCSI or (Small Computer System Interface) is a controller bus, which is often used, in server tape backup system for computers. The SCSI interface is an intelligent interface, which use an independent processor controller based I/O bus. Because SCSI support multithreading it also supports the multitasking capabilities of Windows, UNIX and LINUX.

The IDE family or (Integrated Drive Electronics) is the most common I/O bus for PCs. Tape drives based on the Enhanced IDE or EIDE bus also know as ATA are generally cheaper than tape backup based on SCSI bus interface. This bus standard is commonly used in PCs for tape devices. The backup methods used in tape devices are performed using either a linear tape or a helical scan technology.

Linear tape technology records as the data by writing it in a linear continuing pattern in the tape. The most popular tape formats for linear recording are DLT, LTO and Travan.

Helical scan tapes are written using a method in which the data are recorded in an angle over the tape thus making the recording track substantially longer which makes this a tape backup technology for a high density capacity. This is also the method also used in ordinary VCR tapes for video purposes. DAT and AIT are two of the most used helical tape recording standards.

QIC
QIC quarter-inch cartridge linear tape drives was the most common computer tape backup method used until the mid 90, after that time this technology have been outdated. QIC is based on a tape cartridge technology developed by the 3M Company. There exist a large number of QIC standards. QIC have a capacity between 80MB and up to 2 GB.

Travan
Travan tape backup devices are based on a linear tape technology. Travan was developed by Imation and is marketed by Seagate Technology. Travan NS, NS stands for Network Service, is an inexpensive tape backup device for the small and medium company. HP Colorado Backup systems support both QIC and Travan.

DAT
DAT (Digital Audio Tape) is a helical scan tape recording technology that was original developed for

high quality audio recording. Sony and HP defined the DDS (Digital Data Storage) standard, which is a standard for data backup device using the DAT technology. The latest DDS-4 standard provides 20 GB of storage capacity. This standard is not planed for any further development.

8mm
Similar to the DAT technology, the 8mm uses 8mm tape instead of DAT's 4mm tape. Exabyte Corporation is a promoter for the standard 8mm backup tape drives. 8mm uses a helical scan backup drive technology with tape capacity from 3.5 to 14 GB.

Mammoth
Exebyte Mammoth tape storage is a top end tape backup market product for the corporation market. It is based on an integrated tape recorder solution with few moving parts and with a high tape data density. Mammoth 2 have a capacity of 60GB with 150GB compressed and with a data rate of 12MBps. It uses a helical scan format technology and tape drive technology with few moving parts to minimize tape stress. Exabyte are developing Mammoth-3, which will have a capacity of 625GB and data transfer rate of 60MBps. Mammoth uses two-level Reed-Solomon ECC (Error Correction Code).

AIT technology
AIT (Advanced Intelligent Tape) introduced by Seagate and Sony is based on 8mm technology and represents a new 8mm technology known as Advanced Intelligent Tape (AIT). AIT-3 can store 100GB, 260GB compressed with a 12 MBps data rate. Increased rewind and positioning access time for fast access of data segments. This is possible while the cartridge contains a built in chip for data tape positioning.

Digital Linear Tape DLT
DLT or Digital Linear Tape was developed by DEC in the mid-1980 for MicroVAX mini computers. It is a linear tape technology, which uses several tracks for storage. Between 128 and 208 tracks per tape, using a half-inch tape width. DLT is a popular technology for backup tape drives and it is being favored by Compact. The DLT 8000 has a storage capacity of 40GB and data transfer rate of 6 MBps.

SuperDLT is the most technical advanced tape system in the DLT family. The SDLT320 have a capacity of 320GB compressed and with a 32 MBps data transfer rate. This is expected to rise to 2.4TB with SDLT2400.

DLT1 both from Benchmark Storage Innovation delivers similar storage capacity as DLT8000 at a lower cost. The tradeoff is a lower transfer rate of 3Mbps.

ValueTape 80 tape backup drive also from Benchmark Storage Innovation is compatible with DLT Tape IV and can read Quantum DLT4000 tape backup drives. It has a capacity of 20GB.

ADR technology
ADR technology Advanced Digital Recording technology was developed by Philips and is market by OnStream. It was first introduced in 1999 with an IDE tape backup drive that have a capacity of 15 GB, 30GB compressed. It uses 192 tracks on a linear backup drive with 8mm-tape width. It reads and writes on 8 tracks simultaneously to achieve a high data transfer speed. It has outstanding data reliability because it reads 8 tracks simultaneously which lower the demand of the tape speed and it uses strong error correction coding.

Linear Tape Open
LTO or (Linear Tape Open) is as its name implies a linear tape backup driver technology. This technology has been developed in a consortium by Seagate, IBM and HP. There are two formats for LTO

Ultrium and Accelis. They serve different needs and are not compatible.

Accelis format have a fast access time. Accelis is waiting to be introduced but have extreme data access time as it is expected to have a capacity of 25 GB, 50 GB compressed when it is introduced.

Utrium single-reel format for backup have an ultra high capacity. 100GB per cartridge and a 16Mbps transfer speed. It is planed to store up to 1.6TB compressed on a single cartridge and will have a transfer speeds between 160-320MBps.

LTO is linear multi-channel, bi-directional formats and uses error correction code for maximum capacity and performance. LTO is now the tape backup device system which have the currently the most market acceptance at the high-end market.

VXA technology

VXA is a helical tape backup device technology which is aimed to solve the problem of slow data transfer which can be caused when the data bus and CPU is to slow to communicate or busy. While most tape drives for backup write a chunks of block of data at a time, slowdown can occur when the drive have to wait for next data block as the tape have to be retracted.
The VXA uses a wrapper technology for data blocks by dividing them into smaller data units. They call this method Discrete Packet Format (DPF). It is a highly reliable technology, which has been developed by ExaByte. This is the same company which markets the Mammoth tape drives. VXA-2 has a capacity of 80GB and 160GB compressed with a speed rate of up to 6MBps.

Mirror Backup (RAID)

Selecting the proper solution of mirrored disks for your server can mean the difference between having your data intact, and losing all of your data. Given the large amounts of data stored on servers, there is a need to keep that data secured against hardware failure. In most circumstances, a RAID (Redundant Array of Inexpensive Disks) array is the best way to protect your data. However, there are several different implementations of RAID, each with its own specific drawbacks and advantages. Let's explore the different types of a RAID array, and how they can protect your data.

Perhaps the most common type of server mirroring is a RAID-1 array. This array consists of two hard disk drives, which are exact duplicates of each other. In the event that one hard drive should fail, the other hard drive contains an exact duplicate of the data. This provides the easiest method of failure recovery (if all else fails, just use the good drive by itself), but also the most expensive. In order to provide full protection, the capacity of a RAID system must be cut in half. In other words, if there are two 120 GB hard drives, only 120 GB of data may be saved on this file system.

Another common method of storing files on a disk mirroring system is RAID-5. This array consists of at least three hard drives, one of which is used for redundancy. With this method of redundancy, high disk read and write speeds are possible. In addition, this array can lose one hard drive without affecting the data integrity of the entire array. This type of server hard disk array is growing in popularity, due to its performance advantages over the more common RAID-1 array.

Yet another type of mirror server systems consists of essentially two separate arrays, one built for speed, and one built for redundancy. This system is called RAID 0+1, and it consists of one RAID array that contains two separate arrays within. For instance, the first two drives contain data, which is striped across the two drives. In addition, another two drives contain the same data, but mirrored. This results in faster data access times than RAID-1, while retaining redundancy. The main drawback of this method, however, is that it is expensive in terms of disk usage. Roughly ½ of the total disk space can be used with this array. In other words, if there are 4 120 GB hard disk drives, the actual storage capacity of this array would be

240 GB.

No matter which server RAID mirror solution you select, you will have the redundancy and reliability that only disk mirroring solutions can provide. Although data backups are still important, you can rest easier knowing that the crucial data stored on your server has some redundancy to its storage system.

ANNEX VII: INFORMATION SECURITY

Information security, or sometimes Information Systems Security (INFOSEC), deals with several different "trust" aspects of information and its protection. Another similar term is Information Assurance (IA), but INFOSEC is a subset of IA. Information security is not confined to computer systems, nor to information in an electronic or machine-readable form. It applies to all aspects of safeguarding or protecting information or data, in whatever form or media.

INFOSEC is described as 'Protection of information systems against unauthorized access to or modification of information, whether in storage, processing or transit, and against the denial of service to authorized users or the provision of service to unauthorized users, including those measures necessary to detect, document, and counter such threats'.

Most definitions of information security tend to focus, sometimes exclusively on specific usage and, or, particular media; e.g., "protect electronic data from unauthorized use". In fact it is a common misconception, or misunderstanding, that information security is synonymous with computer security—in any of its guises:

1. Computer and network security
2. Information technology (IT) security
3. Information systems security
4. Information and communications technology (ICT) security.

Each of these has a different emphasis, but the common concern is the security of information in some form (electronic in these cases). Therefore all are subsets of information security. Conversely, information security covers not just information but all infrastructures that facilitate its use—processes, systems, services, technology, etc., including computers, voice and data networks, etc.

It is an important point that information security is, inherently and necessarily, neither hermetic nor watertight nor perfect. No one can ever eradicate all risk of improper or capricious use of any information. The level of information security sought in any particular situation should be commensurate with the value of the information and the loss, financial or otherwise, that might accrue from improper use—disclosure, degradation, denial, or whatever.

Three widely accepted elements (aims, principles, qualities, characteristics, attributes...) of information security are:

1. Confidentiality
2. Integrity
3. Availability

Historically, up to about 1990, confidentiality was the most important element of information security, followed by integrity, and then availability. By 2001, changing use and expectation patterns had moved availability to the top of most versions of this priority list. The first goal of modern information security

has, in effect, become to ensure that systems are predictably dependable in the face of all sorts of malice, and particularly in the face of denial of service attacks.

Some other facets of information security are:

1. Governance
2. Security Program Development
3. Access control
4. Risk assessment
5. Return on information security investment
6. Classification
7. Compliance
8. Identification and authentication
9. Information Technology Infrastructure Library
10. Non-repudiation
11. Authorization
12. Administration and provisioning
13. Auditing
14. Alerting
15. Assurance and reliability
16. Business Continuity Planning
17. COMSEC

Cryptography and Cryptanalysis are important tools in assuring confidentiality (in transmission or storage of information), integrity (no change can be made undetectably), and source identification (the sender can be identified and all other than that sender can be excluded). Always assuming, necessarily, that the key(s) involved have not been misused or compromised, and that the crypto systems employed have been well chosen and properly used.

Organization

The Standard is broken into five categories, or aspects:

i. **Security Management.** Keeping the business risks associated with information systems under control within an enterprise requires clear direction and commitment from the top, the allocation of adequate resources, effective arrangements for promoting good information security practice throughout the enterprise and the establishment of a secure environment.

ii. **Systems Development.** Building security into systems during their development is more cost-effective and secure than grafting it on afterwards. It requires a coherent approach to systems development as a whole, and sound disciplines to be observed throughout the development cycle. Ensuring that information security is addressed at each stage of the cycle is of key importance.

iii. **Critical Business Applications.** A critical business application requires a more stringent set of security controls than other applications. By understanding the business impact of a loss of confidentiality, integrity, or availability of information, it is possible to establish the level of criticality of an application. This provides a sound basis for identifying business risks and determining the level of protection required to keep risks within acceptable limits.

iv. **Computer Installations.** Computer installations typically support critical business applications and safeguarding them is, therefore, a key priority. Since the same information security principles apply to any computer installation—irrespective of where information is processed or on what scale or type of computer it takes place—a common standard of good practice for information security should be applied.

v. **Networks.** Computer networks convey information and provide a channel of access to information systems. By their nature, they are highly vulnerable to disruption and abuse.

Safeguarding business communications requires robust network design, well-defined network services, and sound disciplines to be observed in running networks and managing security. These factors apply equally to local and wide area networks, and to data and voice communications.

Security and systems design

Most current real-world computer security efforts focus on external threats, and generally treat the computer system itself as a trusted system. Some knowledgeable observers consider this to be a disastrous mistake, and point out that this distinction is the cause of much of the insecurity of current computer systems - once an attacker has subverted one part of a system without fine-grained security, he or she usually has access to most or all of the features of that system. Because computer systems can be very complex, and cannot be guaranteed to be free of defects, this security stance tends to produce insecure systems.

Financial cost

Serious financial damage has been caused by computer security breaches, but reliably estimating costs is quite difficult. Figures in the billions of dollars have been quoted in relation to the damage caused by malware. Individuals who have been infected with spyware or malware likely go through a costly and time-consuming process of having their computer cleaned.

Reasons

There are many similarities (yet many fundamental differences) between computer and physical security. For those seeking to prevent security breaches, the first step is usually to attempt to identify what might motivate an attack on the system, how much the continued operation and information security of the system are worth, and who might be motivated to breach it. The precautions required for a home PC are very different for those of banks' Internet banking system, and different again for a classified military network. Other computer security writers suggest that, since an attacker using a network need know nothing about you or what you have on your computer, attacker motivation is inherently impossible to determine beyond guessing. If true, blocking all possible attacks is the only plausible action to take.

Vulnerabilities

To understand the techniques for securing a computer system, it is important to first understand the various types of "attacks" that can be made against it. These threats can typically be classified into one of these seven categories:

1. **Exploits:** Software flaws, especially buffer overflows, are often exploited to gain control of a computer, or to cause it to operate in an unexpected manner. Many development methodologies rely on testing to ensure the quality of any code released; this process often fails to discover extremely unusual potential exploits. The term "exploit" generally refers to small programs designed to take advantage of a software flaw that has been discovered, either remote or local. The code from the exploit program is frequently reused in trojan horses and computer viruses. In some cases, vulnerability can lie in a certain programs processing of a specific file type, such as a non-executable media file.

2. **Eavesdropping:** Any data that is transmitted over a network is at some risk of being eavesdropped, or even modified by a malicious person. Even machines that operate as a closed system (i.e., with no contact to the outside world) can be eavesdropped upon via monitoring the faint electro-magnetic transmissions generated by the hardware such as TEMPEST. The FBI's proposed Carnivore program

was intended to act as a system of eavesdropping protocols built into the systems of internet service providers.

3. **Social engineering and human error:** A computer system is no more secure than the human systems responsible for its operation. Malicious individuals have regularly penetrated well-designed, secure computer systems by taking advantage of the carelessness of trusted individuals, or by deliberately deceiving them, for example sending messages that they are the system administrator and asking for passwords. This deception is known as Social engineering.

4. **Denial of service attacks:** Denial of service (DoS) attacks differ slightly from those listed above, in that they are not primarily a means to gain unauthorized access or control of a system. They are instead designed to render it unusable. Attackers can deny service to individual victims, such as by deliberately guessing a wrong password 3 consecutive time and thus causing the victim account to be locked, or they may overload the capabilities of a machine or network and block all users at once. These types of attack are, in practice, very hard to prevent, because the behavior of whole networks needs to be analyzed, not only of small pieces of code. Distributed denial of service (DDoS) attacks are common, where a large number of compromised hosts (commonly referred to as "zombie computers") are used to flood a target system with network requests, thus attempting to render it unusable through resource exhaustion. Another technique to exhaust victim resources is though the use of an attack amplifier - where the attacker takes advantage of poorly designed protocols on 3rd party machines, such as FTP or DNS, in order to instruct these hosts to launch the flood. There are also commonly vulnerabilities in applications that cannot be used to take control over a computer, but merely make the target application malfunction or crash. This is known as a denial-of-service exploit.

5. **Indirect attacks:** Attacks in which one or more of the attack types above are launched from a third party computer which has been taken over remotely. By using someone else's computer to launch an attack, it becomes far more difficult to track down the actual attacker. There have also been cases where attackers took advantage of public anonymising systems, such as the tor onion router system.

6. **Backdoors:** Methods of bypassing normal authentication or giving remote access to a computer to somebody who knows about the backdoor, while intended to remain hidden to casual inspection. The backdoor may take the form of an installed program (e.g., Back Orifice) or could be in the form of an existing "legitimate" program, or executable file. A specific form of backdoors are rootkits, which replaces system binaries and/or hooks into the function calls of the operating system to hide the presence of other programs, users, services and open ports. It may also fake information about disk and memory usage.
7. **Direct access attacks:** Common consumer devices that can be used to transfer data surreptitiously. Someone gaining physical access to a computer can install all manner of devices to compromise security, including operating system modifications, software worms, keyboard loggers, and covert listening devices. The attacker can also easily download large quantities of data onto backup media, for instance CD-R/DVD-R, tape; or portable devices such as key drives, digital cameras or digital audio players. Another common technique is to boot an operating system contained on a CD-ROM or other bootable media and read the data from the hard drive(s) this way. The only way to defeat this is to encrypt the storage media and store the key separate from the system.

Reducing vulnerabilities

You can reduce a cracker's chances by keeping your systems up to date, using a security scanner or/and hiring competent people responsible for security. The effects of data loss/damage can be reduced by careful backing up.

Security measures

A state of computer "security" is the conceptual ideal, attained by the use of the three processes:

1. Prevention.
2. Detection.
3. Response.

User account access controls and cryptography can protect systems files and data, respectively.

Prevention:

Firewalls are by far the most common prevention systems from a network security perspective as they can (if properly configured) shield access to internal network services, and block certain kinds of attacks through packet filtering.

Intrusion Detection Systems (IDS's) are designed to detect network attacks in progress and assist in post-attack forensics, while audit trails and logs serve a similar function for individual systems.

Response:

Is necessarily defined by the assessed security requirements of an individual system and may cover the range from simple upgrade of protections to notification of legal authorities, counter-attacks, and the like. In some special cases, a complete destruction of the compromised system is favored. Today, computer security comprises mainly "preventive" measures, like firewalls or an Exit Procedure. A firewall can be defined as a way of filtering network data between a host or a network and another network, such as the Internet, and is normally implemented as software running on the machine, hooking into the network stack (or, in the case of most UNIX-based operating systems such as Linux, built into the operating system kernel) to provide real-time filtering and blocking. Another implementation is a so-called physical firewall, which consists of a separate machine filtering network traffic. Firewalls are common amongst machines that are permanently connected to the Internet. However, relatively few organisations maintain computer systems with effective detection systems, and fewer still have organised response mechanisms in place.

Difficulty with response

Responding forcefully to attempted security breaches (in the manner that one would for attempted physical security breaches) is often very difficult for a variety of reasons:

Identifying attackers is difficult, as they are often in a different jurisdiction to the systems they attempt to breach, and operate through proxies, temporary anonymous dial-up accounts, wireless connections, and other anonymising procedures which make backtracing difficult and are often located in yet another jurisdiction. If they successfully breach security, they are often able to delete logs to cover their tracks.

The sheer number of attempted attacks is so large that organizations cannot spend time pursuing each attacker (a typical home user with a permanent (e.g., cable modem) connection will be attacked at least several times per day, so more attractive targets could be presumed to see many more). Note however, that most of the sheer bulk of these attacks are made by automated vulnerability scanners and computer worms.

Law enforcement officers are often unfamiliar with information technology, and so lack the skills and interest in pursuing attackers. There are also budgetary constraints. It has been argued that the high cost of technology, such as DNA testing, and improved forensics mean less money for other kinds of law

enforcement, so the overall rate of criminals not getting dealt with goes up as the cost of the technology increases.

ASEAN + 3 Regional Workshop on Global Taxonomy Initiative: Needs Assessment and Networking

SEARCA, Los Baños, Laguna, Philippines
18-23 May 2009

PROCEEDINGS

Background

The 1992 Earth Summit in Rio de Janeiro gave birth to the Convention on Biological Diversity (CBD). The three goals of this convention – conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of the benefits arising from the use of genetic resources – have become prime points on the political agenda of most of the world's governments. Achieving these goals depends largely on our understanding of biodiversity. Yet, in many countries of the world, particularly in the tropics, many species remain poorly known or undescribed and unnamed. Taxonomy – the science of describing, naming, and classifying organisms – has also been hampered by the shortage or lack of expertise at the regional and national levels.

The Conference of the Parties (COP) for the CBD adopted the ecosystem approach rather than the tactic to conserve only charismatic species or vegetation types. As such, taxonomic expertise and competence have become needed across all taxonomic groups of living organisms. However, already at the Second Meeting of the COP to the CBD, it was realized that taxonomic (inclusive of genetic) information, taxonomic and curatorial expertise and infrastructure are insufficient in many parts of the world, especially in developing countries. Hence, such lack of expertise was anticipated to be one of the key obstacles in the implementation of the Convention, in particular of Article 7 on identification and monitoring. In order to overcome this taxonomic impediment, subsequent COP's endorsed consecutive Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA) recommendations and established the Global Taxonomy Initiative (GTI).

The programme of work of the GTI consists of five operational objectives: (1) assess taxonomic needs and capacities at national, regional, and global levels for the implementation of the Convention; (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; (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; (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; and (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.

At the COP9, outcome-oriented deliverables of each planned activities of the Programme of Work for the GTI was endorsed. In decision IX/22, the following were annexed.

> **Planned activity 1:** Country-based taxonomic needs assessments and identification of priorities
>
> Output 1.1.1. Develop an Assessment Support Pack to be made available through the GTI Portal by the end of 2009, building on the assessments done on the BioNET-INTERNATIONAL Web site. Suggested actors may include Parties, BioNET-INTERNATIONAL; the Coordination Mechanism of the Global Taxonomy Initiative, and other compilers of taxonomic needs assessments.
>
> Output 1.1.2. A taxonomic needs assessment in at least one sector to have been completed by 10 percent of Parties by 2010, and by 25 percent of all Parties by 2012. Suggested actors may include Parties with assistance from taxonomic institutions and networks and GTI national focal points.
>
> **Planned activity 2:** Regional taxonomic needs assessments and identification of priorities
>
> Output 1.2.1. Complete at least one pilot regional assessment within a United Nations sub-region, integrated with implementation of a thematic area or cross-cutting issue of the CBD, by the end of 2009. Results and lessons learned can be placed before the fourteenth meeting of the SBSTTA and disseminated by the Clearing-House Mechanism. Suggested actors may include BioNET-INTERNATIONAL, CBOL, Species 2000, and ITIS Catalog of Life.

In view of the above, workshops to identify the national and regional taxonomic needs by the end users of taxonomic knowledge and taxonomic services are urged.

Although there is inadequacy in the field of taxonomy, the discipline is still well-off compared to other sectors in the economy (Trade & Industry) and governance (ministries) where taxonomy is needed but is staffed by non-taxonomists. Industries relying on biodiversity such as medicine/ pharmaceuticals, wildlife trade and its enforcement, agriculture, aquaculture, forestry, fishery and food production, tourism, and other industries which require identification of the materials and products which they are dealing and trading with. The industries sector, however, leaves much to be desired if it would contribute to the objectives of the GTI programme of work and the Millennium Development Goals.

Adequate taxonomy is one of the necessary fundamental tools required for the global community to implement the Millennium Development Goals and the development targets from the World Summit for Sustainable Development. Without adequate long-term investment in the human, infrastructural (including, important biological collections), and information resources necessary to underpin the science of taxonomy, the now well-recognized taxonomic impediment will continue to prevent adequate implementation of sound, scientifically-based sustainable, environmental management and development policies.

Expertise needs to be mobilized and shared. Taxonomic capacities need to be accessible to all countries and in concerned sectors to support the prompt identification and monitoring of these concerns.

The "ASEAN + 3 Regional Workshop on Global Taxonomy Initiative: Needs Assessment and Networking" was conceptualized to respond to this need.

OBJECTIVES OF THE WORKSHOP

The general objective of the workshop was to provide a venue for sharing experiences especially in best cases and lessons learned in the implementation of the Programme of Work (PoW) for the Global Taxonomy Initiative and identify future programmes and plans for Capability Development in the ASEAN.

Specifically, the Workshop sought to:

- Provide a venue to discuss the PoW of the GTI and identify best cases and lessons learned from its implementation
- Establish a baseline / status of the PoW of the GTI among the ASEAN nations
- Recommend doable activities (future courses of action) based on best cases and lessons learned including future activities with France and other European countries
- Establish an initial network of taxonomists/systematists, other scientists, policy makers between ASEAN and France, other European Commission (EC) countries and among the participants

ORGANIZATION OF THE WORKSHOP

The workshop began with a presentation of the state of taxonomy in the ASEAN region. This was followed by the presentation of the CBD Global Taxonomy Initiative and its status in the global level to contextualize the ASEAN GTI. The French counterpart presented their country's experiences in implementing the GTI in some parts of Southeast Asia and the South Pacific, and Europe's case as a whole. This served as a reference point on the implementation of the GTI in different regions of the globe.

Given the overall picture of the taxonomy scene, the participating countries shared their experiences in implementing the GTI in their respective countries through a "roundtable type" of discussion which highlighted their current efforts on taxonomic initiatives, their best cases, lessons learned, and challenges faced in implementation.

Based on the best cases and lessons learned, the participating countries formulated future courses of action for the ASEAN region and for their respective countries' implementation. This was conducted during Day Two of the workshop proper.

The workshop focused on the formulation of future courses of action that addressed the following:

- Scientific Capability Development
- Information exchange and networking

- Collaboration activities with French institutions and other European countries / agencies
- Sustainable financing for the ASEAN GTI

A recap of the discussions was presented for final review of the courses of action.

EXPECTED OUTPUT

- Courses of action for the ASEAN GTI implementation of the Programme of Work
- Collaborative activities identified with France and other European countries
- An initial directory of taxonomists, scientists, policy makers, and other like-minded participants to establish a network among AMS and French Experts

The Post-Workshop output shall be a proceeding of the activity and a policy brief to be disseminated among the ASEAN Member States and the French Government.

PARTICIPANTS OF THE WORKSHOP

A total of 67 participants from 14 countries attended the workshop. The breakdown of country representation is as follows: Japan – 7; France – 10; AMS – 44 (official and non-official); China – 2; South Korea – 2; SCBD – 1. All ASEAN Member States were represented. Four (4) representatives from each of the ASEAN Member States were invited to participate, specifically the National Contact Point for the in-country GTI, the ACB National Contact Point, one expert from the government or academe, and one from the private sector.

The workshop also welcomed other participants interested in the topic.

The resource persons, who also facilitated the discussions and workshop proper, came from France, AMS, and Japan. The French government supported identified French experts working in Southeast Asia and the South Pacific who can share their capacities with their ASEAN counterparts in building overall the human and institutional capabilities for undertakings essential to taxonomic work. The Japanese delegation consisted of persons from the Biodiversity Center of Japan and the Japan Wildlife Research Center, both from the Ministry of the Environment. Japan also invited participants from China and South Korea involved in the ESABII (East and Southeast Asia Biodiversity Inventory Initiative). The list of participants is attached as **ANNEX 1**.

OPENING PROGRAM

The program was attended by dignitaries from the co-sponsors.

1. Mr. Maurice Siveton, Regional Counsellor for Cooperation, Embassy of France in Thailand;
2. Dr. Noriaki Sakaguchi, Head of the Japanese Delegation and Deputy Director, Biodiversity Center, Ministry of the Environment of Japan;

3. Dr. Keiichi Matsuura, Vice Chair of the Governing Board of the Global Biodiversity Information Facility;
4. Dr. Junko Shimura, Programme Officer of Taxonomy and Invasive Alien Species, Secretariat of the Convention on Biological Diversity;
5. Dr. Luis Rey Velasco, Chancellor, University of the Philippines Los Baños;
6. Dr. Gil Saguiguit, Deputy Director, Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)

Welcome Messages were delivered by the following persons:

1. Mr. Rodrigo U. Fuentes, Executive Director, ASEAN Centre for Biodiversity
2. Mr. Maurice Siveton, Regional Counsellor for Cooperation, Embassy of France in Thailand;
3. Dr. Noriaki Sakaguchi, Head of the Japanese Delegation and Deputy Director, Biodiversity Center, Ministry of the Environment of Japan;
4. Dr. Emmanuel Abraham, representing Dr. Luis Rey Velasco, Chancellor, University of the Philippines at Los Banos;
5. Mr. Manuel D. Gerochi, Undersecretary for Staff Bureaus, Department of Environment and Natural Resources (DENR), Philippines

The keynote address was delivered by Usec. Manuel D. Gerochi on behalf of the Honorable Secretary of the DENR, Mr. Jose L. Atienza, Jr.

In the keynote address, Secretary Atienza highlighted that “Taxonomy is very important for biodiversity. It is not there to simply name and identify species. It can be a useful tool to improve knowledge, which can then lead to the efficient use and protection of biodiversity. Taxonomic information provides insights that are used by ecologists and management authorities to understand species distributions, untangle species interactions and ecosystem structure, rank and justify conservation areas, and plan restoration efforts.”

Maurice Siveton, Regional Counsellor for Cooperation of the Embassy of France in Thailand, stressed the need to develop networks of scientific cooperation. He highlighted France’s action “to help convince the international public opinion and decision makers of the seriousness of the crisis of biodiversity loss.”

Ambassador Alistair MacDonald of the EC Delegation to the Philippines acknowledged the collaboration among the European Commission, France and Japan in supporting initiatives to strengthen the capacity of countries in Southeast Asia to conserve biodiversity.

WORKSHOP PROPER

A Welcome Dinner for the participants was hosted by the Chancellor of UPLB, Dr. Luis Rey I. Velasco on 18 May.

Day 1 (19 May)

In the morning session, six (6) presenters delivered their papers, including the Rationale and Mechanics of the workshop. The morning session specifically discussed the global picture of the GTI and related activities.

In the afternoon session, specific project activities were presented and discussions ensued after the presentations.

Day 2 (20 May)

Day 2 was the workshop proper where the participants were divided into three groups. Each group was assigned a specific topic: Group 1 – Scientific Capacity Development; Group 2 – Information Exchange and Networking; Group 3 – Needs for Biodiversity Information

Day 3 (21 May)

The morning of Day 3 was devoted to the break-out group sessions to finalize their discussions on their assignments. The Plenary, where the group outputs were presented and discussed, was held just before noon.

A resolution was also crafted and adopted by the participants. This is attached as **ANNEX 2**.

The participants also developed and adopted a Regional Action Plan on GTI. This is attached as **ANNEX 3**.

The Closing Program messages were delivered by Dr. Gil Saguigit, Deputy Director of the host institution, SEARCA, and by Dr. Antonio Manila, Deputy Director of the Protected Areas and Wildlife Bureau, DENR as the host country.

Certificates of participation were handed out to the workshop participants.

After the Closing Program, the body was divided into three groups and taken to a tour of the University Herbarium in the nearby building (Institute of Biological Sciences).

Day 4 (22 May) International Day for Biodiversity 2009

The fourth day was the celebration of the International Day for Biodiversity. A formal programme was the main activity of the morning. Attendees were the GTI workshop participants, UPLB Youth, Ambassadors / representatives of the Embassies of France, Cambodia, European Commission, Lao PDR, and Singapore.

The representative of the Office of the Mayor of Los Baños, Laguna delivered a message from Mayor Caesar Perez.

The latest video documentaries of the Centre entitled “Values of Biodiversity” and “ACB: An Introduction” were premiered during the programme. Copies were also distributed to the participants.

ACB, the European Commission, and the Asian Institute of Journalism launched the first ASEAN-wide photo contest on biodiversity “Zooming in on Biodiversity”.

A ceremonial watering of the ASEAN-EU trees planted in the UPLB CFNR Campus at the foot of Mt. Makiling by the European and ASEAN ambassadors in September 2009 capped the celebration.

After the programme, the attendees were again divided into two groups; one group went to Manila to tour the historical sites; the other group was taken to the Makiling Botanic Gardens and the Mudspring, a volcanic mudpool located 400 meters above sea level up the legendary Mt. Makiling.

On the same day, the executive officials of the ACB were in the Philippine Senate where the Host Country Agreement (HCA) of the ACB was presented on the floor in the Committee on Foreign Relations. The HCA was approved by the Committee. The Chair also assured the executive officials of the ACB that the HCA is as good as ratified by the Senate in its next plenary meeting.

Day 5 (23 May) Departure

All participants departed on the 5th day.

ANNEX 1

Directory of Participants

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ANNEX 2
RESOLUTION

1. Taxonomy is a basic tool to achieve the objectives of the CBD, namely the conservation of biodiversity, sustainable use of its components and fair and equitable sharing of benefits arising out of genetic resources. However, to reach the CBD goals our understanding of the species richness of the Southeast Asian Region's biodiversity is still neglected. Therefore, the lack of information, limited number of taxonomists, weaknesses in networking, limited funding, and lack of understanding by policy makers have to be addressed.

2. ASEAN Member States in the spirit of ASEAN-ESABII- regional and international participating countries during the ASEAN+3 Regional Workshop on GTI declare our hope to strengthen collaboration in implementing GTI-Programs of Work and emphasize the need for capacity building of taxonomy in the region. Measures include raising capacity and creating new possibilities for taxonomists; increasing networking and information exchange within and with the taxonomic community, and seeking new avenues for funding and technical support

3. Under ACB coordination, ASEAN Member States recommend the adoption of the Draft of the Regional Action Plan 2010-2014 to support GTI PoW in the region, for implementation by the parties in each country. Policy makers, researchers, academicians, and end users of taxonomic information all are major stake holders need to work hand in hand to advance the Global Taxonomy Initiative.

ANNEX 3
GTI Workshop – Consolidated Output of Group Sessions: ASEAN Regional Action Plan 2010 - 2014

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who

Policy Makers/ Decision Makers	• Policy makers are more interested in data in the context of ecosystems, watersheds, etc.
	• New information on taxonomy needs to be generated
	• Access to existing information on taxonomy (Information system, easy access of scientific literature) needs to be improved
	• Need to have an operational global taxonomic view
	• Description on necessity of taxonomic capacity building into NBSAP and other national level environmental policy agendas
	• Lack of application of taxonomy to policies
	• Lack of databases on taxonomy
	  ○ List of organisms (baseline data for all member countries) – should include status of conservation and details of taxonomic and ecological information
	•
		• ACB should adopt the concept of Heart of Borneo; Other member countries should consider a similar concept;
		• Propose more similar transboundary projects in the Region
		• Sharing should be encouraged within the region
		• Conduct more meetings on GTI focusing on the ASEAN Region
		• Regional cooperation should be improved
		• ASEAN Member States to make use of the National lists in reference to the CITES list / IUCN list
		• Propose agenda item on taxonomy for policy makers in their meetings
		• CEPA
		  ○ Interpret taxonomic information so government policy makers can appreciate;
		  ○ Simplify presentation of taxonomic data for
			2009 – 2010
			2010
			Once every two years
				ACB & AMS
				ACB & AMS
				ASEAN + 3

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who

		appreciation of policy makers without losing the scientific basis
		• Information networking
		  ○ Make biodiversity portal for each country in English and local language
		  ○ Standards for information exchange
		  ○ Information exchange with local people
		• Recommendation to participate in the biodiversity meeting in Singapore (ASEAN Conference on Biodiversity 2009)
		• Integrate information on biological materials for each ASEAN+3 countries into a Database
		  ○ Economically valuable species
		  ○ Invasive alien species
		  ○ Climate change adaptation
		  ○ Ethno-botany
		  ○ Monitoring information – conservation status (IUCN status on protected areas)
		  ○ Integrate IUCN's Red list (threatened categories should be different at national level)		

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who
		in CITES publication in the GBIF o Coordination networking o Threatened species listed on CITES Appendices o GBIF data in the ASEAN region o Keystone species that are difficult to be defined or selected o Indicator species o Endemic species o Migratory species		
Users of Taxonomy	• Lack of taxonomists to assist practitioners of traditional medicine • Lack of information and training in species identification for Customs officers • Lack of taxonomic expertise in plantation crop industry or pharmaceutical industry • Better communication needed between taxonomic community and private sector • Lack of information on the compatibility of existing databases to adapt to global database • No ASEAN server to link with other servers in China, Korea and Japan • Existing DB should be flexible enough to be able to absorb new categories of information and is able to be incorporated into other DB e.g. ACB database • There must be a facility for identifying IAS in entry	• Generate two sets of taxonomic information/data – one basic information for the professional / scientific community and another one for the practitioners • Develop a directory at all levels • Develop guidelines for enforcement officers • Training on IT for data accumulation/integration • Use GBIF database as common database • ACB should follow the GBIF data conditions • ACB should become a member of the GBIF	2009 (for development of directories)	ACB and AMS

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who
	points •	• Put a page in the ACB website to link (URLs) all the existing networks on data bases relevant to GTI • ACB to take part in linking with ASEAN server to China, Korea and Japan • Suggest ACB to provide training regionally • Develop inventories for focused groups such as: Invasive species, alien species, economically important species, Keystone species, Indicator species, endemic species • ACB to play a role in helping AMS to identify the species and their risks • Establish Taxonomic Working Groups that would be able to advise on quarantine regulations and enforcement agencies • Sharing is encouraged • Develop an ASEAN Species Data Base • Provide Directories of: o Contacts for 4 levels (Regional, National,		

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who
		Institutional, Individual) ○ Contacts for Local / Provincial government for information and permit ○ Facilities and the availability of experts for those facilities ○ Species list • No need for a standard DB since changing it would be costly		
Academe/ Research	•Taxonomic work often is not recognized on its own; such research is conducted under the guise or umbrella of another kind of study •Scientists in some countries need training in research methodology or information access ○ Few trained taxonomists ○ Techniques of information exchange and networking • There is frequently insufficient access to information or to specimens ○ Access to taxonomic literatures. ▪ Access literature through biodiversity heritage library ▪ Copyright restrictions ▪ China-Chinese Academy of Science –(Chinese Virtual	• Parataxonomist training in Korea as model for other countries to follow (MNHN also to train parataxonomists) • Propose to ACB and ESABII to have ASEAN taxonomy directories/ initiatives database • Propose trust fund for publication of species book (identification guide) • Academic institutions should create links • Suggest ACB and ESABII to provide training on a long term basis (degree program) regionally	•	ASEAN +3 ACB, France, EU

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who
	Herbarium) English interface Need for Literature •Lack of academic positions or opportunities for taxonomists •Insufficient funding •There often is insufficient communication between researchers and their national GTI focal point o Networking between taxonomists could be improved, including international collaborations •Time may be limiting for taxonomists owing to teaching or administrative duties Regional consent on specimen taxa for scientific purposes – must not be confused with CBD regulations. – ownership by donor country – Identify local depository facilities – Specimen loan - regulations might change – Type donor countries must write and should have access to types deposited in other facilities – travel assistance should be made available. – Data must be shared	• Capacity development of taxonomists on a long term basis (ESABII included) • Lobby to governments to recognize taxonomy to create market for new positions • Private sector to involve taxonomists • Put in incentive mechanisms to produce taxonomic information products (electronic form in CDs, flyers, other media, etc) • ACB requested to look into coordinating the library work / assistance to the AMS especially for obscure and very old taxonomic journals / information • ACB to look into providing funding to existing AMS libraries to update their publication collections		
GTI/CBD Focal Pts	• Focal points may shift from time to time • Goodwill of everybody	•AMS who do not have designated GTI focal points should do so •Improve communication between GTI National Focal Point, Secretariat-CBD, ASEAN	•	ASEAN +3 ACB, France

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who

		Secretariat, ACB and researchers
		• Strengthen communication among countries – forum and meet regularly to discuss things that should be done. Online communication – Yahoo group?, forum
		• Make initiative among group members to keep in touch with each other
		  • Mailing List
		  • Establish a forum
		  ○ Identify lead person/ administrator
		  ○ Discussion on progress of what is going on in different countries on initiatives in line with GTI, industries, public matters
		  ○ A suggestion to keep the same people in the forum
		  ○ Define task of forum
		  ○ Define agenda
		  ○ How to follow up after the forum
		  ○ How to run the forum and course discussions to appropriate persons/ entities
		  ○ Singapore – Blog (wildsingapore.com)		

	Needs and Capacity Gaps	Recommended Actions	Time Frame	Who
		○ Who are target group – public or taxonomists ○ Focus on taxonomy community – key persons to connect to public and policy makers ○ Two forum: for public – feature success stories; for taxonomists – for scientific information • BioNet International has success story on taxonomy. Learn from this. • A node at each level of administration must be identified maintain "corporate memory" on taxonomic data and updates. These will become the waypoints in which data can be pooled into the regional DB, e.g. ACB • Propose to ACB to support a standard scientist –taxonomist forum to meet annually and exchange information • Proposal for funding to support the Group to meet regularly • Find out why problems exist • Capacity-building and forum		

General Elements of the GTI Proposal:

- Governance
  - Designate ASEAN GTI National Focal Points for those who have not yet designated
  - Organization of ASEAN GTI NFP and ESABII NFP
  - Mainstreaming GTI concerns in policy- / decision- making
  - Coordination and cooperation between relevant institutions
- Communication, Education, and Public Awareness (CEPA)
  - Increase ASEAN-ESABII collaboration on CEPA
- Capability Building / Development
  - Exchange of scientists / Experts sharing
  - Study tours
  - Scholarship program
  - Access to library information
- Integrating information systems among the ASEAN, ESABII participating countries and other countries
  - Database development / improvement
  - Information generation
  - Network linkaging
  - Information standards
  - Systematizing information sharing mechanisms
    - Forum
    - Conferences
    - Workshops
    - Regional and National Implementation Plans
    - [MEAs]