Solutions

All of this adds up to a large and difficult problem. It is this problem that the Global Taxonomy Initiative has been set up to resolve. As a first step in addressing the challenge countries have decided to find out to what extent they are affected. In carrying out this 'taxonomic needs assessment' they are looking at the problems faced by conservation, sustainable use of biological resources and access to the benefits arising from them (set out in National Biodiversity Strategies and Action Plans), seeing to what extent the lack of taxonomic skills and resources are holding things up, and deciding what they have to develop in order to meet these needs. As a first step to resolving the issues, developing their national reference centers and training staff in all of the techniques they need to identify and describe their biodiversity have already been identified as priorities.

The Collections at Bogor: reviving a national institution

Indonesia is one of the most species-rich countries in the world. Within its approximately 47 distinct natural ecosystems there may be up to 17% of the world's species – perhaps 11% of the flowering plants, 12% of the mammals and 37% of the fish. Among groups such as insects the numbers can only be guessed at. With increasing threats to the biodiversity of the country came the realization that programmes designed to deal with them suffered from an inadequate input from taxonomy. While national collections of plants and animals existed, at Bogor in Java, this needed a great input of money, expertise and energy if the country was to be able to use it appropriately. Funding from the Global Environment Facility (GEF) has enabled this development to take place, with greatly improved facilities, human resources, improved collection housing and databases, and an increasing level of interaction nationally and internationally.

Even with these developments, most countries (including developed nations), cannot afford to employ enough taxonomists to cover all of their needs. To deal with this more and more international networks are being brought into being. Institutions and nations are joining together to link their resources and share expertise, so as to meet the challenges posed by the threats to biodiversity. Species, after all, do not respect national boundaries; it makes good sense to forge links between states to better study these organisms, and provide access to information about them.

SAFRINET – realistic self-reliance in taxonomy

In Southern Africa, just as elsewhere in the world, there are immense problems facing biodiversity and the people who wish to use biodiversity products sustainably. One of the major bottlenecks is the lack of available taxonomic expertise. To deal with this problem 14 countries have collaborated to form SAFRINET, a regional network of taxonomic institutions – museums, botanical gardens, universities and research institutes – working together to develop capacity within the region. In the four years since it became operational it has put together a cadre of 35 highly trained taxonomic technicians, each capable of training others. Other products have included training manuals, keys, databases and high-level training of staff who now provide sub-regional identification services. Training like this can be provided both at universities and museums in the North or within the region itself, or though collaborative research and development programmes.

There has also been an international dialogue to identify the main problems associated with taxonomy facing the implementation of the Convention and seek solutions. Some of these problems are global – the need for an easily accessible list of described species, for example, and to have lists of species that are stored in the various museums, herbaria, arboreta, botanical gardens and culture collections in the world, together with where they originally came from. These tasks sound deceptively simple; in fact they will require a great deal of work and funding, although many institutions are trying hard to make information more available.

Other tasks are more specific. The Convention on Biological Diversity operates through a number of 'thematic areas', each representing a different sort of environment. Within each of these – marine and coastal, inland waters, forests, dry and sub-humid lands, and agricultural biodiversity – there are problems to be solved that require a taxonomic component. There are also a number of issues which cut across these, such as how to monitor changes in the environment, how to deal with the impact of cotourism, how to treat the growing problems of species which are transported across the globe to places where they have no natural enemies, and can then become serious pests. In all of these there is a need for species to be named, so that more can be found out about them, and the information shared without fear of mistake. As well as species, there can be different 'strains' or 'subspecies' of organism that have their own biologies and genetic makeup, and taxonomists need to be active here too, in order to distinguish between subtly different groups. The Global Taxonomy Initiative (GTI) is highlighting the major problems, and trying to make sure that solutions to issues that are raised under other part of the Convention's activities have the necessary taxonomic component.

The role of the CBD

The Convention on Biological Diversity, of which the GTI is a part, does not itself actually carry out research or directly preserve the biota. What it does, though, is to make countries aware of issues and possible solutions, to help them to share ideas and resources, and to highlight the need for funding and the most effective way to direct finances. This works particularly through the 'Financial Mechanism' of the Convention, the GEF, and the many other bodies that provide funds.

While it is still early days in the development of the GTI, there are already clear indications that involvement of taxonomy in conservation and sustainable use projects can have very positive results, and more projects will be building on models like this in the future. While we are still a long way from identifying, separating and giving names to all of the animals, plants and microorganisms with which we share our planet, we are beginning to be able to tell where our taxonomic expertise is needed, to help more people develop the skills needed to do the work, and to share the information we have more equitably among the peoples of the World.

If you would like to know more about the Global Taxonomy Initiative write, phone, fax or e-mail or visit us:

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The Global Taxonomy Initiative - The Response to a Problem

CBD
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UNEP

There are a vast number of kinds of plants, animals, fungi and micro-organisms, all of them of interest under the Convention on Biological Diversity. Taxonomy is a specialized science that deals with giving names to, classifying and describing this biological diversity. Over 1.7 million different species have so far been given names, and there may be 30 million or more actually alive today. However, the expertise needed to identify and describe them is in short supply, and it is difficult to find information about what species have already been named. In particular many of the biodiversity-rich countries in the tropics – where a great deal of work on conservation and sustainable use of biodiversity is urgently required – lack resources even to find out what species live within their boundaries. This 'taxonomic impediment' is a serious issue hindering the full implementation of the Convention on Biological Diversity.

What's in a name?

Different kinds of animals, fungi and plants and microorganisms are called different 'species'. This reflects a real biological difference – a species is defined as a potentially interbreeding group of organisms that can produce viable offspring that themselves can interbreed. Thus animals of two different species, like a horse and a zebra, cannot interbreed, while animals of the same species can. Taxonomists provide unique names for species, labels that can help us find out more about them, and enable us to be sure that we are all talking about the same thing. Of course, there are names for organisms in many languages, but it is important, for example, when discussing the hedgehog to know whether one is talking about the small spiny insectivore Erinaceus europaeus, other members of the same family, cacti of the genus Echinocerus, or the orange fungus Hydnum repandum, all of which have the same 'common' name in English. For this reason the Latin 'scientific' name, is given as a unique universal identifier.

Does it really matter what species live in a patch of forest, or an area of coral reef? We might all agree that conserving tigers or tapirs, manta rays or butterfly fish is a 'good thing', and therefore we need to know that they are there. Knowing that there are mahogany trees in a forest, and being able to distinguish them from other similar trees, is also clearly useful, since this information allows sustainable use and management. However, what about all of the rest? Does it really matter which beetles are present, or which bacteria? Why should anyone want to know whether a particular sort of lichen is growing on a patch of grassland?

In fact it can matter a great deal. A tropical forest, for example, produces much more than timber and some glimpses of jaguars for tourists. This ecosystem, just like grassland, or a coral reef, or a river system, is there because of a complex web of interactions between different living organisms. For example:

- Certain insects must be present to pollinate plants, or the plant species will die out; monitoring in both natural and agricultural systems is important to ensure that such pollinators are present in sufficient numbers;
- Some microscopic fungi must grow among the roots of many species of tree so that the plant can obtain nutrients it needs to live, and the fungus itself may need the help of particular small beetles to get to the roots. Monitoring of the system allows management to maximize conditions suitable for fungal growth and reproduction, but this monitoring needs taxonomic identification to be successful;
- Coral growth in nutrient-poor waters is aided by algae living within them, and a reef seems to need a range of different algae to survive the recent scourge of coral bleaching which is destroying reefs worldwide;
- Identification of which seaweeds are growing around the coast has enabled early detection of the so-called 'killer alga' in North American waters, and given a chance of eradicating it before it drives out other species, as it is doing in the Mediterranean;
- A 'biological crust' of lichens and other small plants covers soils in rangelands. These plants are both vital for the health and preservation of the soils, and the species present are used to indicate if rangelands are healthy or not.
- Different organisms have different genetic make-ups, and may produce different chemicals. Some of these chemicals are of immense importance to people's health, and their extraction and development of great value. Knowing which species are sampled is of clear importance.
- Crops are attacked by large numbers of pests and diseases. Other organisms can sometimes control these, and knowing which species feed on the pests enables such mechanisms to be put into place.

Pollinating moths

Members of a particular family of moths, called 'hawk moths' or 'sphinx moths', pollinate many trees and other plants in forests. Each species of moth will pollinate just one species of plant, so if the moth is not there the plants cannot produce seeds, and will die out. Recently a taxonomist working in a tropical forest noticed that a gas flare at an oil refinery was attracting and killing hundreds of these moths. Over the course of the months and years that the refinery was running a vast number of moths must have been killed, suggesting that plants could not be pollinated over a large area of forest. Without being able to tell what the moths were, this important information could not have been learned, and no remedial action could have been taken.

The problems

Once we accept that there is a need to know what species are present, why should this be a problem? What prevents people from finding out? Why not just go and find a list? Unfortunately it is not so straightforward. For a start, there are many more species than people generally realize. In the past 250 years of research taxonomists have given scientific names to about 1.7 million different species of animals, plants and micro-organisms. They estimate that there are actually between 5 million and 100 million species on the planet! Even the ones that are named are not gathered together into a single reference work or index; one of the big problems is just getting an access point to these data. For many groups of organisms there are no up to date or complete lists of species found in different countries or regions of the world.

How to name a species: the taxonomic process

Taxonomists begin by sorting specimens to separate sets they believe represent species. Once the specimens are sorted the next job is to see whether or not they already have names. This may involve working through identification guides, reading descriptions written perhaps 200 years ago, and borrowing named specimens from museums to compare with the sample. Such comparison may involve external characters, a need to dissect internal structures, or even molecular analysis of the DNA. If there is no match the specimens may represent a new species, not previously given a name. The taxonomist then has to write a description, including ways in which the new species can be distinguished from others, and make up a name for it, in a Latin format. The name and the description must then be properly published so that other taxonomists can see what has been done, and be able to identify the species themselves. From finding the specimens to the name appearing in print can take several years.

People have been collecting animals and plants for many years, and built up large stores of preserved specimens. One might think that these collections could help conservationists and planners find out what is living (and what has become extinct) in their environments. Unfortunately there is a problem here as well. The collections are concentrated in just a few places, particularly in developed countries in the Northern Hemisphere. Most of them are not indexed on a computer or anywhere else, and it can be very difficult to find just where specimens from a particular country are held – even the museums and herbaria where they are stored may not know themselves! Keeping such collections is very expensive, since they have to be in controlled environments to prevent them from decaying or getting eaten by insects. Many developing countries cannot afford to maintain large collections of their own fauna and flora.

There are of course many books and scientific papers written about species of animals, fungi, microorganisms and plants, many with guidance on how to identify them. However, most of these are stored in the great libraries of the developed world, and are not available in developing countries where often there is no way of even finding out that they exist. Even when the books are available many of them need very specialized knowledge to interpret and use, since taxonomists on each group of organisms tend to use very complex terms and language. Many of the earlier books are written in Latin, which relatively few people can read now anyway.