



Assessing Taxonomic Needs in Ghana

Taxonomic Needs Assessments: Introductions and Guidance

Introduction

187 nations around the world that have signed and ratified the Convention on Biological Diversity. All have made commitments on conservation, sustainable use, and fair and equitable access to the genetic benefits of biological diversity – the three aims of the Convention. In order to meet these commitments, and manage their biodiversity, they need to be able to identify what that biodiversity is made up of. This process needs taxonomy – the identification, naming and classification of organisms.

For most countries in the world, there is simply too little taxonomic expertise, information and infrastructure available to enable them to work with their biota in the way they need. This deficiency is known as the 'Taxonomic Impediment' to implementing the Convention on Biological Diversity. The Taxonomic Impediment is therefore specifically about the taxonomic needs of non-taxonomists: conservationists, environmental managers, quarantine officers, foresters and so on. It is distinct from the Taxonomic Capacity of a country, which refers to what taxonomy can be done, and the levels of expertise, information and infrastructure, without considering needs.

Understanding the Taxonomic Impediment in a country or region so that it can be removed can only be done by working with the users of taxonomy in these other fields, and identifying their taxonomic needs and the way they use taxonomy. This process is known as a Taxonomic Needs Assessment.

The Parties to the Convention on Biological Diversity (CBD) have repeatedly identified the importance of National Taxonomic Needs Assessments. The GTI Programme of Work suggests that National Governments, with the support of national and international organizations and institutions as needed, should play a leading role in carrying out assessments. Some countries have used national biodiversity strategies and action plans (NBSAPs) as well as national reports under the Convention to indicate their need for taxonomic capacity, but few details have been provided. So far, national needs assessments have been or are being carried out by a few countries, for example UK and South Africa. In each case the assessment does not cover all possible stakeholders with an interest in taxonomic information, since resources have been too few to allow such a comprehensive process.

Understanding what taxonomic information is required in order to meet CBD-related needs is vital for good management and of great importance in building National Biodiversity Strategies and Action Plans. Once the needs are known the available resources can be assessed and the results used to set goals and priorities for building necessary capacity. If countries are involved in regional taxonomic networks, needs can also be assessed within the context of meeting obligations to those collaborations, especially when participation may include complementarities and sharing of research effort. For Ghana, the partnership with other countries of the WAFRINET LOOP of BioNET-INTERNATIONAL is of potential importance in this regard.

As with so many Convention-related activities, a taxonomic needs assessment has both policy and implementation outputs. For policy, assessments should state clearly if and how lack of taxonomic capacity and / or information impedes implementation of NBSAPs. The needs assessment is also a working document which can be used to inform taxonomists and funding bodies of the taxonomic input required. The process of conducting a needs assessment itself can be used to raise awareness of the CBD and of taxonomic needs.

Some valuable suggestions on how to carry out a national needs assessment were provided by the report of the DIVERSITAS/Systematics Agenda 2000 Workshop (Anon, 1998c¹). These suggestions are summarized below, with additional ideas and protocols developed through the UK assessment.

The process can be seen as a seven-step operation:

- a) Selection of Assessment focus;
- b) Assessment of national user needs and priorities for taxonomic information;

¹UNEP/CBD/SBSTTA/4/INF/7 - <http://www.biodiv.org/doc/meetings/sbstta/sbstta-04/information/sbstta-04-inf-07-en.pdf>

- c) Assessment of existing taxonomic knowledge about national biodiversity, its availability to and employment by users, and the sustainability of these sources;
- d) Assessment of current national taxonomic infrastructure;
- e) Assessment of current national human resources in taxonomy;
- f) Analysis of results; and
- g) Recommendations for action.

Selection of Assessment Focus

The focus of the assessment is likely to be one or more of the focal areas of the CBD ('Thematic Areas' and 'Cross-cutting Issues'). Alternatively, it might be a sector such as 'Conservation' (the focus of the recent UK Assessment). Such targeting will assist mapping to CBD COP Decisions, which will be useful in formulating questions, subsequent analysis and targeting and prioritisation of resources as a response to the Assessment. It will also assist the National CBD Focal Point in reporting on activities, since these are organised by CBD Thematic Areas and Cross-Cutting Initiatives.

Within these focal areas there are many non-taxonomist users of taxonomic information. Some of the most significant of these from the point of view of CBD implementation are:

- Conservation managers, environmental managers, resource managers, protected area managers;
- Environmental protection agencies;
- Agencies involved in intercepting and managing invasive alien species and pests;
- Agencies responsible for biosafety, including those dealing with genetically modified organisms;
- Departments involved in implementing Access and Benefit-sharing legislation;
- Agriculture, horticulture, forestry, and fishery agencies;
- Forest product industries;
- Biotechnology industries;
- Ecotourism industries;
- Agencies and organizations involved in applied health and medical research; and
- The research community (biological science, global change, environmental science).

This list is not exclusive, and other areas of focus might be appropriate for Ghana.

These users may be government departments, NGOs, research institutions, amateur societies, educational bodies, private companies etc. Each might have different needs, and different sources for the information they use.

In addition to the Users, there are likely to be national policy documents or reports that deal with the focal area. These might contain information on taxonomic needs, either explicitly or by inference (any call for 'monitoring and assessment', for example, implies a need for a taxonomic resource to identify the organisms being monitored).

The first steps in the Assessment project will be to:

- a) decide which sector or sectors to focus on,*
- b) identify the stakeholders that should be included,*
- c) decide the paper and policy documents that should be examined.*

Assessing national user needs and priorities for taxonomic information

There are two tools that will be of value in assessment of user needs. These are a questionnaire and interviews. Ideally, they should be used in conjunction, so that the subject can think about the questionnaire and enter data that, being of a standard format, is more simply analysed, and then interviewed to discover aspects that either do not fit on the questionnaire, or can be prompted by the questions. As the assessment continues, the interviewer will become increasingly aware of issues and needs that were not recognised initially, and can use the interviews to explore these. Although such issues may be discovered, the questionnaire should not be changed, since this will make subsequent analysis more difficult.

Questionnaire

A draft questionnaire is included in the pack. This is based on the one used for the UK Taxonomic Needs Assessment of conservation bodies, and may not be fully appropriate for Ghana. However, it does give some ideas which could be incorporated.

Before sending out the questionnaire the recipient should have been contacted to give them warning, and an explanatory letter accompanying the questionnaire will need to be drafted.

In the UK and Europe, legislation gives people certain rights over data about them held electronically. For this reason the questionnaire includes a form on which the person filling it in can signify their agreement to the use of the data. Ghana may or may not have similar legislation, but it might be useful to include on the form a statement of the use of the information collected, and its distribution.

The first part of the form collects information about the organisation being questioned, including their status. Different types of organisations may use

taxonomic information in different ways, so this classification will assist analysis. A classification not included on the draft of the questionnaire is the nature of the 'customers' of the organisation. For example, an organisation may need taxonomic information because its staff manage the environment directly, because they advise those who do, because they advise government, or because they create analyses that are used by other researchers.

A potentially useful figure not included in the draft questionnaire is the number of people in the organisation that are working on the focal area. For example, the questionnaire may be completed by someone working in a one-man ecotourism business, or a government body with several hundred staff who might be using the resources. Such a figure, appropriately scaled, will assist in providing levels of need.

Although the focus has been determined by this stage, the users selected might be asked to identify the areas of CBD implementation they are focussed on. It may be that their interpretation differs from that of the Assessment Team, or that their interests (and resources) extend more widely than anticipated.

The Thematic Areas of the CBD are referred to in the draft questionnaire as Ecosystems. However, this breakdown is quite possibly insufficiently detailed to account for sectoral interests in Ghana, and a more detailed term for the ecosystem or environment may be useful (e.g. 'mangroves', 'savannah', 'desert' etc.).

In addition to the ecosystem the draft questionnaire has a table investigating the higher groups of organisms the users may be interested in. This table is grouped by broad ecosystem, and it might be useful to change this grouping. In addition, not all users may be interested in groups as set out; 'forest pests', or 'grassland herbivores' are equally valid groups from a non-taxonomist user point of view, and the questionnaire may need to be modified to accommodate such assemblages.

The draft questionnaire also seeks to establish to what extent the activities of the user involve different taxonomic activities and tools. There is some overlap with earlier questions as the draft is written, and we may wish to change this. This table is essentially about what the organisation does rather than what is needed; needs, however, may be inferred from the responses, and investigated during an interview.

The next part of the form is focussed on what taxonomic products the organisation uses or needs. Before finalising the questionnaire the various categories and items should be considered carefully to see if any should be omitted or more added. For example, currently the form includes a set of ecological information elements which, although they fall under the heading of the GTI (taxonomy operating at ecosystem, species and genetic levels) may be

outside the remit of most taxonomic organisations. For each item the organisation is asked:

1. to rank the importance of the item on a scale of 1-5, 1 being 'very important' and 5 'unimportant';
2. state whether the resources are available or unavailable;
3. identify the source of the resources (e.g. in-country professionals, amateurs, local library);
4. indicate whether the source is in their view sustainable;
5. Make additional comments.

Finally, the questionnaire includes a blank page where the user is invited to add more detail to their taxonomic needs.

Interviews

Following the questionnaire it may be valuable to carry out an interview with the correspondent. In this points made in the answers can be followed up, and more detailed questions asked to clarify or explore problems and needs. For example:

- The interviewee should be encouraged to think of both current and expected future needs for taxonomic information.
- Where do they currently obtain taxonomic information, and are these sources adequate and sustainable?
- What kinds of taxonomic knowledge (e.g. species lists, identification tools, authoritative images, data from specimens in collections) about those groups are most essential?
- What format (e.g. field guides, formal taxonomic publications, dedicated reports, dynamic web-based) do they prefer the information to be in?
- What gaps in knowledge need to be filled?

It is difficult, and probably counter-productive, to set a prescriptive list of questions.

Assessing existing taxonomic knowledge about national biodiversity and its availability to users

At least some taxonomic information about national biota exists for all countries, but this is scattered over a myriad of different sources, is of uneven quality, and may not be easily available electronically. Moreover, where it exists it may not be in a format or language that makes its employment simple for non-taxonomic users or even many taxonomists, especially in the country of origin. Consequently an assessment of availability must include its main formats and the possibilities of distributing it to the appropriate personnel (Lyal, 2004). The types of knowledge that might be considered arise from the needs assessment, but are likely to include: (i) species lists for the country and areas within it, particularly protected areas; (ii) detailed data associated with specimens; (iii) taxonomic

literature (including field guides and electronically-mediated information) pertaining to the biota of the country.

Two key data sources for species lists are existing literature and specimens held in collections. An important consideration is that taxonomic names do change through time, and consequently any list must be checked and corrected if it is to be of value.

Some information from the literature may be relatively easy to retrieve. This is most likely to be so for well-known groups, such as many vertebrates, some groups of vascular plants, and some of the more spectacular or economically important invertebrates. Such information can often be found in field guides, extant national or regional checklists and reports, and electronic databases. On the other hand some faunal or floristic lists, reports, and databases may be unavailable within the country, and will need to be sought elsewhere. More difficult to collect are species data discussed in detailed and specialist sources, such as monographs and primary taxonomic literature, both because of the distributed nature of the information within the publications, and the likelihood that they will not be available within the country.

Natural history collections potentially provide the most reliable records of species distribution, whether at national or other geographic scales, and thus have a role in compilation of species lists. A benefit of data from this source is that records can be associated with voucher specimens, the identity of which can be checked. For the purposes of a national assessment, key national and extra-national collections could be identified and information of the holdings requested from the institution concerned. Routes to identifying these key collections are (a) asking institutions within the country about contacts and long-term scientific involvement with extra-national institutions; (b) searching the internet for relevant collections information; (c) checking the major web portals to such information (see section 6²); (d) checking available taxonomic literature for references to specimen repositories (e) asking the major world collection-holding institutions, which can generally be named by any competent taxonomist. Provision of the information by collection-holding institutions may, however, require a considerable amount of work, not least because many institutions do not keep records of their holdings associated with geographic origin. Information delivery might therefore involve a cost, which should be factored into the budget of the needs assessment. A valuable exercise that might arise from this part of the assessment could be networking relevant institutions to pool collections data.

For many taxonomic groups, information retrieval will be extremely time consuming and may not be possible with available resources. In such cases, estimates of species richness of such groups would be valuable so that plans

² Many specimen records from numerous institutions are accessible through the Global Biodiversity Information Facility: <http://www.gbif.org>

can be made to acquire or develop additional information subsequently. Moreover, the information that is gathered may highlight gaps in data availability, and provide the basis for subsequent data- or specimen-collection projects. Plans for subsequent projects could be included within the NBSAP.

The creation of a list of species found within a country is not an academic exercise. Apart from supporting implementation of Article 7 of the Convention, it underpins many other aspects of Convention implementation. One key aspect is that of Access and benefit-sharing, where knowledge of the species, subspecies, varieties and strains within a country's borders is a vital prerequisite to protecting genetic resources and their benefits (see below).

Detailed data associated with specimens can be of value for a number of reasons, including ecological modelling of species distributions. This system has been used to great effect in Mexico, where databases of specimen-level information have informed policy on a number of issues including invasive alien species, living modified organisms, and protected areas. The assessment will determine what collections are readily available and what can be found outside the country. Plans and priorities can then be developed for data repatriation. Issues regarding location of collections apply here also.

Taxonomic literature is a necessary tool for the majority of users. In order to maintain any functional taxonomic activity there must be access to the appropriate specialist literature. This is covered under 'libraries' below. Literature of a more generalist type including field guides and electronically-mediated information pertaining to the biota of the country is also of considerable value, particularly to non-taxonomists charged with implementation work. A review of field guides that deal with biota of the country would be comparatively simple, and stem perhaps from responses to questions by the users targeted in the assessment.

Assessing available taxonomic infrastructure

A survey of scientific infrastructure supporting taxonomic research is a key element of any taxonomic assessment. Three broad categories of taxonomic infrastructure include: i) collection facilities, ii) libraries, and iii) associated technical, management and other institutional support for taxonomists.

i) Collections facilities

These include museums, herbaria, arboreta, zoos, botanical gardens, culture collections and seed banks. The facilities might be housed in stand-alone institutions, universities, private institutions or governmental agencies such as agricultural research stations. As part of any assessment, the following information should be gathered for each collection:

- taxonomic coverage and the kind(s) of specimens housed;

- curation of collection (the proportion of specimens which are identified and / or sorted, those which are available for research, and whether specimen tracking systems are in place);
- capacity for growth, in terms of space and infrastructural support;
- quality of the facilities (e.g. adequacy of collection housing such as cabinets, supplies, maintenance, specimen preparation areas, curatorial and staff office and research space);
- security (whether the collection is adequately protected from fire, pests, and other adverse conditions);
- information availability and communications infrastructure (e.g. printed catalogues, electronic database(s) and electronic links to other databases);
- institutional structure (e.g. relevant policies, quality of business management, budgetary support, sustainability, whether loans of specimens can be received from other institutions); and
- institutional long-term planning, particularly in terms of GTI goals.

ii) *Libraries*

Taxonomic research requires access to libraries with reference collections. Thus the libraries in natural history institutions, universities, agricultural or medical research centres, and other agencies should be surveyed for their capacity to support taxonomic research. General information to be gathered will include:

- numbers and kinds of libraries;
- extent of holdings (e.g. books, monographs, journals, electronic databases etc relevant to the particular area of the world and group(s) being studied);
- financial support to enable continued purchase of relevant journals and books;
- communication capabilities (e.g. electronic access to holdings; electronic linkages to other libraries, ability to receive books on interlibrary loan).

iii) *Associated scientific support (policies, infrastructure)*

All scientific research, including taxonomy, requires a broad range of general supporting infrastructure. An assessment might include the following broad categories:

- universities with appropriate expertise, relevant governmental and nongovernmental institutions, field stations, etc.;
- computing capacity and quality;
- molecular, biochemical, morphological, cytological and other laboratory facilities;
- research equipment available (microscopes, field vehicles, etc.);
- ocean-going ships, other research vessels, and sorting gear; and
- existing strategies and frameworks to develop and promote in-country research (including funding procedures, agencies, project evaluation, legislation, permit access policies, and multilateral institutional agreements).

Assessing available human resources supporting taxonomy

For the GTI to contribute adequately to the implementation of NBSAPs, action may be needed to strengthen the human resources supporting taxonomic work. No country has all the taxonomists it needs, nor taxonomic expertise in all groups. Therefore, countries will want to assess current human resources in the light of national goals and needs, taking into account accessibility of expertise at regional levels. The following information will be useful in evaluating capacity:

i) *Professional research staff in each taxonomic institution (curators, research scientists):*

- Numbers;
- Demography (age structure of experts in the various areas of work);
- Taxonomic coverage (expertise); and
- Status: (e.g. qualifications, participation in professional activities within the country and internationally).

ii) *Support staff:*

- Professional collection managers;
- Technicians or research assistants;
- Students (undergraduate, graduate, and postdoctoral);
- Parataxonomists (non-professionals having some curatorial or research responsibilities);
- Collectors;
- Interns and trainees;
- Volunteers (retired scientists, trained lay persons, amateurs etc.);
- Financial support staff (with expertise in funding agencies, financial administration, etc.); and
- Managers.

iii) *Capacity for education and training in taxonomy:*

- Education or training available (taxonomic coverage, content, course titles);
- Level of education available (B.Sc, M.Sc., Ph.D., other qualification, parataxonomy training, collections management, etc.);
- Numbers and kinds of trainees;
- Facilities for training; and
- Prospects for productive employment in relevant taxonomic work (institutions, number and kind of posts available, sustainability).

The results of such a survey could be used to inform prospective students and trainees through publication either as hard copy or on the internet.

While national human resources in taxonomy are being evaluated, countries could assess human resources at the international level that may have a relevant role in building in-country capacity. Critical areas of needed information include:

- a list of in-country specialists working in foreign countries;
- a list of foreign taxonomists working in-country;
- a list of foreign taxonomists experienced in relevant groups; and
- the availability of training opportunities in foreign countries.