THEMATIC REVIEW OF DARWIN INITIATIVE'S CONTRIBUTION TO THE GLOBAL TAXONOMY INITIATIVE

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The Darwin Initiative aims to promote biodiversity conservation and sustainable use of resources around the world. It uses UK expertise working with local partners to help countries rich in biodiversity but poor in resources to fulfil their commitments under the CBD. The Initiative is funded and administered by the UK Government's Department for Environment, Food and Rural Affairs (Defra). Since 1992, the DI has committed over £45m to over 450 projects in over 100 countries.

For information on the Darwin Initiative see www.darwin.gov.uk
For information on the CBD see www.biodiv.org

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EXECUTIVE SUMMARY

This report is the first in a series of proposed thematic reviews commissioned by the Department for Environment Food and Rural Affairs (DEFRA) to examine the contribution of the UK Darwin Initiative (DI) to the Convention on Biological Diversity (CBD).

The theme for this review is capacity-building for taxonomy, which is vital to understanding and conserving biodiversity. The review takes as its framework the Global Taxonomy Initiative (GTI), which was set up under the CBD to remove the taxonomic impediment (the lack of taxonomic knowledge, capacity and expertise which hinders our ability to manage and use biological diversity).

The DI aims to promote biodiversity conservation and the sustainable use of resources around the world, and has so far supported over 400 projects towards achieving this aim. Fifty of these projects have made significant reference to taxonomy. Contact was made with UK and host country staff on this cluster of projects, and all project documentation was examined with respect to the five Operational Objectives of the GTI. This enabled the review to determine the clustered projects' contribution to the GTI in terms of best practice, lasting legacy, and lessons learned, and to draw attention to valuable case studies.

Operational Objective 1 recognises the need to assess taxonomic capacity at national, regional and global levels. DI project leaders have a good understanding of national taxonomic needs, which were successfully addressed in projects throughout the world – from terrestrial invertebrate biodiversity in the Galapagos to deep sea fish communities in the Maldives. Through improving our knowledge of species taxonomy, DI projects also implicitly highlighted taxonomic capabilities. This assessment will have a lasting impact through national biodiversity strategies and action plans.

The majority of DI projects reviewed had an enormous impact upon GTI **Operational Objective 2** – building and maintaining the resources to obtain and manage taxonomic collections. Impacts included:

- Establishing and developing both local and national collections (such as local herbaria in *Conservation of Plant Diversity in Western Cameroon* and the National Borneensis [Lepidoptera] collection developed by *Biodiversity of Butterflies in Tropical Rainforests in Sabah*);
- Technology transfer (for example methodologies for culturing fungal collections transferred by the *Microbial Genetic Resource Programme*);
- Infrastructural provision (for collections such as the Insect National Collection, Thailand, through *Taxonomic Capacity Building in Support of Biodiversity Conservation*);
- Training motivated students (such as an exciting new team at Sucre herbarium, Bolivia, by *Plant Endemism of the Central Andean Valleys*); and
- Employment of trained staff post-project (e.g. at the *Binatang* research centre, after *Developing Local Capacity for Biodiversity Surveys in Papua New Guinea*).

A combination of "on-the-job" training and formal qualifications increased the skills base of a large number of trainees, while enabling them to play an important ongoing role in maintaining collections, developing policy and training subsequent generations of taxonomists.

Operational Objective 3 highlights the need to make taxonomic collections accessible, particularly in their country of origin. Many DI projects contributed, through:

- Developing databases, including web-based systems such as the *Darwin Nematode Virtual Collection*;
- Repatriating specimens from the developed world (*Repatriation of Herbarium Data for the Flora of Bahia, Brazil*); and
- Publishing field guides and manuals, such as the two local-language manuals produced by *Marine Benthic Invertebrate Study in Coastal Waters of Ecuador*.

Darwin projects have been involved in generating the taxonomic information needed for decision-making in conservation in all of the major thematic work programmes of the CBD (**Operational Objective 4**), through discovering new species, records and populations, and identifying key areas and taxa for conservation. Some projects (e.g. *Conservation of Plant Diversity in Western Cameroon*) discovered as many as 30 new species.

Through the activities described above, DI projects contributed to most of the cross-cutting issues of the CBD (**Operational Objective 5**). Particular contributions were made in public education and awareness, sustainable use of biodiversity, and technology transfer and cooperation.

Overall, this review found that the DI delivers good value for money, having a significant impact on GTI objectives for a modest investment of funds. Having highlighted examples of best practice and drawing attention to the constraints taxonomic DI projects may face, we conclude by making recommendations for the DI which include:

- Addressing the declining number of taxonomic projects;
- Encouraging regional projects and projects to assess taxonomic capacity in new areas;
- Considering a range of project durations, possibly with up to five years' funding;
- Targeting resource allocation to the CBD major thematic work programmes and cross-cutting issues;
- Fostering closer links between the CBD, DI and GTI, and between DI projects in the same region;
- Assessing training needs to better match the training provided with host country skills bases;
- Contributing to both local and national taxonomic collections;
- Continuing to support repatriation of taxonomic data and collections;
- Emphasising the need for outputs in local languages;
- Submitting data from past and present DI projects to recognised international databases or websites;
- Emphasising the importance of protecting indigenous peoples' intellectual property rights; and
- Emphasising the importance of a clearly-defined exit strategy.

The DI is an important, unique, source of funding for biodiversity science and conservation that ensures taxonomic research gets to the people and places that need it most. These recommendations, if adopted, should further enhance its contribution to the GTI.

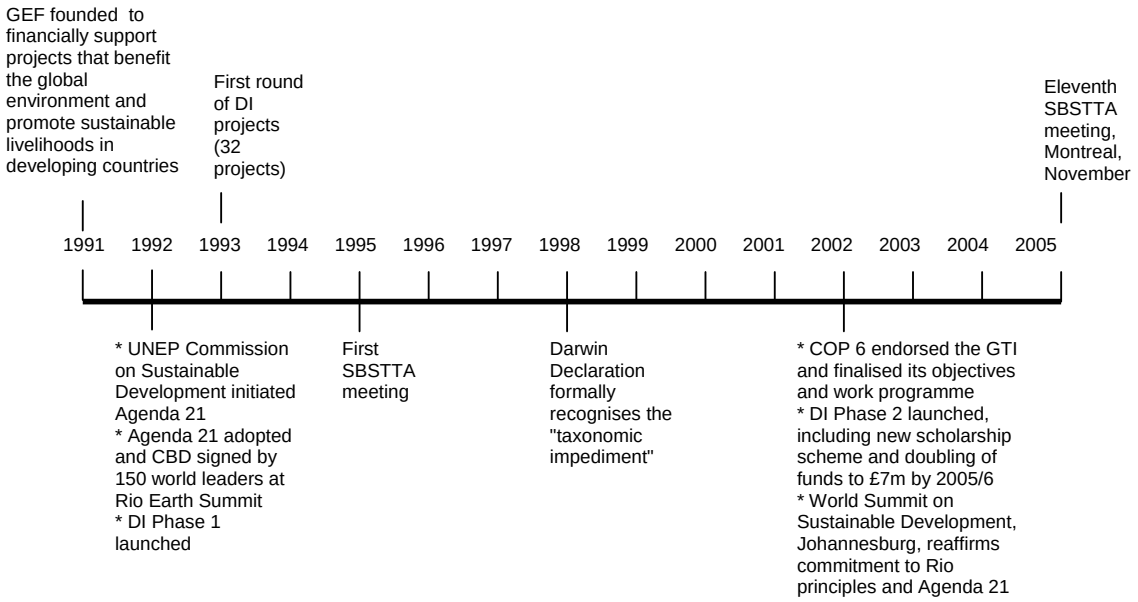
INTRODUCTION

Our planet is home to an estimated 13 million species, up to 10% of which will become extinct or decline irrecoverably over the next 25 years (Hanski *et al.,* 1995). However, to date only 1.7 million have been described (Stork, 1997), and our understanding of these organisms is highly variable across different groups.

In the face of this urgent need for knowledge, taxonomy provides a crucial reference system for all organisms and a framework for identifying and discussing the elements of biodiversity (Environment Australia, 1998a) In essence, taxonomy is an essential component of any initiative aimed at sustainable development and conservation.

Over the past 15 years, several UK and global initiatives have been developed to tackle these issues.

Timeline



The Convention on Biological Diversity (CBD)

Signed by 150 world leaders at the 1992 Earth Summit in Rio de Janeiro, the CBD is part of a world strategy for sustainable development and sets out practical commitments for maintaining the earth's ecological underpinnings as economic development progresses. The three main goals of the convention are:

- Conservation of biological diversity;
- Sustainable use of its components; and
- Fair and equitable sharing of the benefits from the use of genetic resources.

The CBD comprises 42 articles, governed by the Conference of the Parties (COP), and is advised by the Subsidiary Body on Scientific Technical and Technological Advice (SBSTTA).

The Darwin Initiative (DI)

Initiated in 1992 and funded and managed by the Department for Environment Food and Rural Affairs (DEFRA), the DI aims to assist developing countries that are "rich in biodiversity but poor in financial resources" to meet their objectives under the CBD. Since 1992, the DI has committed over £35 million in funding to more than 400 Darwin projects in 100 countries around the world. Its annual budget has increased from an original £3 million to £7 million for 2005/6.

Objectives of DI projects

- Draw on UK expertise in the field of biodiversity;
- Be demonstrably collaborative, involving partnership with host country institutions or communities at all stages;
- Be of real value to the biodiversity of the host country;
- Leave a legacy, a real and lasting impact on the capacity of the host country to meet its obligations under the CBD;
- Where appropriate, raise awareness of the value of natural resources and encourage their sustainable use;
- Be of high quality and scientific excellence;
- Where possible, act as a catalyst to lever additional funding for project work;
- Avoid overlapping with work funded through other mainstream environmental or research programmes;
- Wherever possible, be innovative and distinctive;
- Generally include training of host country personnel;
- Demonstrate good value for money; and
- Include a well-defined exit strategy.

Source: http://www.darwin.gov.uk/about/objectives.html

The Global Taxonomy Initiative (GTI)

Through the CBD, national governments have acknowledged the existence of a "taxonomic impediment" to the management and conservation of biodiversity. The removal of this impediment is seen as crucial to the implementation of the CBD (Environment Australia, 1998b; House of Lords, 1992, 2002) and has been established as one of the CBD's cross-cutting issues by the COP.

What is the Taxonomic Impediment?

Taxonomy is the science of discovering, describing and naming the individual species of plants and animals, including microscopic forms, which make up the world's biota, and of working out their relationships to provide a classification. Such work has been reasonably well completed for some groups, such as mammals, birds, some higher plant groups, and some spectacular species of insects and molluscs. These species, however, comprise only a small portion of the flora and fauna. Little is known of the taxonomy, distribution, biology, and genetics of the vast majority. The **taxonomic impediment** is a term that describes the gaps of knowledge in our taxonomic system (including knowledge gaps associated with genetic systems), the shortage of trained taxonomists and curators, and the impact these deficiencies have on our ability to manage and use our biological diversity.

Source: Darwin Declaration (Environment Australia, 1998b)

The GTI provides a framework to address the taxonomic impediment. It was established under the CBD to underpin decision-making in conserving biological diversity, sustainable use of its components and equitable sharing of the benefits derived from genetic resources. In particular

it addresses the lack of taxonomic information available to help identify the components of biological diversity in many parts of the world and the need to build capacity for taxonomic activity in all regions, but especially developing countries. This includes reference materials, databases and taxonomic expertise relevant to the objectives of the CBD. At its sixth meeting, the COP endorsed a programme of work for the GTI and formalised its objectives, with an intention of reporting progress against these objectives at the forthcoming COP 8.

Objectives of the GTI

- To develop national, regional and sub-regional training programmes;
- To strengthen reference collections in countries of origin including, where appropriate, the exchange of paratypes on mutually agreed terms;
- To make information housed in collections worldwide, and the taxonomy based on them, available to its countries of origin;
- To produce and distribute regional taxonomic guides;
- To strengthen infrastructure for biological collections in countries of origin, and the transfer of modern technologies for taxonomic research and capacity-building; and
- To disseminate taxonomic information worldwide, *inter alia* by the clearing-house mechanism.

Source: The Global Taxonomy Initiative (Environment Australia, 1998a)

Thematic review of the DI's contribution to the GTI

The Edinburgh Centre for Tropical Forests (ECTF) is commissioned by DEFRA to undertake the monitoring and evaluation of the DI in order to assess progress in achieving implementation of the CBD articles. To date, this monitoring has centred on assessing progress, achievements and impacts of individual projects through desk-based reviews of reports, and on-site mid-term reviews.

The need to examine the contribution of the DI to particular themes was recently identified as a further means of assessing DI achievements. Thematic reviews are intended to consider the DI's contribution to broad themes associated with the CBD, particularly with respect to best practice, lasting legacy and lessons learned.

For the first thematic review, the DI has recognised a need to assess the extent to which projects have contributed to capacity-building for taxonomy, taking the GTI as a framework against which to measure these achievements.

In particular this review will:

- Assess how DI projects have contributed toward assessment of taxonomic needs and capacities at national, regional and global levels;
- Assess how DI projects have contributed towards building and maintaining the systems and infrastructure to obtain, collate and curate the biological specimens that are the basis for taxonomic knowledge;
- Assess how DI projects have supported improved and effective information systems, institutional capacity and, where relevant, socio-economic aspirations;
- Assess how DI projects have generated information needed for decision-making in conservation and sustainable use of biodiversity and its components, using the CBD thematic work programmes and socio-economic considerations with regard to benefits from use and access to biodiversity; and
- Draw out conclusions on best practice and impact, making recommendations to the DI on how best to maximise the DI's contribution to the GTI.

These assessments were based upon projects' contributions to the five Operational Objectives of the GTI:

Operational Objective 1:

Assess taxonomic needs and capacities at national, regional and global levels for the implementation of the Convention.

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.

Operational Objective 3:

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

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.

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 (Conference of the Parties, 2002).

To date, the DI has funded more than 400 projects in 100 countries around the world. Of these projects, 50 (12.5%) use the terms **taxonomy** or **systematics** in their project documentation, both of which contribute to the "taxonomy" defined by the GTI.

While the number of DI projects funded has remained relatively steady at an average of 28 per year since the inception of the programme, the number of taxonomic projects has slowly declined, especially relative to the large increase in projects funded in the past year (figure 1). Over the last five years the DI has funded an average of 2.2 taxonomic projects per year, relative to five per year in the first eight years to 2000. In 2005 only two taxonomic projects were funded out of 68 overall.

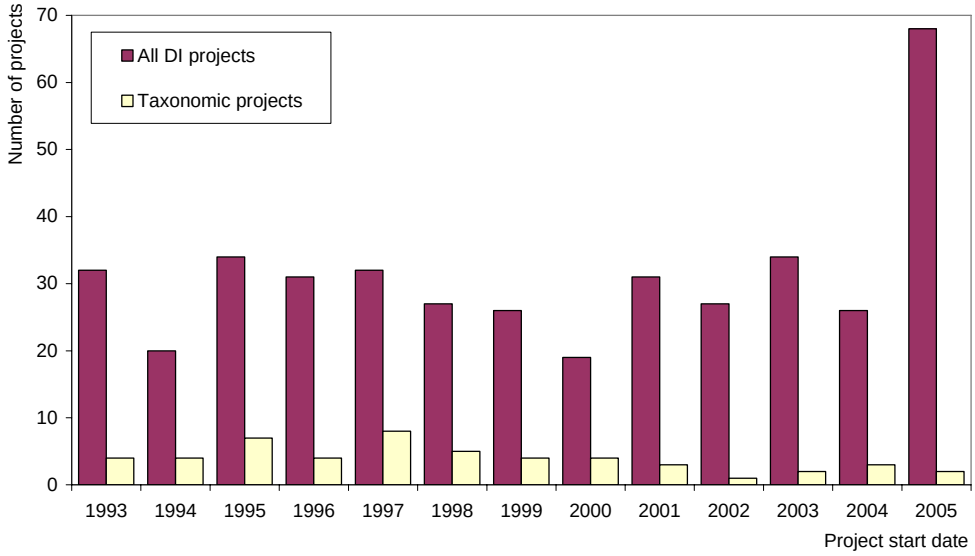


Figure 1. Number of DI projects funded each year.

Thirty-seven of these projects (Annex 1) provided information to the review team. This was through project reports and their reviews, questionnaires to both UK and host country project leaders (Annexes 2 and 3) and interviews. These 37 projects form the cluster upon which the review is based.

The average cost of taxonomic DI projects was very similar to the average of DI projects overall: £115,643 as opposed to £117,359. Approximately equal numbers of projects covered flora and fauna (figure 2), but microbes (including fungi) were poorly represented. The majority of projects were based in terrestrial ecosystems (figure 3), but the distribution of projects was relatively even across the globe (figure 4).

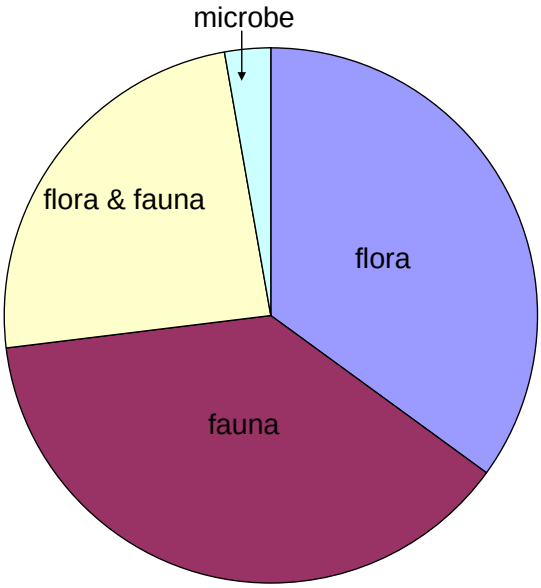


Figure 2. Distribution of clustered projects across taxa.

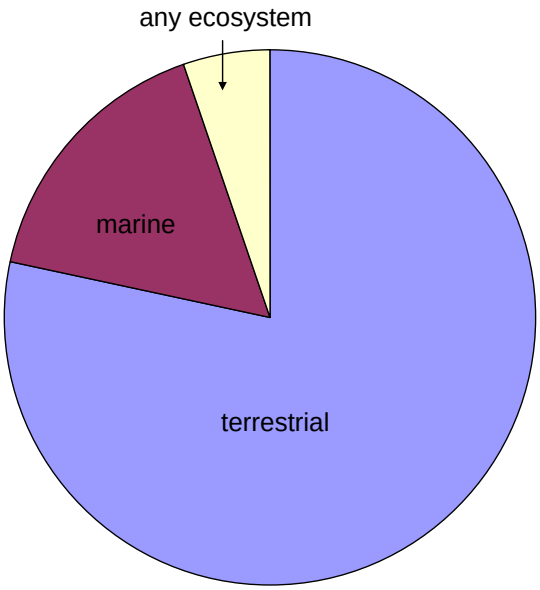


Figure 3. Distribution of clustered projects by ecosystem.

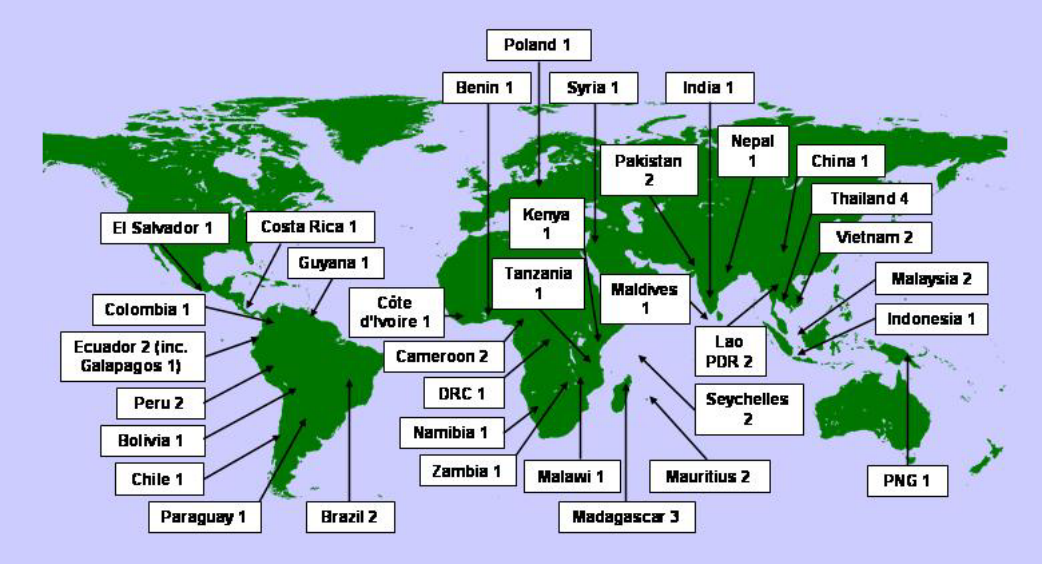


Figure 4. Worldwide distribution of clustered projects (labels show country and number of clustered projects taking place there). Note that some projects took place in more than one country.

The clustered taxonomic projects were assessed against both the Operational Objectives of the GTI and across the key themes of **effectiveness** and **Impact and legacy.**

REPORT FINDINGS RELATING TO OPERATIONAL OBJECTIVES OF THE GTI

Operational Objective 1 – Assessing taxonomic needs and capacities

A lack of taxonomic information, facilities and skilled human capacity, are widely considered to be limiting factors for conservation and sustainable development.

> *An inability to properly identify tree species of economic potential was preventing their effective evaluation in utilisation and conservation programmes. At the root of this problem lies a lack of high quality biodiversity data and trained personnel in [host country] institutions. (Dr Carlos Reynel, 9-017: Tree Diversity, Agroforestry Development and Reafforestation in the Peruvian Andes*).

Often, very little information is available about what the taxonomic needs and capacities of a country are and this information can vary enormously between countries. For plants, *Index Herbariorum* (http://207.156.243.8/emu/ih/index.php) provides some information on the taxonomic collections of countries, listing over 3,240 herbaria in 165 countries, and almost 10,000 staff members associated with these collections. However, this does not address the issue of countries with little or no capacity at present, and is only relevant to plants. For animals there is no global depository for this type of information although in the near future BioCASE will fulfil such a role in Europe (http://www.biocase.org/).

In terms of existing infrastructure, there is also wide variation between target countries. For instance, Costa Rica is strongly committed to resolving the taxonomic impediment through its world-renowned INBio programme (http://www.inbio.ac.cr/es/default.html) while in countries such as Lao PDR, taxonomic work and collections are much less developed and a national taxonomic reference centre does not exist.

Effectiveness

At the national level, DI project workers often have a good understanding of the taxonomic needs and capacities of their host country. Many have a long history of working with their collaborators and most projects have arisen out of discussions with in-country partners. This makes them keenly aware of the challenges facing host country institutes and the capacity-building measures that are needed, enabling them to develop DI projects that address these needs.

> *Collaborators in Nepal identified the need for capacity building and training and requested our help to achieve this. (Dr. Mark Watson, Royal Botanic Gardens Edinburgh, 12-030: Building Capacity for Plant Biodiversity Inventory and Conservation in Nepal).*

Some projects were also aware of needs at a regional level:

> *The DI was an obvious funding route ... given the premise that there was a need in Southeast Asia to develop a taxonomic infrastructure across a number of countries. (Dr. Gordon Paterson, Natural History Museum, 5-108: Taxonomic Information Across the Internet).*

A large number of projects were involved in regional networks or workshops (Annex 4) with potential to discuss and assess taxonomic needs and priorities. Informal regional links, such as the *Darwin Nematode Network* (http://www.pml.ac.uk/darwinnematode/disc4_welc.htm) actively encourage discussion between taxonomists and highlight needs and opportunities.

Few projects explicitly assessed needs and capacities at a global level. One example was the *Repatriation of Herbarium Data for the Flora of Bahia, Brazil* project (7-108), which assessed the potential for projects like itself to be conducted outside Brazil.

Projects developed from assessments of taxonomic needs

- Based on needs identified during an independent workshop (9-010: *Terrestrial Invertebrate Biodiversity in Galapagos: Training and Collection Rehabilitation)*;
- Following approach to UK researchers by overseas NGO (4-057: *Biodiversity Inventory of the Mbaracayú Forest Nature Reserve, Paraguay*, 4-060: *Deep Demersal Fishes of the Maldives*);
- Following approach to UK researchers by overseas government (8-150: *Empowering Local People to Manage the Biodiversity of El Salvador*);
- Arising out of discussions between UK and overseas researchers (12-030: *Building Capacity for Plant Biodiversity Inventory and Conservation in Nepal*, 13-007: *Taxonomic Training for a Neglected Biodiversity Hotspot Within Lao,* 4-117: *DI Herbarium Techniques Course - Malaysia*);
- Arising out of previous work (7-091: *Insect Biodiversity: Taxonomic Capacity Building in Guyana*).

Impact and legacy

DI projects have had substantial impact in assessing taxonomic needs at a local level for the implementation of the Convention, with most projects being undertaken to meet identified needs. They have been less explicit in assessing the capacity of countries to undertake taxonomic work, but through contributing greatly to our knowledge of species taxonomy they have also implicitly highlighted strengths and weaknesses in taxonomic capability.

DI projects involvement in assessing needs and capacities will have a lasting impact through the integration of their data into national biodiversity strategies and action plans. Impacts range from contributing to national species status assessments (5-174: *Chameleons, Conservation and Local Communities in Madagascar*), producing publications which have been used in the formulation of BAPs (6-046: *Rattan Diversity and Sustainable Management in Lao PDR,* 9-017: *Tree Diversity, Agroforestry Development, Reafforestation in the Peruvian Andes*), to establishing a UNESCO MAB Biosphere Reserve (4-057: *Biodiversity Inventory of the Mbaracayú Forest Nature Reserve*). A formal and long-term contribution to national BAPs requires a strong relationship with government. Thirty percent of project leaders considered they had no relationship with the host country government; 20% considered the relationship "minimal," 40% "reasonable" and 10% "extensive".

Operational Objective 2 – Building and maintaining human resources, systems and infrastructure for taxonomic collections

Reference collections underpin all basic taxonomic research. They allow the comparison and identification of new specimens, collation of information such as distribution data, naming of new species, and training of new taxonomists and parataxonomists. The utility of collections depends on their condition, curation and, crucially, identification. This requires long-term investment in infrastructure, equipment and training. The GTI recommends that collections should ideally be housed in a national taxonomic reference centre where they can be efficiently arranged, maintained and accessed, and supported by a range of trained staff.

Effectiveness

Collections

Fifty-nine percent of projects reported an improvement in collections through their work, ranging from four bat specimens (14-011: *Taxonomic Initiative for Southeast Asian Bat Studies*) to more than 26,000 invertebrates (9-010: *Terrestrial Invertebrate Biodiversity in Galapagos: Training and Collection Rehabilitation*). Infrastructural improvements such as computers, literature, specialist equipment such as microscopes, specimen cabinets, GIS technologies, freeze-driers and air-conditioning units were also widespread. In addition, technology was transferred in terms of methodologies for obtaining taxonomic collections (e.g. marine invertebrates; 6-023: *Marine Benthic Biodiversity in China*), culturing (e.g. fungi; 3-207: *Microbial Genetic Resource Programme*) and curating them (e.g. herbarium specimens: 4-117: *Darwin Initiative Herbarium Techniques Course – Malaysia*).

Training

Maintaining taxonomic collections requires trained staff. Based on project leaders' questionnaire returns, most developing countries had few trained taxonomists prior to DI involvement (e.g. ten in Paraguay, two in El Salvador, three in Bolivia, two in Ecuador, eight across a number of West African countries, up to ten in Lao PDR, and one insect taxonomist in Malaysia), although these figures depend upon personal definitions of a "taxonomist". Seventy-two percent of projects claimed to have trained at least one new taxonomist or parataxonomist.

A **parataxonomist** is usually a locally-recruited worker who has been given limited training but can play an important part in biodiversity collection and inventory. A **taxonomist** is usually trained to a higher level and is essential for the accurate identification of collections. The skill level of both types of worker can vary widely depending on local knowledge of the environment and the level of training received.

Training conducted during DI projects took many different forms (figure 5). In all cases however, successful training depended upon the availability of suitably motivated, and educated potential students.

Training	Intensity	Advantages	Disadvantages	Example
Awareness-raising	**Low**	Empowers local people.	Rarely results in new taxonomists.	Awareness-raising of biodiversity among national park rangers (10-022: *Bai Tu Long Bay Awareness Project, Vietnam*).
Short courses		Relatively easy and cheap to administer for large numbers of people.	Few attendees likely to remain working in taxonomy.	Two week courses for existing staff from a variety of local institutions (4-117: *Darwin Initiative Herbarium Techniques Course – Malaysia*).
Practical training		Research can be conducted at the same time.	Research may not be as high quality as with fully-trained staff.	A group of six young scientists were trained on-the-job; at least two of them are now looking at long-term careers in taxonomy (11-010: *Plant Endemism of the Central Andean Valleys, Bolivia*).
Guided study visits/mentoring		Can produce highly competent, motivated taxonomists.	Expensive.	Six trainee parataxonomists took part in guided study visits to the UK, including a number of taxonomic institutions, before returning to active parataxonomy in Papua New Guinea (10-030: *Developing Local Capacity for Biodiversity Surveys in Papua New Guinea*).
Formal diploma Formal degree Formal masters degree Formal doctorate	**High**	Qualifications recognised worldwide; can be funded separately through Darwin Scholarship scheme.	Trainees dynamic in local community may be affected; trainees may move away from developing country to seek better paid work, or may be promoted to a more "important" administrative role.	An entomologist at the host institute, the Charles Darwin Research Station, Galapagos, Ecuador, conducted work in-country to obtain a PhD from the University of Cardiff (9-010: *Terrestrial Invertebrate Biodiversity in Galapagos: Training and Collection Rehabilitation*).

Figure 5. The training continuum in DI projects.

Finding and inspiring new taxonomists: The Sucre group

A group of students at Sucre herbarium in Bolivia provided an example of good practice in finding and inspiring promising new taxonomists.

Students were selected to take part in the DI project from those already working in taxonomy or related fields across the country. The selection was largely co-ordinated by the host institution, through advertising and word of mouth and was followed by interviews with both the UK and host-country project coordinators.

The best candidates were found to come from Sucre, the smallest and poorest herbarium involved in the project, where they had developed as a group around one existing botanist, feeding intellectually upon each other.

The most promising of these students is Hibert, the youngest worker on the project – enthusiastic, hardworking and target-focused. He is a good fieldworker, excellent at digital photography, and has good botanical knowledge. Hibert is presently working on the plant family Iridaceae and is helping to describe two new species in this family – a *Cardenanthus* and a *Sphenostigma*. With continued support, Hibert is expected to become a valuable asset to Sucre and Bolivian taxonomy as a whole.

(Project 11-010: *Plant Endemism of the Central Andean Valleys, Bolivia*. Based on discussion with J.R.I. Wood, University of Oxford).

Hibert (demonstrating the leather gloves needed for collecting cacti!) and two of the new species he is currently describing (pictures courtesy J.R.I. Wood, University of Oxford).

Impact and legacy

Collections

Many projects had a significant role in establishing national taxonomic reference centres, a key recommendation of the GTI. National taxonomic reference centres are more likely than local collections to gain worldwide recognition and to be used by the international taxonomy community, since having all a country's collections stored in one place makes future taxonomic work easier and more efficient. They are also more likely to attract government support and stable funding. For example, the National Borneensis (Lepidoptera) collection was established in Sabah and is still maintained by staff trained on a DI project (7-040: *Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo*). DI funding helped establish a national reference collection for invertebrates in Galapagos by providing equipment, taxonomists to organise and identify the collections, and by developing protocols for the maintenance of the collection. As a result, the number of specimens has increased to 400,000, curation protocols are still being used, the collection is now internationally recognised and it is growing rapidly. It is used by the Galapagos Park Service, the Ministry of Agriculture and the Quarantine and Inspection Service, for decision-making and management plans (9-010: *Terrestrial Invertebrate Biodiversity in Galapagos: Training and Collection Rehabilitation*). Other examples include the National Centre for the Study of Marine Invertebrates, Ecuador (6-029: *Marine Benthic Invertebrate Study in Coastal Waters of Ecuador*) and the Insect National Collection at Queen Sirikit Botanic Garden, Chiangmai, Thailand (13-003: *Taxonomic Capacity Building in Support of Biodiversity Conservation in Thailand*). These projects left a successful legacy because they had developed strong relationships between the UK and host institutes during the project, which continued after the project ended, and strong links with other projects providing complementary funding.

However, national taxonomic reference centres may be expensive to establish and are often located in capital cities, far from the remote sites of conservation importance. In this context, smaller local reference collections are invaluable, especially where infrastructure is poor or political issues make travel and information exchange prohibitively expensive or difficult. (e.g. 8-038: *Conservation of Plant Diversity in Western Cameroon,* 7-108 *Repatriation of Herbarium Data for the Flora of Bahia, Brazil)*.

Both local and national taxonomic reference centres can be useful for developing taxonomy within the host country. Local collections often have a high short-term impact but risk fragmenting resources, making them harder to maintain and access, and are less likely to receive stable funding. Their long-term impact can be maximised by ensuring all local collections are also duplicated to a single national collection, such as that at La Paz (11-010: *Plant Endemism of the Central Andean Valleys, Bolivia*) or, where this is not possible, to a herbarium outside the host country (e.g. 10-011: *Community-Based Conservation of Hoang Lien Mountain Ecosystem, Vietnam*, 10-030: *Developing Local Capacity for Biodiversity Surveys in Papua New Guinea*).

Training

Training is a major element of the DI objectives, but its long term impact has varied across projects, largely depending upon the people trained and the taxonomic employment opportunities available post-project.

In-country training has reached a large number of trainees. This type of, largely informal, on-the-job training allows promising taxonomists to develop their skills through employment on specific taxonomic projects and has often led to further relevant, non-DI-funded, employment. For example, the *Guide to the Forest Trees of Southern Thailand* (13-026) has, to date, employed six assistants who have received training in taxonomy, three of whom will continue careers in taxonomy in Thailand's Peninsular Botanic Gardens.

Long-term impact of training: Papua New Guinea

At the Binatang Research Centre (http://www.entu.cas.cz/png/index.html) in Papua New Guinea, students receive a parataxonomic training partially funded by the DI. The result is a team of parataxonomists capable of collecting high quality material suitable for deposition in national collections. They are trained to enter field data to computer databases, and to document their specimens with conventional and digital images.

For example, William Boen has been employed at the Binatang Research Centre since 1996, during which time he has gained experience in a variety of techniques:

- Insect and plant collecting;
- Mounting and labelling;
- Insect morphotyping;
- Curation of insect collections;
- Databasing and data management;
- Digital and macro-photography; and
- Image processing.

He has been involved in surveying projects, studies of species diversity, training butterfly farmers, and environmental education in schools. In 2001 William was made the leader of the Binatang parataxonomy team.

This project has proven successfully sustainable because the parataxonomists are employed full-time and strongly involved in the running of their research centre. A shallow hierarchy amongst the team allows for a transfer of knowledge and ongoing training. The long-term aim of the project is to withdraw foreign input altogether, and this is gradually being realised as the centre itself is having increased success at securing contracts from both local and national governments and international research projects. Similar programmes are now being developed in Guyana and Costa Rica.

(Project 10-030: Developing Local Capacity for Biodiversity Surveys in Papua New Guinea. Based on discussion with Dr. Alan Stewart, University of Sussex).

The Binatang team of parataxonomists; part of the Binatang butterfly collection (picture courtesy Dr. Alan Stewart, University of Sussex).

Formal training courses, such as the Royal Botanic Gardens, Kew's *DI Herbarium Techniques Course* (4-117) have been most successful for countries with an existing investment in taxonomic staff. Masters courses and doctoral-level training has led students to play an important role in the establishment and maintenance of collections, development of policy initiatives and training of new taxonomists.

A legacy of training: Borneo

The project *Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo* (7-040) employed four Darwin fellows, Joseph, Mahadi, Nazirah and Susan, all of whom gained an MSc. By the end of the first project, Mahadi was employed at Sabah university on an immediate lectureship and Joseph became a senior conservation officer. A second DI project was developed in liaison with Joseph, retaining Nazirah and Susan who gained PhDs through their work. After this, Nazirah was employed on a senior lectureship. A third DI project retained Susan as a post-doctoral researcher with responsibility for training a new student, completing a full cycle of training.

The team of Darwin-trained fellows therefore now comprises:

- One biodiversity surveyor and lecturer;
- One molecular geneticist and lecturer;
- One taxonomist, geneticist, ecologist and soon-to-be lecturer;
- One fieldworker and conservationist; and
- One researcher undergoing training

These fellows are all actively putting their training into practice: making key strategic decisions, managing people, impacting on public policy, training students of their own and publishing in scientific journals. The Sabah scientists are now leaders in their field.

In this case, the successful legacy was due to:

- Ideal in-country conditions (recent expansion of further education in Malaysia meant there was capacity for the trainees to be employed, providing a guaranteed chain of uptake for the DI project's work, and a secure future for the university infrastructure);
- Careful trainee selection; and
- Ongoing DI input through subsequent projects and continued contact.

(Project 7-040: *Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo*. Based on discussions with Dr. Keith Hamer, University of Leeds, Dr. Jane Hill, University of York, and Dr. Chey Vun Khen, Forest Research Centre, Borneo).

The long-term legacy of any training (both formal and informal) in increasing the taxonomic capacity of a country depends very much on the continued employment of the trainees in taxonomy where they can maintain, add to and curate reference collections. In Bolivia, workers have been encouraged to stay in taxonomy by a combination of fostering their individual interests (such as collecting, community education), flexible approaches to employment, and recognition of their qualifications by the employer.

Encouraging trainees to remain in taxonomy: Maggy Makado

Curator of the herbarium at Cochabamba University, Bolivia, Maggy is a dedicated researcher with a good knowledge of the characteristics of flowering plant families and is highly competent at her job. Without her the herbarium would rapidly start to fall into disrepair and become useless.

Before the DI project Maggy was employed on a one-year, renewable contract which gave no long-term guarantee of employment and often only paid her for eight months each year. Since the project began her contract has been made permanent, giving her job security and encouraging her to stay in this role, making the best use of the training she has received. This is at least partly due to the presence of the DI project and its' raising of taxonomy's profile among senior university staff.

(Project 11-010: *Plant Endemism of the Central Andean Valleys, Bolivia*. Based on discussion with J.R.I. Wood, University of Oxford).

Maggy pressing plants with her UK tutor (picture courtesy J.R.I. Wood, University of Oxford).

Another key factor in the legacy, and sustainability of that legacy, is the motivation of those trained. The most noticeable success has been found with trainees that had a proven interest in pursuing taxonomy as a career, particularly if they were already working in a related field. The project *Insect Biodiversity: Taxonomic Capacity Building in Guyana* (7-091), experienced a high level of motivation among its project partners and trainees (despite a lack of resources) and this, to a large extent, led to the establishment of a Network of Entomologists to maintain a post project momentum. This has led to subsequent additional training workshops entirely at the instigation of the trainees themselves.

A legacy of training: Ecuador

In Ecuador, a DI marine invertebrate study delivered a strong legacy of taxonomists working in their home country. They are now transferring their expertise to a second generation while maintaining useful contact with their UK partner.

Five host-country personnel received training during this project:

- Elba Mora, a university teacher has remained in her post, making increased use of the collections and publications generated by the project;
- Manuel Cruz, a professor and navy marine biologist, has continued in these roles, registered for a part-time PhD through Heriot-Watt University in the UK and is heavily involved in Ecuador's marine biodiversity working group;
- Daisi Merino, a Darwin scholar, is now also a teacher in marine biodiversity;
- Maria Fernanda Arroyo, Darwin scholar, is employed as a researcher at the university with responsibility for maintaining the collection set up by the project; and
- Alba Calle, the third scholar, is working in polychaete taxonomy at another university in Guayaquil and also working on a PhD.

The successful legacy of this project was due to a number of key factors including:

- The incredibly dedicated trainees themselves;
- A good balance between training, research and capacity-building; and
- Strong regional links with other DI projects in Panama and Colombia through regional conferences.

(Project 6-029: *Marine Benthic Invertebrate Study in Coastal Waters of Ecuador*. Based on discussions with Dr. James Mair, Heriot-Watt University, and Professor Manuel Cruz, Oceanographic Institute, Guayaquil, Ecuador).

Ecuadorian Darwin project team members plus Guayaquil University students on a shore sampling survey (image courtesy Elba Mora, University of Guayaquil, Ecuador).

Sustainability requires the expertise gained by local researchers to be transferred to subsequent generations of taxonomists. A good example was provided by a series of Earthwatch projects in West Africa. Here, a legacy of training facilitated local transfers of expertise, which in time became as valuable as transfers of British expertise to the host country (6-100: *Plant Biodiversity Conservation and Sustainable Utilisation Training in West Africa*). The provision of permanent resources such as training manuals has also proved invaluable in achieving this. In Ecuador (6-029: *Marine Benthic Invertebrate Study in Coastal Waters of Ecuador*) multiple copies of two local language manuals (authored jointly by UK and Ecuadorian workers, and covering techniques for the collection, preservation and identification of marine invertebrates) encouraged continued work and teaching long after the end of the DI project.

With respect to both collections and training, the crucial aim of DI projects must be to initiate a sustainable program for the future. This relies upon a gradual exit strategy so that the research does not become dependent on funding and initiatives from any one project and is instead adopted and supported by relevant in-country authorities.

Exit strategies: Chameleon conservation in Madagascar

Exit strategies are crucial to the ongoing legacy of DI projects. In Madagascar an ongoing commitment from NGOs such as the World Conservation Society (WCS) and the Peregrine Fund allowed for a gradual takeover from the University of Kent researchers on the DI project until Malagasy students, such as Jeanneney Rabearivony, were entirely running the subsequent work. Jeanneney's work now includes:

- Training other university students;
- Training visiting students from the UK;
- Working to change the attitude of indigenous people, some of them even becoming herpetologist guides in protected areas of the island;
- Continuing scientific research such as clarifying the distribution of the rare *Calumma parsonii parsonii* in North-eastern Madagascar;
- Continuing to visit each study site twice a year to follow seasonal fluctuations in chameleon populations;
- Maintaining contact with UK researchers including literature and information exchange;
- Setting up new links with additional institutions;
- Submitting proposals to international funding agencies to help continue the work; and herself
- Undergoing further training for an MSc and PhD.

(Project 5-174: *Chameleons, Conservation and Local Communities in Madagascar.* Information provided by Jeanneney Rabearivony, Peregrine Fund, Madagascar).

Operational Objective 3 – Facilitating access to taxonomic information

The link between taxonomy, conservation and sustainable development depends upon accessing the taxonomic data held in collections. The accessibility of this information requires suitable facilities, good curation and cataloguing, and today often relies on computer databases and the world-wide-web. For historical reasons, European institutes hold a massive proportion of the reference collections made in developing countries. If developing countries are to increase their taxonomic capacity, access to this information needs to be made possible in its country of origin.

Effectiveness

Many DI projects have been involved with improving access to information about biodiversity in developing countries. Often this has involved cataloguing specimens on a computerised database. Several projects have been involved in establishing databases using UK-developed software such as BG-Base (Royal Botanic Garden Edinburgh: http://rbg-web2.rbge.org.uk/BG-BASE/) or BRAHMS (University of Oxford: http://www.brahms.co.uk/).

In some cases (such as the case study below, in Brazil) improving access has taken the form of repatriating actual specimens from institutions in the developed world, or providing digital images of the most important "type" specimens.

Impact of repatriating taxonomic data: Brazil

Prior to 1998, the extent of botanical collections in Brazil was constraining in-country taxonomic progress. Few type collections were represented in-country and the state of naming specimens was very basic and out-of-date. Based at the Herbário da Universidade Estadual de Feira de Santana (HUEFS) in Brazil, one project, in a single year, repatriated data on 7,504 specimens of more than 1,200 plant taxa, along with images of a further 556 type specimens. This led to a continued improvement in collections, with a database of specimens being continually maintained and the project's methods evolving to suit advances in technology – from cibachromes to digital images. The repatriated data and images of collections have been used to produce a Flora of Bahia region, a checklist of plants from North-eastern Brazil, and contributed to a list of endangered species for the whole of Brazil. The project has also targeted areas for future research and identified areas of endemism needing protection. The methodology used has been developed for similar projects elsewhere, extending the vital transfer of taxonomic capability from the developed to the developing world.

(Project 7-108: *Repatriation of Herbarium Data for the Flora of Bahia, Brazil*. Information provided by Dr. Daniela Zappi, Royal Botanic Gardens, Kew).

In other projects images of collections, related literature and distribution data have been made available on the internet – for instance through Missouri Botanical Gardens' *Tropicos* database, the world's largest database of plant information. This contains searchable records for around two million specimens, linked to images and bibliographic information (http://www.mobot.org/plantscience/default.asp). The online nature of many collections databases (e.g. the Darwin Nematode Virtual Collection at http://www.pml.ac.uk/nematode/nem_vc/) facilitates their management from both the host country and the UK, improving enormously the host country's access to, and knowledge of, the collections their institutes hold. Overall, DI projects have contributed significantly to providing access to information via the world-wide-web (see Annex 5).

Access to web-based information requires reliable internet connections, which may not be consistently available in many countries or at least to all individual taxonomists. To circumvent such problems, DI projects continue to make available a wide range of publications in printed form such as field guides and manuals. Sixty percent of projects published such literature, often in a local language, such as the two manuals published in Ecuador by 6-029: *Marine Benthic Invertebrate Study in Coastal Waters of Ecuador* (see Annex 6).

Impact and legacy

The repatriation of identified specimens has provided a lasting source of taxonomic reference material to host countries for further taxonomic research, as have digital images of material. The continued sustainability of the collections and access to them is very much dependent on the capacity and funding of the institutes which receive this material and information. The contribution of data to other global taxonomic databases also facilitates continued access to this information, and global databases such as the Global Biodiversity Information Facility (GBIF) may be more likely to be maintained long-term than local, project-based ones, some of which have already closed down. A number of older DI projects made information available as CD-ROMs, which are perhaps more likely to be lost to the taxonomic community over the years.

The more traditional publication of field guides, check-lists, and manuals by DI projects has proved very effective in providing long-term access to taxonomic information. Many of these were produced as a response to user demand and as such are most likely to have a continued uptake and lasting impact.

> *The most important, unexpected outcome was the production of a field guide ... done at their [the local community's] request... If a project is not meeting on-the-ground needs it is not worth doing! (Dr. Sandy Knapp, 4-057: Biodiversity Inventory of the Mbaracayú Forest Nature Reserve, Paraguay).*

The continued use of such resources depends on their ongoing distribution to appropriate user-communities – for example the two manuals produced by *Marine Benthic Invertebrate Study in Coastal Waters of Ecuador* (6-029) are now distributed to students as part of a marine biology MSc course. Similarly, the continued use of taxonomic outputs relies upon user-communities being aware of their presence. The Biodiversity Interpretation Centre set up by the *Bai Tu Long Bay Awareness Project, Vietnam* (10-022) was instrumental in encouraging both local people and national park rangers to make use of the four field guides generated by this project.

Operational Objective 4 – Within the work of the major thematic 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

Through the COP, the CBD initiated work on seven major thematic programmes designed to establish a vision and basic principles for future work in key ecosystems. These are:

- Agricultural Biodiversity,
- Dry and Sub-humid Lands Biodiversity,
- Forest Biodiversity,
- Inland Waters Biodiversity,
- Island Biodiversity,
- Marine and Coastal Biodiversity, and
- Mountain Biodiversity.

Effectiveness

The objectives of the DI are much broader than the thematic work programmes highlighted above. Nonetheless, DI-funded projects have generated the taxonomic information needed for decision-making in conservation and sustainable use of biological diversity across these thematic areas (figure 6).

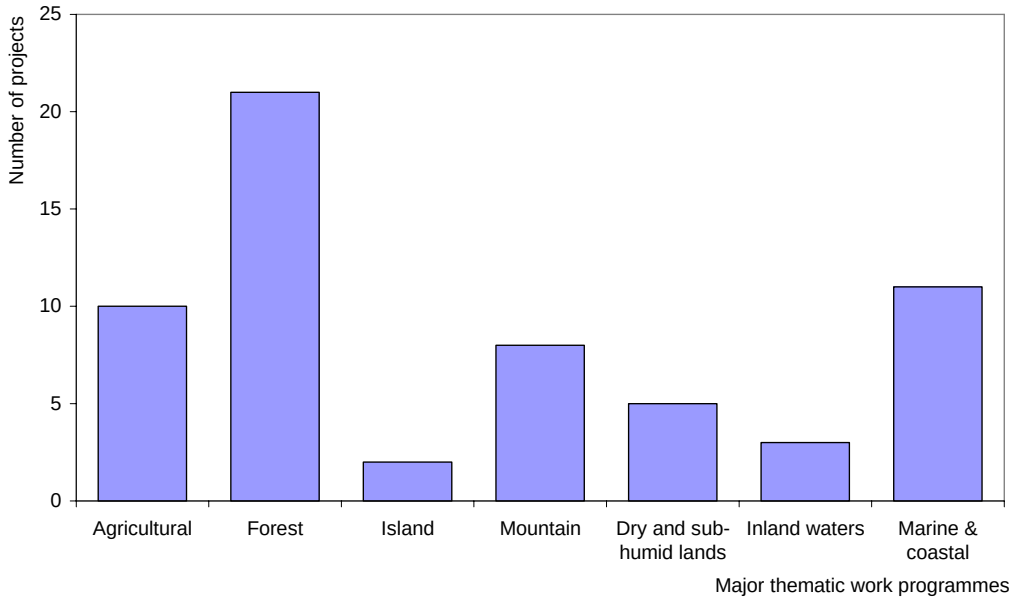


Figure 6. Number of clustered projects relevant to each of the CBD major thematic work programmes.

All thematic programmes were covered by at least one DI project. Fifty-seven percent of projects covered forests, 6% islands, 26% mountains, 14% dry and sub-humid lands, 11% inland waters, 31% marine and coastal habitats and 26% agricultural lands. Within each of the major thematic work programmes (excluding agricultural lands), work towards aiding decision-making is broken down by the GTI into "conservation activities". The contribution of DI projects to these activities was assessed across the major thematic programmes (Table 1).

		GTI conservation activity				
		Increasing knowledge of species composition	Selecting sites for protection	Indicating areas for future taxonomic research	Indicating taxa for future taxonomic research	Developing criteria or indicators for biodiversity
CBD major thematic work programme	Forests	17	8	12	9	11
	Islands	1	1	0	1	2
	Mountains	7	3	6	5	2
	Dry and sub-humid lands	4	1	3	2	0
	Inland waters	3	0	1	2	1
	Marine and coastal habitats	10	4	7	5	6

Table 1. Number of clustered projects conducting specified GTI activities related to conservation in each of the CBD major thematic work programmes.

DI projects have **increased our knowledge of species composition** in all ecosystems, but particularly those of forest and marine and costal environments. Thirty percent of projects in the cluster claimed to have so far discovered new species. The ongoing *Guide to the Forest Trees of Southern Thailand* (13-026) has estimated to have collected at least 10 species not previously recorded for Thailand, many from sites which are very poorly known botanically. *Conservation of Plant Diversity in Western Cameroon* (8-038) discovered approximately 30 new species, one new genus and one new tribe of flowering plants.

Just as important as describing new species, is collecting new information about existing species, such as new populations and distribution data or new records for a country. *Biodiversity Inventory of the Mbaracayú Forest Nature Reserve, Paraguay* (4-057) rediscovered a palm that was previously thought to have been extinct. *Tree Diversity, Agroforestry Development and Reafforestation in the Peruvian Andes* (9-017) made several new plant records for Peru (including genera as well as species). *Terrestrial Invertebrate Biodiversity in Galapagos: Training and Collection Rehabilitation* (9-010) made many new insect records for the Galapagos. One of the most exciting projects (10-011: *Community-Based Conservation of Hoang Lien Mountain Ecosystem, Vietnam*) made a combination of important taxonomic discoveries including a new deer species (new large mammal species are very rarely discovered), a new record for Vietnam of a coniferous tree, and a new population of salamanders.

Discovering new species: Mimosa *in Bolivia*

One DI project worker, Margoth Atahuachi, had long had an interest in the flowering plant sub-family Mimosoideae (Fabaceae). As part of the project, she studied collections at many institutions including Oxford, New York and Missouri. Whilst in Bolivia, she familiarised herself with the genus by arranging field trips to *Mimosa*-rich areas both inside and outside the project area and visits to Bolivian herbaria to select specimens. She subsequently described two new species of *Mimosa* and devised a key to Bolivian *Mimosa*. During field testing of this manual a third new species was discovered. Thus, intensive study of this one particular genus, facilitated by a DI project, has revealed at least three species new to science.

(Project 11-010: *Plant Endemism of the Central Andean Valleys, Bolivia*. Based on discussion with J.R.I. Wood, University of Oxford).

Sixty-eight percent of clustered projects have been actively involved in undertaking inventory work. In at least ten projects (27% of the cluster) this resulted, or will result in (for current projects) the **selection of sites for protection.** This may be through contribution to BAPs, identification of areas with high levels of endemism or endangered species, or designation of internationally-recognised reserves.

Taxonomy contributing to site protection: Paraguay

The current economic situation in Paraguay makes it impossible for the Government to prioritise funding for scientific research. At present there is little public interest in conservation; less still in scientific and taxonomic research. This is all the more worrying considering there is a great deal of threatened biological diversity yet to be investigated, with huge areas remaining unexplored due to difficulty of access.

One DI project in Paraguay demonstrates how taxonomy can be used to support conservation under such circumstances:

- Taxonomy workshops attended by forest rangers, national park managers and students raised awareness and stimulated collecting;
- Botanists such as Juna de Gea were inspired to continue studying, training and teaching others in taxonomy despite the lack of opportunities and funding;
- The provision of better reference collections helped further identification of species in the precious Chaco humedo ecosystem and resulted in reliable species checklists for the reserve;
- Partly as a result of this DI project, Mbaracayú was designated as the nucleus of a UNESCO MAB Biosphere Reserve (http://www.unesco.org/mab/about.htm) in recognition of its importance on a global scale; and
- The entire area has now been proposed as a UNESCO World Heritage site (http://whc.unesco.org) – and the work of the project was cited as important, if not critical, to the case for designation. The awareness raised will help open new possibilities for funding and further conservation projects in the area.

(Project 4-057: Biodiversity *Inventory of the Mbaracayú Forest Nature Reserve, Paraguay*. Based on discussion with Juna de Gea, Project Coordinator, Panama and Sandy Knapp, Natural History Museum, London).

Rather than highlighting **areas for future taxonomic research,** many of the DI projects are already working in areas previously identified as requiring taxonomic research, such as recognised "hotspots" (Myers et al., 2000), WWF ecoregions (http://www.worldwildlife.org/wildplaces/) or known from their own, and their host country counterparts', knowledge and experience. Through their work, many projects were then able to confirm or reinforce these priorities, and narrow them down to particular areas within the scope of the study, such as a particular forest fragment containing important chameleon populations in Andranomay area Madagascar (5-174: *Chameleons, Conservation and Local Communities in Madagascar*).

Likewise, projects have tended to focus on particular taxonomic groups already known to be in need of work, rather than on surveys of a range of groups in order to **highlight taxa for future taxonomic research**. This is because many groups in need of taxonomic study have already been identified in the priorities set by UK and host institutions, so DI project applications will reflect these priorities. Within taxonomic groups, examples of specific priority groups for further research have been identified through DI projects, e.g. species of *Calamus* and *Plectocomia* during 6-046 (*Rattan Diversity and Sustainable Management in Lao PDR*).

From the cluster, only a few projects identified potential **indicator species**. 13-003 (*Taxonomic Capacity Building in Support of Biodiversity Conservation in Thailand*) recognised fireflies as a potentially important indicator group. In *Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo* (7-040), butterflies proved to be ideal for assessing the impacts of disturbance (especially selective logging) upon biodiversity in fragmented tropical forests. The relatively small number of projects making use of indicator taxa may reflect the opinion of some taxonomists we spoke to, that this is a problematic and unhelpful concept for biodiversity conservation.

Impact and legacy

The DI is clearly addressing the major thematic programmes and conservation activities highlighted in the GTI and CBD. There is no doubt that the DI has contributed significantly to our understanding of species composition on earth. Once this information is in the public domain (usually through publications and on the world-wide-web) it will be of lasting value. The immediate impact of taxonomic work on conservation is often diffuse and there is a long lag-time between research and impact. However, the incorporation of taxonomic information into field guides and checklists, and in supporting the development of national BAPs is essential and often very significant.

Taxonomy contributing to ecosystem conservation: Borneo

A primarily forest management project, aimed at assessing the impact of logging upon diversity, found capacity-building for taxonomy to be vital to success.

- A large Lepidoptera collection was established in the University of Borneo, where it became seen as a key indicator of research success;
- A succession of projects supporting both collecting and storage facilities developed in tandem, with each providing leverage and support to the others;
- Local techniques for appropriate specimen preparation were combined with UK protocols;
- Students were trained to competence in identifying, preparing specimens and databasing;
- They were inspired to go out and collect further; and
- By seeing the links between conservation application and taxonomy, were inspired to ask new questions and seek out new avenues of research.

Malaysia is perhaps special, in that its scientists already understood the importance of describing diversity in order that it can be conserved. This project was able to generate a large, complex dataset to support conservation action. Taxonomy played a crucial role in developing this dataset and the capacity underlying it.

(Project 7-040: *Biodiversity of butterflies in tropical rainforests of Sabah, Borneo.* Based on discussions with Dr. Keith Hamer, University of Leeds, Dr. Jane Hill, University of York, and Dr. Chey Vun Khen, Forest Research Centre, Borneo).

Darwin trainees Susan and Nazirah working with butterfly specimens in the field; *Junonia orythia*, a species that prefers disturbed habitats (pictures courtesy Dr. Jane Hill, University of York).

Unlike taxonomic collections, which require ongoing resources to maintain, placing taxonomic information in the public domain is relatively inexpensive and sustainable. The close working relationships that most DI projects continue to have with host institutes aids the long-term awareness of a wide group of potential user-communities to the taxonomic information and facilities that are available for CBD implementation across the major thematic work programmes. Long-term reduction of the taxonomic impediment depends upon a relationship of equal partnership between the UK and host country institutions. DI projects have been very effective in developing such relationships.

Achieving a legacy through equal partnership: Lao PDR

The need for a project studying rattans in Lao PDR was identified during discussions between a number of UK and Lao partners, including Oxford University, the Lao Forest Research Council (FRC), and UK researchers based long-term in Lao. Lao partners provided suggestions for project design and content and had already made efforts towards achieving some of its goals before the start of the DI project. This equal partnership led to a long-term commitment by the FRC, over and above that required by the proposal, in terms of staff, offices, and vehicles, which has facilitated further work in the area including a subsequent DI project: *Taxonomic Training for a Neglected Biodiversity Hotspot within Lao PDR* (13-007).

(Project 6-046: *Rattan Diversity and Sustainable Management in Lao PDR*. Information provided by Dr. Nick Brown, University of Oxford).

Operational Objective 5 – Within the work of the 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

The CBD contains a set of cross-cutting issues, of relevance to all thematic areas, and essentially corresponding to CBD Articles 6-20. These help bring cohesion to the work of the CBD by providing links between the thematic programmes. The cross-cutting issues are:

1. Access to Genetic Resources and Benefit-sharing,
2. Alien Species,
3. Biological Diversity and Tourism,
4. Climate Change and Biological Diversity,
5. Economics, Trade and Incentive Measures,
6. Ecosystem Approach,
7. Global Strategy for Plant Conservation,
8. Global Taxonomy Initiative,
9. Impact Assessment,
10. Indicators,
11. Liability and Redress,
12. Protected Areas,
13. Public Education and Awareness,
14. Sustainable Use of Biodiversity,
15. Technology Transfer and Cooperation,
16. Traditional Knowledge, Innovations and Practices,
17. 2010 Biodiversity Target.

Effectiveness

Project leader assessments suggest that DI projects have been effective in addressing almost all the cross-cutting issues highlighted in the CBD (figure 7).

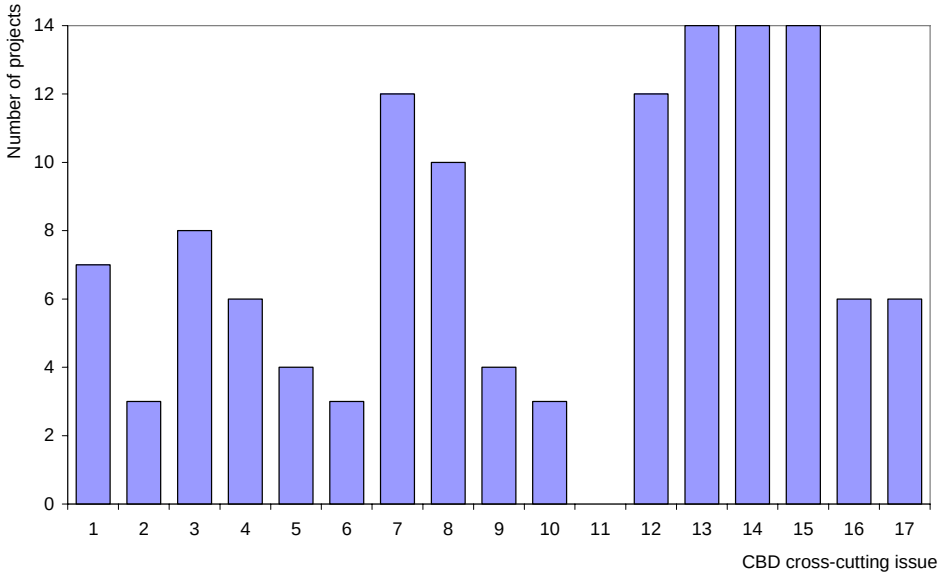


Figure 7. Number of clustered projects relevant to each of the CBD cross-cutting issues.

A large number of projects have delivered, in particular, on the issues of public education and awareness (13), sustainable use of biodiversity (14) and technology transfer and cooperation (15). To a certain extent this reflects the priorities set out by the DI itself in education and technology transfer, and the inherently collaborative nature of taxonomic research. Although all projects were involved, to some extent, in technology transfer, *Automating Insect Identification for Inventorying Costa Rican Biodiversity* (6-050) worked especially well to develop UK-based ideas for automated identification into a workable program in Costa Rica (known as DAISY - Digital Automated Identification of Insects). This software may now even be marketed as a profit-making enterprise.

Many projects have also been involved with setting-up protected areas (12), which often require some influence on government or international policy, frequently through BAPs. Such positive impacts have been observed around the world (figure 8).

Taxonomy influencing conservation policy: Malaysia

This project demonstrates how best practice can maximise impacts on biodiversity policy:

- Focusing on a country with a strong, stable political system and long-term provision for education, research and conservation;
- Training people to gain positions of responsibility (such as Joseph, now a conservation officer who is involved in selecting protected areas);
- Supporting local intellectual property rights, for instance through agreements to leave all collections in-country;
- Understanding local politics. In this case, logging concessions are allocated through a government organisation, the Sabah Foundation. By running a field station through the Foundation, information exchange is relatively easy;
- Ensuring information is made available through talks to local NGOs, articles in local press, and reports sent to influential government policy-makers;
- Feeding and disseminating to local education programmes;
- Working with other NGOs to send complementary messages to policy-makers; and
- Simply being there: in Malaysia, some importance is placed by local communities on the presence of scientists, which are believed to indicate that the forests are worth protecting. Expeditions to remote areas can be especially successful at generating public support for conservation.

(Project 7-040: *Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo.* Based on discussions with Dr. Keith Hamer, University of Leeds, Dr. Jane Hill, University of York, and Dr. Chey Vun Khen, Forest Research Centre, Borneo).

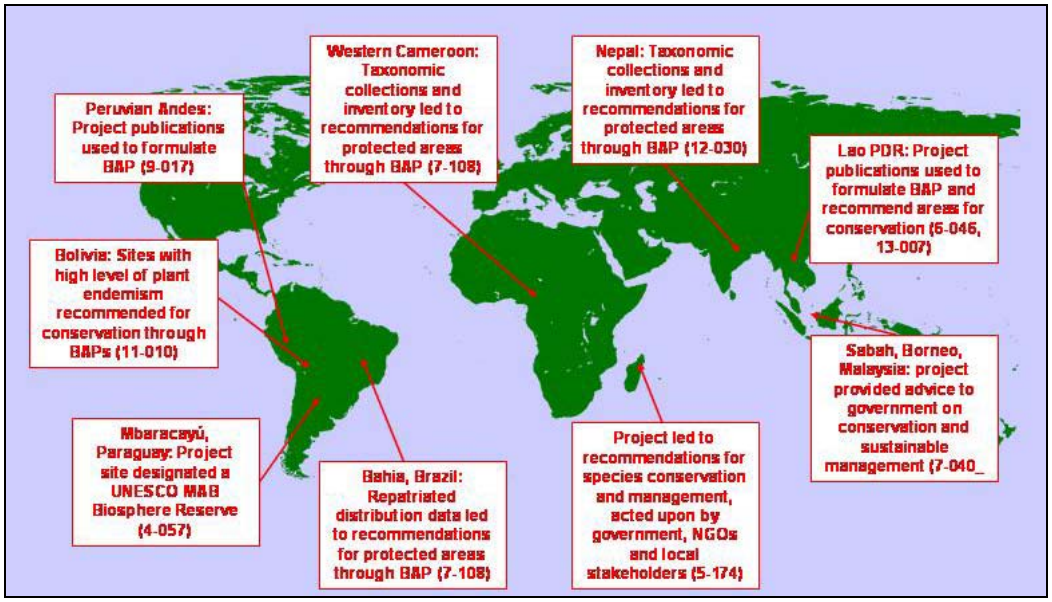


Figure 8. World-wide impact taxonomic projects on conservation.

Project leaders also considered their projects to have contributed to global strategies such as the global strategy for plant conservation (GSPC; cross-cutting issue 7). Strategies such as the GSPC and the GTI itself (cross-cutting issue 8) highlight the need to conserve diversity at all levels – from ecosystem down to species and genetic population. However, few projects were found to be considering conservation at the genetic level. One successful example is outlined in the case study below.

Taxonomy contributing to genetic conservation: West Africa

Despite the strong focus of most DI projects at the organismal and ecosystem level, genetic diversity below the species level – ie the gene pool – is also a crucial component of the GTI, especially for socio-economically valuable species. One DI project trained taxonomists to engage in genetic-level conservation, in partnership with the primary international body engaged in this, the International Plant Genetic Resources Institute (IPGRI).

Molecular taxonomic techniques and assumed correlations with habitat or ecogeographic features were used to sample populations of endangered wild relatives of cultivated crops, generating a geographic profile to preserve genetic diversity. Taxonomic data then facilitated conservation through monitoring, preventing genetic pollution by introgression from cultivated species, and maintaining a gene pool for the future. Through their training, project participants were better able to organize conservation of their mandate crop species.

(Project 6-100: *Plant Biodiversity Conservation and Sustainable Utilisation Training in West Africa*. Based on discussions with Dr. Nigel Maxted, University of Birmingham and Raymond Vodouhe, INRAB, Benin).

Members of the training course at work (pictures courtesy Dr. Nigel Maxted, University of Birmingham).

The comparison of indigenous and scientific systems of classification is a key objective of the GTI relating to CBD cross-cutting objective 16. This type of work can facilitate the transfer of useful knowledge about biodiversity that is otherwise locked inside traditional taxonomic systems. However, this process is not without problems, as a single vernacular (local) name can apply to many scientific species, and *vice versa.* Few DI projects attempted a comparison of indigenous and scientific taxonomic systems. The project, *Towards Sustainable Development of Southeastern Madagascar's Biologically Unique Littoral Forests* (9-006) was, however, able to report a direct correlation of over 90% between the two taxonomic systems in this instance, suggesting potential for future successful work in this area.

The protection of intellectual property rights, also a key part of cross-cutting issue 16, is inherent to both the CBD and DI. Thirty percent of projects actively took steps to protect the intellectual property of indigenous communities.

Means of protecting indigenous people's intellectual property employed by DI projects

- Collecting only in host institute-approved areas, under permit regulations (13-026: *Guide to the Forest Trees of Southern Thailand*);
- Leaving a complete set of specimens in the national taxonomic reference centre, to be available for local intellectual activity (11-010: *Plant Endemism of the Central Andean Valleys, Bolivia*);
- Storing all collections in country, none taken out of host country (3-207: *Microbial Genetic Resource Programme*);
- Working with a non-profit-making institution and publishing all results in the public domain (3-040: *Phytochemical Variation and Resistance to* Fusarium oxysporum *in Wild Species of Chickpea*);
- Working in collaboration with local community representative groups (7-040: *Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo;* 13-015: *Participatory Forest Management for Medicinal Plant Production in Peru*);
- Ensuring that information was tagged with the generator's name, and use of the information was only possible with the consent of the generator (5-108: *Taxonomic Information Across the Internet*);
- Full participation and involvement in all stages of project, including authorship on final publications (4-057: *Biodiversity Inventory of the Mbaracayú Forest Nature Reserve, Paraguay*).

One project (13-026: *Guide to the Forest Trees of Southern Thailand*) noted that the only aspect of taxonomic knowledge valued highly among local people is medicinal uses. Other types of knowledge such as edibility, social/ritual significance, vernacular names, diagnostic descriptive characters or ecology were not considered to have economic potential and were freely given to DI researchers.

Working with local people can also have a positive effect on the conservation impacts of the project:

> *[If] we pronounce a tree species to be important for conservation … the management council of that forest, will then ensure that these species are identified and protected even if there is no known use for such species. Further still, the fact that we produce a report on a forest in itself helps convince local communities of the importance of their forest… By increasing local pride in their forest they achieve a conservation-positive social impact. (Dr Martin Cheek, UK project leader, 8-038: Conservation of Plant Diversity in Western Cameroon).*

Impact and legacy

DI projects are clearly having an impact in delivering the cross-cutting issues identified by the CBD, one of which is itself the GTI. Although only half of projects clustered considered themselves to contribute to the GTI, this is encouraging given that the GTI is relatively new (only being endorsed by the COP in 2002) and as such several projects were initiated (and often completed) before this date. The DI objectives (on which projects are based) are also more wide-ranging than those of the GTI, and several projects in the cluster only allocated a portion of their time to taxonomic activities.

One of the great strengths of the DI programme, in terms of achieving a lasting legacy, is in its ability to act as a catalyst in securing additional funds, and new projects. Seventy-three percent of projects had led, or were confident that they would lead, to related projects receiving funding from other organisations. Regardless of additional funding, the vast majority of projects indicated that both UK and host country partners were eager to maintain contact following the end of the project. Reasons for this ranged from having common goals and hoping to collaborate on future projects, to friendships with individual colleagues, ongoing supervision of shared students, or a continuing link through additional collaborations.

LESSONS LEARNED AND BEST PRACTICE

Training

Training is a vital component of both the DI and its ability to deliver against GTI objectives for removing the taxonomic impediment. Many examples of best practice are detailed in this report, with common features being displayed across a number of projects. Projects that were most successful were those that attracted highly-motivated trainees. Projects that used in-country publicity (such as press releases) to highlight their taxonomic work often acted as a catalyst to generate interest among potential taxonomic trainees. The most successful projects provided a combination of training in their own country and overseas.

Of equal importance were the establishment, from the outset, of good institutional links and host country institutional support for the project and its legacy. Projects that, from the start, attracted outside funding or a commitment to post-project funding from the host institute, were also most likely to have a sustained legacy of training. In these cases, trained taxonomists were most likely to continue building capacity in the host country, through continued relevant employment.

Collections

Many projects increased substantially the number of collections available for future research in host countries. In tandem with training staff, and through good links with international experts, these were also correctly named, well-curated and maintained. Projects that worked in collaboration with other funding initiatives to provide both collections, and purpose-built facilities in which they could be housed, had the greatest impact in countries without an existing collections infrastructure. In many cases, a combination of both national and local collections provided the best overall resource for in-country taxonomists. Best practice for a long-term legacy of collections involved commitments by host-country institutes or governments to the employment of curators, and funding for maintenance of collections infrastructure.

Accessibility to taxonomic resources

Best practice also ensured that collections were made available and accessible to a range of user-communities, both locally and world-wide.
Locally, accessibility was best achieved through computer databases in tandem with manuals, especially in local languages, and training in their use. Globally, the most successful projects fed into world-wide networks or centrally-funded institutional databases or web-sites.

Linkages to CBD programmes

Good DI projects were able to identify under-collected areas of the globe, corresponding to all of the major thematic work programmes of the CBD. Taxonomic projects are best-placed to increase our knowledge of species composition in these key habitats, by documenting new species, records or populations.

DI projects were also able to contribute to the cross-cutting objectives of the CBD. The best projects not only generated taxonomic information feeding into the scientific community (for instance contributing to the GSPC or GTI), but also involved disseminating the results of their research to the wider public. In addition they contributed to the development of regionally- and globally-recognised protected areas. Protecting indigenous intellectual property rights, although not relevant to all projects, was in some cases very important. Examples of best practice include working closely in collaboration with local community representative groups at all stages of the project, including authorship on final publications.

Conservation action

Projects that were most effective in delivering on GTI conservation activities had established good links with local government and dynamic collaborations with host institutes and other organisations working on related projects. These enabled their taxonomic information to be incorporated into national BAPs and conservation management plans. Such impacts were maximised by developing an understanding of local politics, training people to gain positions of responsibility and ensuring information was disseminated to both influential organisations and local education programmes.

By demonstrating the links between conservation and taxonomy, stimulating high-quality taxonomic research and outputs, projects have been able to provide the evidence necessary for protected areas to be designated. In addition, simply by being present in a country a project can impact on local opinion for the benefit of conservation.

Constraints

The terms of reference for this review were limited to the implementation of the GTI. As such, DI projects were not assessed for their (sometimes very great) impact upon other aspects of the CBD. Earlier (pre-2002) projects were initiated prior to the GTI itself so could not be expected to explicitly implement it. In addition, the remit of the GTI is in some aspects wider than the generally-accepted scope of DI projects.

The decline in the number of taxonomic projects documented here (figure 1) indicates constraints on both project applications and selection. These are perhaps due to a perception that DI funding is focused on disciplines other than taxonomy and that the nature of taxonomic projects makes it hard for them to fulfil DI criteria despite being valuable proposals very much within the spirit of the initiative.

By their nature, DI projects implicitly assess taxonomic needs but have not tended explicitly to address the issue of measuring taxonomic capacity in host countries. The key focus of the DI is in supporting biodiversity research rather than influencing higher level policy. The latter is a wider task, more realistically achieved by the host country via international mechanisms and regional collaboration. If DI projects are to address this, the remit of the DI needs to be expanded and funding increased so that there is no detriment to delivering on other GTI objectives.

The major impact of DI projects on the GTI is in providing collections, and the infrastructure and trained staff to support them. Constraints to achieving these tasks are often outside the control of those involved in the projects. The infrastructure of the host country influences what projects can achieve. Projects are often limited by a lack of investment in buildings and equipment, as well as in reliable transport and communication networks. One major constraint of training projects has been the availability of suitable trainees (i.e. in terms of existing education, motivation and skills). This is sometimes compounded by a lack of understanding and associated poor public perception of taxonomic work. The lasting impact of DI projects is constrained by the availability of long-term employment and the retention of staff who have obtained formal qualifications which make them suitable for other types of employment. Another key constraint has been instability of national governments and ministries, associated fluxes of policy, and problems of bureaucracy at a local level, including identifying appropriate and effective contacts.

In terms of accessing the taxonomic information produced by the projects, a major limiting factor is the presence of a suitable infrastructure to support computer databases, and access to the internet. If databases and publications are not provided in a local language, this can hinder their usability for accessing collections and associated information.

The time-lag between taxonomic work and its (often substantial) conservation impact is a potential constraint for attracting further funding from organisations that require tangible evidence of immediate conservation outcomes from existing work.

Finally, DI projects may be constrained in addressing the major thematic work programmes of the CBD by the collaborating institutes' priorities for research in specific ecosystems. DI projects addressing the CBD's cross-cutting issues may also be constrained by the expertise available to projects, both in UK and host country institutions. As stated by COP 6, a further constraint on DI fulfilment of GTI Operational Objectives 4 and 5 is the need for "further setting of priorities ... for integration within the work plans of the Convention".

CONCLUSIONS AND RECOMMENDATIONS

This review has shown that the DI gives good value for money in implementing the GTI by delivering significant impact for a modest amount of funding. DI projects have contributed to all the major Operational Objectives of the GTI. In particular, DI projects have made a major contribution to Operational Objective 2, largely reflecting the priorities set by the objectives of the DI itself and the type of taxonomic projects approved.

From this review it is clear that:

- The importance of taxonomy to achieving the goals of the DI cannot be underestimated, and taxonomic work must continue to be supported; and
- The declining number of projects with a taxonomic focus needs to be addressed, perhaps by re-wording the project application guidelines to emphasise that taxonomic projects fall within the scope of the DI.

If the DI is to increase its contribution to GTI Operational Objective 1 (assessing taxonomic needs and capacities at national, regional and global levels for the implementation of the Convention):

- Projects which directly assess taxonomic capacity should be encouraged, **but not at the expense of delivering taxonomy itself**:
    - Regional projects in particular should be considered;
    - Applications for projects in new areas should be welcomed;
- The DI pre-project proposal scheme should be further publicised to enable assessment of taxonomic needs and capacities;
- DI projects should be encouraged to inform databases, such the EU's BioCASE, about taxonomic capacity in-country;
- Closer links between CBD, DI and GTI reporting should be considered to enable greater synthesis in terms of assessing taxonomic needs and capacities; and
- Closer links between DI projects in the same region should also be encouraged, to facilitate greater dialogue and coordination for assessing taxonomic needs and capacities.

If the DI is to increase its contribution to GTI Operational Objective 2 (providing 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):

- Projects should be encouraged to undertake an initial training needs assessment to match the training provided with the host country skills base and project purpose;
- The accessibility of training across gender, age and social status should be monitored and reported by DI projects;
- Projects should be encouraged to include a budget for English language lessons alongside taxonomic training;
- Greater emphasis should be placed on producing taxonomic and training outputs, such as manuals, in local languages;
- Projects should be encouraged to develop strong regional links with other DI projects to strengthen the impact of training programmes;
- The DI Scholarship Scheme is an important mechanism for improving the legacy of training and should be better publicised;
- The DI should ensure that projects contributing to both local and national taxonomic collections are supported, as these address different host country needs;
- The DI should continue to support repatriation of taxonomic data such as collections, digital images of specimens, and associated literature;

- The DI Advisory Committee should be encouraged to support taxonomic collections-based projects that will greatly increase taxonomic capacity, even where these do not involve novel methodologies.

If the DI is to increase its contribution to GTI Operational Objective 3 (facilitating 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):

- Projects should be encouraged or required to submit their taxonomic information to international databases, to prevent the loss of information by project-based web-sites shutting down within a short time of the projects' end:
    - One possibility would be to use the existing DI website as a depository to which projects could submit information;
    - This should also be linked to global databases such as GBIF;
    - A mechanism should be investigated by which information from past DI projects held on CD-ROM can be incorporated into such a scheme;
- To ensure continued access to taxonomic information, the DI should re-emphasise the importance of a clearly-defined exit strategy, developed in close consultation with host country partners.

If the DI is to increase its contribution to GTI Operational Objective 4 (within the major thematic work programmes of the Convention, including key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components):

- The DI should ensure that projects target all the CBD major thematic programmes;
- The relatively low number of genetic-level taxonomy projects should be addressed.

If the DI is to increase its contribution to GTI Operational Objective 5 (within the work on cross-cutting issues of the Convention, including key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components):

- The impact of the DI could be enhanced further through targeted resource allocation to addressing CBD cross-cutting issues, including the GTI;
- The long-term nature of capacity-building for taxonomy in many under-developed countries suggests a need to consider a range of durations in project funding cycles, possibly up to five years;
- More emphasis should be placed on the importance of projects adopting measures to protect the intellectual property rights of indigenous peoples. This could be achieved through inclusion in the project application guidelines;
- The distinctive nature of the DI must be upheld. It is an important and unique source of funding for biodiversity research including taxonomy. The DI ensures taxonomic research gets to people and places that need it most – through technology transfer. The recommendations made in this report, if adopted, will in our opinion further maximise the impact of the DI upon CBD objectives and the GTI in particular.

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Annex 1. Clustered projects

Project	Title	DI funding	Start date	Countries	Length (years)
03-040	Phytochemical Variation and Resistance to *Fusarium oxysporum* in Wild Species of Chickpea	£75,471	1993	India, Pakistan, Syria	2
03-207	Microbial Genetic Resource Programme	£59,405	1994	Indonesia	2
04-057	Biodiversity Inventory of the Mbaracayú Forest Nature Reserve, Paraguay	£206,140	1995	Paraguay	3
04-060	Deep Demersal Fishes of the Maldives	£15,280	1995	Maldives	3
04-104	Biodiversity Management Training	£123,678	1995	Tanzania, Zaire, Madagascar	2.5
04-117	Darwin Initiative Herbarium Techniques Course - Malaysia	£14,850	1995	Malaysia	Less than 1
05-108	Taxonomic Information Across the Internet	£98,690	1996	Thailand	3
05-174	Chameleons, Conservation and Local Communities in Madagascar	£84,958	1996	Madagascar	2.5
06-023	Marine Benthic Biodiversity in China	£99,000	1997	China	3
06-029	Marine Benthic Invertebrate Study in Coastal Waters of Ecuador	£124,510	1997	Ecuador	3
06-046	Rattan Diversity and Sustainable Management in Lao PDR	£142,771	1997	Laos	3
06-050	Automating Insect Identification for Inventorying Costa Rican Biodiversity	£142,894	1997	Costa Rica	2.5
06-054	Conservation of Endangered Plants and their Associated Fungi in Kenya	£147,114	1997	Kenya	3
06-065	Four Volume Field Guide to Herpetofauna of Mainland SE Asia	£33,000	1997	Thailand	3
06-100	Plant Biodiversity Conservation and Sustainable Utilisation Training in West Africa	£148,200	1997	Benin, Cote d'Ivoire, Cameroon	3
06-101	Capacity-Building Fellowships in Southern Africa	£119,427	1997	Namibia, Malawi, Zambia	3
07-040	Biodiversity of Butterflies in Tropical Rainforests of Sabah, Borneo	£108,912	1998	Malaysia	3
07-055	Marine Environmental Training in Seychelles and Mauritius	£113,700	1998	Seychelles, Mauritius	3
07-091	Insect Biodiversity: Taxonomic Capacity-Building in Guyana	£76,384	1998	Guyana	2.5
07-108	Repatriation of Herbarium Data for the Flora of Bahia, Brazil	£38,307	1998	Brazil	1.25
07-147	Marine Habitat Mapping Development in San Andres Archipelago, Colombia	£119,935	1998	Colombia	3
08-038	Conservation of Plant Diversity in Western Cameroon	£121,947	1999	Cameroon	5
08-150	Empowering Local People to Manage the Biodiversity of El Salvador	£122,273	1999	El Salvador	3
08-249	Nematode Biodiversity and Worldwide Pollution Monitoring	£163,200	1999	Poland, Pakistan, Brazil, Chile	3.5

Project	Title	DI funding	Start date	Countries	Length (years)
09-004	Biodiversity in the Basement of the Food Web – Plankton Sampling, Processing Techniques, Taxonomy and Data-Evaluation Training in Seychelles and Mauritius and its Use in Environmental Monitoring and Management of Marine Resources and Biodiversity	£173,007	2000	Seychelles, Mauritius	3
09-006	Towards Sustainable Development of Southeastern Madagascar's Biologically Unique Littoral Forests	£79,169	2000	Madagascar	2
09-010	Terrestrial Invertebrate Biodiversity in Galapagos: Training and Collection Rehabilitation	£159,765	2000	Ecuador (Galapagos)	3
09-017	Tree Diversity, Agroforestry Development and Reafforestation in the Peruvian Andes	£166,684	2000	Peru	3
10-011	Community-Based Conservation of Hoang Lien Mountain Ecosystem, Vietnam	£89,290	2001	Vietnam	2.5
10-022	Bai Tu Long Bay Awareness Project, Vietnam	£125,888	2001	Vietnam	2
10-030	Developing Local Capacity for Biodiversity Surveys in Papua New Guinea	£162,490	2001	Papua New Guinea	3
11-010	Plant Endemism of the Central Andean Valleys, Bolivia	£187,869	2002	Bolivia	3
12-030	Building Capacity for Plant Biodiversity Inventory and Conservation in Nepal	£112,150	2003	Nepal	3
13-003	Taxonomic Capacity-Building in Support of Biodiversity Conservation in Thailand	£208,722	2004	Thailand	3
13-007	Taxonomic Training for a Neglected Biodiversity Hotspot Within Lao PDR	£156,022	2004	Lao	3
13-015	Participatory Forest Management for Medicinal Plant Production in Peru	£140,257	2004	Peru	3
13-026	Guide to the Forest Trees of Southern Thailand	£53,755	2005	Thailand	3

Annex 2. Questionnaire to UK project leader

DARWIN INITIATIVE MONITORING AND EVALUATION - THEMATIC REVIEW OF CONTRIBUTION TO GLOBAL TAXONOMY INITIATIVE

PROJECT LEADER QUESTIONNAIRE

Please note: not all questions will be applicable to all projects. Feel free to answer as many or as few questions as you are able. The questionnaire is designed to provide complementary information to that in the project reports and outputs. We realise it may take a little time to complete, but would like to assure you that all information you can give us will be very useful in determining the future of the Darwin Initiative. **All information you provide will be used only for the purposes of this report** and will not affect your Darwin project or future projects (positively or negatively). All information provided will be fully acknowledged.

1. Project details

Project leader		**UK Institution**	
Project code		**Date**	
Project title			
Project start date		**Project end date**	

Project type (please tick)

Implementing Conservation & Management Initiatives		Improving Information Base	
Institutional Capacity Building		Training	

Project outputs (please tick)

Species inventory		Other biodiversity information	
Description/discovery of new species		Biological collections	
Flora/field guide		Scientific papers (including monographs)	
Training		Training materials	
Database		Website	
Management plan/conservation strategy		Raising awareness (in host country)	
Capacity-building			

Why did you decide to take part in a Darwin-funded project?

Main partner institution

Why did you choose this partner organisation?

2. Assessing taxonomic needs and capacities

To your knowledge, has an assessment of its national taxonomic needs been conducted in the host country? Yes No

If yes, what was the contribution of this Darwin project to that assessment?

Did this Darwin project contribute to any national biodiversity strategies and action plans in the host country? Yes No

If yes, please list them and briefly describe how a contribution was made.

What do you think is the greatest impediment to biodiversity conservation in the host country?

How strong was your relationship with the host country government for assessing & removing any in-country taxonomic impediment (please tick)?

Nonexistent		Reasonable	
Minimal		Extensive	

Are you aware of any regional or sub-regional networks for assessing taxonomic needs and priorities in the host country? Yes No

If yes, please list.

Were the results of your work utilised in any regional or sub-regional level assessment of taxonomic needs and priorities? Yes No

If yes, please list.

Have you contributed to any regional workshops or action plans during the course of the project? Yes No

If yes, please list.

To your knowledge, has the work of your Darwin project been used in the compilation of any global taxonomic needs assessment? Yes No

If yes, please give details.

3. Capacity-building

Please list the public communities that were involved in this project.

How have the public contributed to the taxonomic information collated (e.g. through parataxonomic activities, specimen collection, providing indigenous names, etc?

Prior to the commencement of this Darwin project, approximately how many trained taxonomists were there in the host country?

How many new taxonomists have been trained through this project & to what level?

How many new parataxonomists have been trained through this project?

How many new employment opportunities for taxonomists or parataxonomists have been created through the project and at what level?

Did the project generate links between the UK and host country for sharing taxonomic expertise? Yes No
If so, please detail the type of exchanges that have taken place (e.g. field visits, study tours, book exchanges, workshops, etc)

What was state of systems and infrastructure for taxonomic research in the host country before the start of the project (e.g. collection management systems, computers, etc?)

How did the project improve these (e.g. equipment provided, systems set-up, funding sourced)?

To your knowledge, is there a national taxonomic reference centre in-country? Yes No
And was your project involved in the establishment or consolidation of this centre? Yes No
If yes, in what way?

4. Taxonomic information generated

Please comment on the quality/extent of taxonomic reference collections in the host country prior to the commencement of this Darwin project.

How many reference collections were made during the course of this project?
Flora Fauna

Please list any new taxa identified during this project.

Did the project increase the efficiency of entering/storing any increased knowledge generated? Yes No
If yes, please give brief details (e.g. databases set up).

Did it improve the infrastructure for accessing taxonomic information? Yes No
If yes, please give brief details (e.g. databases or websites set up).

Has the information generated been submitted to any global dissemination project such as ECOPORT, GBIF, Species 2000, ITIS, Tree of Life, IPNI, IOPI, GLOBIS, NABIN, ISIS, BIN21, BCIS or BioNET INTERNATIONAL (please list all that apply)?

5. Support for conservation

Did the project aid decision-making for the conservation and sustainable use of biodiversity in the host country? Yes No

If yes, please give brief details (e.g. management plans produced).

To which of the major thematic work programmes of the Convention on Biodiversity (CBD) do you feel the project contributes (please tick all that apply)?

Agricultural biodiversity	☐	Dry and sub-humid lands biodiversity	☐
Forest biodiversity	☐	Inland waters biodiversity	☐
Island biodiversity	☐	Marine & coastal biodiversity	☐
Mountain biodiversity	☐		

Did this project result in the selection of sites to be protected? Yes No

Did this project indicate important areas for future taxonomic research? Yes No

Did this project indicate important taxa for future taxonomic research? Yes No

If yes, please list.

Were any specific indicator taxa for conservation identified during the course of this project? Yes No

If yes, please list.

Which of the major cross-cutting objectives of the CBD do you feel apply to this project (tick all that apply)?

Access to genetic resources and benefit-sharing	☐	Invasive alien species	☐
Traditional knowledge, innovations and practices	☐	Biological diversity and tourism	☐
Climate change and biodiversity	☐	Economics, trade and incentives	☐
Ecosystems approaches	☐	Global Strategy for Plant Conservation	☐
2010 Biodiversity Target	☐	Global Taxonomy Initiative	☐
Impact assessment	☐	Indicators	☐
Liability and redress	☐	Protected areas	☐
Education and public awareness	☐	Sustainable use of biodiversity	☐
Technology transfer and cooperation	☐		

6. Indigenous knowledge & benefit-sharing

Did the project improve access to genetic resources for scientific or commercial use? Yes No

If so, how?

What steps were taken during the project to ensure that the intellectual property of indigenous and local communities was protected?

Were you aware of any concerns raised by indigenous communities regarding the protection of their traditional taxonomic knowledge? Yes No

If yes, please give details.

Did you obtain the prior informed consent of the holders of any traditional knowledge reported or used? Yes No

Did your project involve any comparison of indigenous & Linnaean taxonomies? Yes No

7. Your experience

How was your UK institution affected financially by this project? Net gain Net loss

Do you believe the project was worthwhile for your UK institution? Yes No
Why?

Do you believe the project was worthwhile for the host country? Yes No
Why?

What did you learn from carrying out this project?

What did you change between the start and finish of the project and why (amount of funding required, methods used, questions addressed, outputs produced, etc.)?

What problems did your project encounter in the UK?

What problems did your project encounter in the host country?

What disappointed you about the project?

What did you intend to do but could not?

What unexpected outcomes emerged during the course of your project?

Will you continue to maintain contact with your host country partners? Yes No
Why/why not?

In your experience, how could the organisation of the Darwin Initiative be improved?

Did the DI project act as a catalyst for other projects? Yes No
If yes, please give details

If you were to apply for another Darwin grant, what would you change about your proposal?

Would you be willing to supply images for inclusion in the report? Yes No

Would you be willing for your project to be used as a case study in the report? Yes No

Are you willing to be contacted for additional information? Yes No

What is the best way to contact you?
Telephone ☐ Fax ☐ Email ☐ Mail ☐

Please supply your most up-to-date contact details for the host country partner in this project.

Do you have any other comments on the contribution of your project, or the Darwin Initiative in general, on the Global Taxonomy Initiative?

Annex 3. Questionnaire to host country project leader

DARWIN INITIATIVE MONITORING AND EVALUATION - THEMATIC REVIEW OF CONTRIBUTION TO GLOBAL TAXONOMY INITIATIVE

HOST COUNTRY PARTNER QUESTIONNAIRE

Please note: not all questions will be applicable to all projects. Feel free to answer as many or as few questions as you are able. The questionnaire is designed to provide complementary information to that in the project reports and outputs. We realise it may take a little time to complete, but would like to assure you that all information you can give us will be very useful in determining the future of the Darwin Initiative. **All information you provide will be used only for the purposes of this report** and will not affect your Darwin project or future projects (positively or negatively). All information provided will be fully acknowledged.

1. Project details

Name **Position**

Institution

Project code **Date**

Project title

Why did you decide to take part in a Darwin-funded project?

What did you expect to get out of the project?

Were these expectations: met? not met? exceeded?
Why?

2. Assessing taxonomic needs and capacities

Has an assessment of national taxonomic needs been conducted in your country? Yes No
If yes, what was the contribution of this Darwin project to that assessment?

Did the project contribute to any national biodiversity strategies and action plans? Yes No
If yes, please list them and briefly describe how a contribution was made.

What do you think is the greatest impediment to biodiversity conservation in your country?

Are you aware of any regional or sub-regional networks for assessing taxonomic needs and priorities involving your country? Yes No
If yes, please list.

Were the results of your work utilised in these regional or sub-regional level assessment of taxonomic needs and priorities? Yes No
If yes, please list.

Did you contribute to any regional workshops or action plans during the project? Yes No
If yes, please list.

3. Capacity-building

Please list the public communities that were involved in the project.

How have the public contributed to the taxonomic information collated (e.g. through parataxonomic activities, specimen collection, providing indigenous names, etc?

Prior to the start of this project, approximately how many trained taxonomists were there in the country?

How many new taxonomists have been trained through this project and to what level?

How many new parataxonomists have been trained through this project?

How many new employment opportunities for taxonomists or parataxonomists have been created through the project and at what level?

Did the project generate links with the UK for sharing taxonomic expertise? Yes No
If so, please detail the type of exchanges that have taken place (e.g. field visits, study tours, book exchanges, workshops, etc)

What was state of systems and infrastructure for taxonomic research in your country before the start of the project (e.g. collection management systems, computers, etc?)

How did the project improve these (e.g. equipment provided, systems set-up, funding sourced)?

Does your country have a national taxonomic reference centre? Yes No
And was your project involved in the establishment or consolidation of this centre? Yes No
If yes, in what way?

4. Taxonomic information generated

Please comment on the quality/extent of taxonomic reference collections in the country prior to this project.

Describe the taxonomic reference collections in the country after this project.

Did the project increase the efficiency of entering/storing taxonomic data? Yes No
If yes, please give brief details (e.g. databases set-up).

Did it improve the infrastructure for accessing taxonomic information? Yes No
If yes, please give brief details (e.g. databases or websites set-up).

Who did you expect to use the information produced during the project?

Who is actually using it?

What do they think of the quality of the information provided?

Are the project outputs, infrastructure, websites and training materials still in use? Yes No

Are they maintained and updated? Yes No

Are the jobs provided by the project still in existence? Yes No

5. Support for conservation

Did the project help in decision-making for conservation? Yes No

If yes, please give brief details (e.g. management plans produced).

Did this project result in the selection of sites to be protected? Yes No

Did this project indicate important areas for future taxonomic research? Yes No

Did this project indicate important taxa for future taxonomic research? Yes No

If yes, please list.

Were any specific indicator taxa for conservation identified during the course of the project? Yes No

If yes, please list.

6. Indigenous knowledge & benefit-sharing

Did this project improve access to genetic resources for scientific use? Yes No

If so, how

What steps were taken during the course of this project to ensure that the intellectual property of local communities was protected?

Were you aware of any concerns raised by local communities regarding the protection of their traditional taxonomic knowledge? Yes No

If yes, please give details.

7. Your experience

Do you believe this project was worthwhile? Yes No

Why?

What did you learn from carrying out this project?

What problems did your project encounter?

What could be done to alleviate these?

What disappointed you about the project?

What did you intend to do but could not?

What unexpected outcomes emerged during the course of the project?

Will you continue to maintain contact with your UK partners? Yes No

Why/why not?

Are you willing to be contacted for additional information? Yes No

What is the best way to contact you?

Telephone ☐ Fax ☐ Email ☐ Mail ☐

Do you have any other comments on the contribution of your project, or the Darwin Initiative in general, on the Global Taxonomy Initiative?

Please return this questionnaire by email to Alexandra-Wortley@ectf-ed.org.uk by July 31st 2005. Or, if you prefer, post or fax it to:

Dr. Alexandra Wortley
(Taxonomy consultant)
Edinburgh Centre for Tropical Forests
3/5, Saunders Street
Edinburgh
EH3 6TR
Fax: 0131 440 5501

Thank you for your co-operation.

Annex 4. Regional networks for assessing taxonomic needs and priorities

AETFAT (http://www.rbgkew.org.uk/aetfat/index.html), the Association pour l'Etude Taxonomique de la Flore d'Afrique Tropicale (Association for the Taxonomic Study of the Flora of Tropical Africa).

BioNET-INTERNATIONAL (http://www.bionet-intl.org/), the Global Network for Taxonomy. A member of the IUCN dedicated to creating sustainable mechanisms to assist developing countries to overcome the Taxonomic Impediment by becoming self-reliant in taxonomy. BioNET International is probably the largest and most important taxonomy network worldwide, and is separated into sub-regional networks ("loops"), appropriate structures through which much of the GTI can be effectively implemented:

- NAMERILOOP (North America)
- MESOAMERINET (Mesoamerica)
- AndinoNET (Andean countries)
- LATINET (Latin America)
- CARINET (Caribbean)
- EuroLOOP (Europe)
- NEURASIANET (Northern Eurasia)
- WESTASIANET (Western Asia)
- EASIANET (East Asia)
- SACNET (South Asia)
- ASEANET (Southeast Asia)
- PACINET (South Pacific)
- NAFRINET (North Africa)
- WAFRINET (West Africa)
- EAFRINET (East Africa)
- SAFRINET (Southern Africa)

CEPF (http://www.cepf.net/xp/cepf/), the Critical Ecosystem Partnership Fund. A joint initiative of CI, the GEF, the Government of Japan, the John D. and Catherine T. MacArthur Foundation and the World Bank, providing strategic assistance to NGOs, community groups and other civil society partners to help safeguard biodiversity hotspots in the developing world, to ensure civil society is engaged in biodiversity conservation.

GRENEWECA (http://www.ipgri.cgiar.org/regions/ssa/Networking/greneweca.htm) the Genetic Resources Network for West and Central Africa. A network founded by IPGRI (the International Plant Genetic Resources Institute) to contribute to the sustainable agricultural development of member countries by judicious conservation and sustainable use of the diversity of their plant genetic resources through a network of functional national programmes.

MRC (http://www.mrcmekong.org/), the Mekong River Commission. An association of the Mekong Basin countries of Cambodia, Lao PDR, Thailand and Vietnam, maintaining regular dialogue with, China and Myanmar, fostering co-operation in sustainable development, utilisation, management and conservation of the water and related resources of the Mekong River Basin, including navigation, flood control, fisheries, agriculture, hydropower and environmental protection.

SABONET, the Southern African Botanical Diversity Network was a capacity-building network of southern African herbaria and botanic gardens, supported by the GEF, co-funded by the USAID/IUCN Regional Networking and Capacity Building Initiative Programme and implemented by the UNDP through South Africa's National Botanical Institute, with the objective of developing local botanical expertise.

SEABCIN (http://www.brahms.co.uk/seabcin.htm), the South East Asian Botanical Collections Information Network. An EU-funded project initiated by the Netherlands National Herbarium and the University of Oxford, UK, partnered by Herbarium Bogoriensis, Indonesia, the Philippine National Herbarium, the Forest Research Institute, Malaysia, the Forest Department of Sarawak, Malaysia, Sandakan Herbarium, Malaysia, the Forest Herbarium, Thailand and the Singapore Botanic Gardens, to develop the exchange of data between herbaria in Europe and Southeast Asia.

Annex 5. World-wide taxonomic databases contributed to which clustered DI projects have contributed

EPIC (http://www.rbgkew.org.uk/epic/), the electronic Plant Information Centre. Set up by the Royal Botanic Gardens, Kew, UK and funded by the Capital Modernisation Fund, to provide a single access point for all Kew's major specimen, bibliographic, taxonomic and image databases on the internet.

GBIF (www.gbif.org), the Global Biodiversity Information Facility. A partnership of more than 70 countries, established to allow people all around the globe to electronically access the world's supply of primary scientific data on biodiversity, GBIF's purpose is to promote, co-ordinate, design and implement the compilation, linking, standardisation, digitisation and global dissemination of the world's biodiversity data. GBIF partnered by the CBD, funded through contributions from its Voting Participant countries and based in CopenHagen, Denmark.

IPNI (www.ipni.org), the International Plant Names Index. The product of a collaboration between The Royal Botanic Gardens, Kew, The Harvard University Herbaria, and the Australian National Herbarium, IPNI is a database of names and associated basic bibliographical details of all seed plants, ferns and fern allies. Its goal is to eliminate the need for repeated reference to primary sources for basic bibliographic information about plant names.

TROPICOS (http://mobot.mobot.org/W3T/Search/vast.html). The website of the Missouri Botanical Garden's VAST (VAScular Tropicos) nomenclatural and specimen database.

WDCM (http://wdcm.nig.ac.jp/), the World Data Centre for Microorganisms. Set up by the World Federation for Culture Collections to provide a comprehensive directory of culture collections, databases on microbes and cell lines, and gateway to biodiversity, molecular biology and genome projects.

Annex 6. Accessing taxonomic data through publications: examples of field-guides produced through DI projects

Conway, D.V.P., White, R.G., Hugues-Dit-Ciles, J., Gallienne, C.P. and Robins, D.B. (2003). ***Guide to the coastal and surface zooplankton of the south-western Indian Ocean.*** Marine Biological Association Guide **15**. 367pp. The first identification manual to the biodiversity of zooplankton in the South-Western Indian Ocean, with joint authorship between UK and host-country workers, that has proved useful to researchers across the Indian Ocean; available in hardcopy, and (still) as an electronic version, on CD or from http://www.pml.ac.uk/pml/sharing/Darwin_Guide.htm.

Set of four field-guides: ***An introduction to the flora of Bai Tu Long National Park; An introduction to the birdlife of Bai Tu Long National Park; An introduction to the butterflies of Bai Tu Long National Park; An introduction to the mammals of Bai Tu Long National Park.*** BTLBBAP/Frontier-Vietnam. Primarily aimed at raising awareness among local people, school children, tourists and national park rangers rather than scientist; available in hardcopy. Also supposed to be available from www.Baitulongnp.com; unfortunately this website is no longer active.

Evans, T.D., Sengdala, K., Viengkham, O.V. and Thammavong, B. 2001. ***A Field guide to the rattans of Lao PDR.*** Royal Botanic Gardens, Kew, UK. 96pp. A user-friendly, well-produced field guide, sharing authorship between UK and Lao researchers, and available in both English and Lao translations; hard copy still available at a cost of £15.

Reynel, C., Pennington, T.D., Pennington, R.T., Daza, A. and Flores, C. 2003. ***Áboles útiles de la Amazonia Peruana y sus usos.*** Tarea Gráfica educativa, Perú. 509pp. Spanish guide written jointly by UK and Peruvian workers, available free in Peru. Describes and illustrates 150 economically-useful tree species, and includes non-technical identifcation tips and extensive information on cultivation requirements.

Mair, J., Mora, E. and Cruz, M. 2002. ***Manual de Campo de los invertebrados bentónicos marinos: Moluscos, Crustáceos y Equinodermos de la zone litoral ecuatoriana.*** University de Guayaquil. 105pp. A field-guide printed by the host university, authored jointly by UK and Ecuadorian workers, including techniques for collection and preservation as well as descriptions of species, and written in Spanish to facilitate both work and teaching in-country. It has so far has a great impact upon teaching at the university, where many copies are in circulation.

Marín, G., Jiménez, B., Peña-Chocarro, M. and Knapp, S. 1998. ***Plantas Comunes de Mbaracayú: una guía de las plantas de la Reserva Natural del Bosque Mbaracayú, Paraguay***; **Peña-Chocarro, M., Marín, G., Jiménez B. and Knapp, S. 1999.** ***Helechos de Mbaracayú: una guía de las pteridofitas de la Reserva Natural del Bosque Mbaracayú, Paraguay*****; Garcete-Barrett, B.R. 1999.** ***Guia ilustrada de las avispas sociales del Paraguay.*** All Natural History Museum, London, and **Marín, G., Jiménez, B., Peña-Chocarro, M. and Knapp, S. 2000.** ***Plantas medicinales de al comunidad indígena Ava Katueté, Tekoha Ka'aguy Ryapu.*** Natural History Museum/Fundación Moisés Bertoni, Asunción, Paraguay. Field guides all in Spanish, one bilingual in Guarani and Spanish.

Annex 7. Review team

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Annex 8. List of abbreviations

BAP	Biodiversity Action Plan
CBD	Convention on Biological Diversity
CI	Conservation International
COP	Conference of the Parties
DEFRA	Department for Environment, Food and Rural Affairs
DI	Darwin Initiative for the Survival of Species
ECTF	Edinburgh Centre for Tropical Forests
GBIF	Global Biodiversity Information Facility
GEF	Global Environment Facility
GTI	Global Taxonomy Initiative
IUCN	International Union for the Conservation of Nature and Natural Resources (the World Conservation Union)
MAB	Man and the Biosphere programme (UNESCO)
NGO	Non-governmental organisation
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
WCS	World Conservation Society