Rapid review of biodiversity technology transfer in the United Kingdom

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Executive summary

1. Biodiversity technology transfer forms an integral part of the Convention on Biological Diversity (CBD) and is of particular importance for developing countries, which are often resource poor yet have the richest biodiversity. Decision X16, reached at the COP10 in Nagoya, invites signatories and relevant international organizations and initiatives, research institutions and the business sector, to submit to the Executive Secretary information on biodiversity technology transfer activities currently being undertaken by international, regional or national organizations and initiatives. This review forms part of this invitation.

2. Biodiversity technology is a broad concept which is defined by the CBD as both ***hard and soft technologies which are relevant to the conservation and sustainable use of biodiversity, or make use of genetic resources and do not cause significant damage to the environment.*** As such, it refers to a variety of techniques relating to *in-situ* and *ex-situ* conservation; sustainable management of biodiversity resources; monitoring techniques; modern biotechnologies using genetic resources; benefit sharing and access to research results. The broadness of this concept, however, is likely to leave the door open to a wide variety of individual interpretations by different stakeholders of what biodiversity technology involves.

3. This review adopts the wide definition of biodiversity technology given by the CBD, though excluding forms of unrecorded or 'unrecognised' technology transfer. It provides a rapid, light-touch overview of current initiatives and UK sector involvement in biodiversity technology transfer by means of web-based and literature review as well as questionnaire survey, and provides examples, case studies and recommendations for transfer initiatives.

4. In total, 113 candidate bodies, programmes, partnerships and networks were included in the review, representing the different UK sectors. Eighty-six percent of multi-organisation partnerships, 71% of NGOs and 67% of business organisations specifically mentioned some form (may be domestic or overseas) of biodiversity technology transfer in their web documentation, compared to 51% of academic institutions and 46% of government departments. However, for NGOs and academic institutions, these percentages dropped to 68% and 24% specifically when focussing on specific mentioning of overseas transfer.

5. Of the 113 candidate organisations, 36 replied to our questionnaire follow-up, generating 41 responses covering the whole spectrum of biodiversity technology components. *In situ* / *ex situ* conservation and monitoring were the most frequently addressed components of biodiversity technology transfer, while involvement in technology transfer relating to the use of genetic resources for biotechnology was the least frequently stated. Technology transfer was most commonly achieved via training and capacity building, facilitation of cooperative work and pertinent workshops and seminars, and was aimed at destinations worldwide, particularly in Africa and Asia, and with predominantly terrestrial systems and plants as the main beneficiaries of technology transfer.

6. The findings from this review show that there is a wealth of existing biodiversity technology initiatives from the UK to other countries. Different sectors fulfil slightly different roles: government initiatives mainly focus on policy frameworks, awareness creation and funding of technology transfer, while NGOs have a wealth of experience in hands-on technology transfer in the field. The UK academic sector provides a wealth of technical know-how which could be more effectively used in technology transfer. Specific funding calls by research councils and other funding bodies have a

major role to play in directing technology transfer from UK academia to other countries.

7. Project databases can contain a wealth of information on technology transfer initiatives, such as the information presented in this review. In the UK in particular, the Darwin Initiative project database provides a repository of information, since all Darwin Initiative funded projects include a degree of technology transfer within their remit. Integrating information from such national databases with the CBD's database on Technology Transfer and Cooperation may provide an easy and meaningful way to link additional information to the CBD's database, give a more balanced overview on transfer from the different countries, and can form a solid basis for future reviews of biodiversity technology transfer initiatives.

8. The broad definition of the term 'biodiversity technology' used by the CBD provides a major stumbling block to any detailed analysis of biodiversity technology transfer initiatives in the UK and elsewhere, as is the fact that biodiversity technology is still a little understood subject. In order for the biodiversity technology transfer component of the CBD to be more effectively addressed by signatories, it is vital to promote the concept and streamline the definition. This would also increase the effectiveness of any centralised biodiversity technology transfer initiative, which may be envisaged to coordinate the CBD's biodiversity technology transfer commitments.

1 Introduction

The 10th Conference of Parties (COP) of the Convention on Biological Diversity (CBD) in Nagoya in October 2010 recognised the potential contribution of a Biodiversity Technology Initiative, which would aid the transfer of technology between countries – in particular from developed countries to less developed countries and transitional economies. As part of this recognition, an invitation was made to signatories of the CBD to submit information on existing biodiversity technology transfer initiatives. This project is designed to address this invitation, and will provide a first broad review of the biodiversity technology transfer initiatives already established within the UK.

1.1 Background to the CBD and its commitment to biodiversity technology transfer

The CBD is a legally binding international treaty committing its signatories to conserve biological diversity, use biological resources sustainably, and fairly and equitably share the benefits derived from the use of genetic resources (CBD 1992). At the Rio Earth Summit in 1992, the CBD was first opened to signatories, as a response to the alarming rates of decline in biodiversity and the degradation of natural systems. At the COP10 in Nagoya, October 2010, and after the failure to achieve the 2010 targets on halting biodiversity loss (Butchart *et al.* 2010), the CBD adopted new targets and objectives to tackle the global biodiversity crisis for 2020 (Normile 2010), such as the protection of 17% of land area and 10% of the seas and the equitable sharing of genetic resources.

As part of the solution to biodiversity loss, it has become increasingly clear that technology and knowledge transfer between countries can make a significant contribution towards addressing biodiversity conservation issues. There is a particular need to establish technology transfer to developing countries, as it is these regions which generally do not have the resources necessary to obtain or generate the technology needed, and often have the richest biodiversity and highest rates of current loss (e.g., Schipper *et al.* 2008; Clausnitzer *et al.* 2009). Other conventions have similarly recognised the need for technology transfer. For example, the CTI was established at the first Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 1995. The CTI works closely within the framework of the convention yet is independent from it. It was set up to promote cooperation between countries in order to facilitate the development and transfer of climate-friendly technologies and best-practice approaches in addressing the climate challenge. The aim of the CTI is to carry out co-operative work with developing countries and transitional economies, to deliver a programme of seminars, workshops and symposia aimed at diffusing knowledge on climate-friendly technologies, to undertake 'technology needs assessments' and to give support for the implementation of key activities arising from these assessments (CTI 2011). It has also in the past given advice on best-practice approaches to technology transfer (OECD & IEA 2001).

From its inception, the CBD has also acknowledged this need for technology transfer, with signatories committing to provide or facilitate access to technologies to other parties under fair and favourable terms (CBD 1992). The CBD refers to the subject in a number of articles, relating to the establishment of training and education in biodiversity techniques, access to genetic resources and benefit-sharing, technology transfer arising from the use of genetic resources, promotion of international technical and scientific cooperation and the participation in biotechnology research of those countries providing the genetic material (CBD 1992, Table 1).

In the run up to the COP10 in Nagoya, talks had already started on the development of a Biodiversity Technology Initiative which would be modelled on the setup used by the CTI (Technical Expert Group on Technology Transfer and Scientific and Technological Cooperation 2007). In Nagoya, the parties reached the decision (Decision X16) to invite signatories and other governments, as well as relevant international organizations and initiatives, research institutions and the business sector, to submit to the Executive Secretary information on biodiversity technology transfer activities currently being undertaken by international, regional or national organizations and initiatives.

Table 1. Articles of the Convention on Biological Diversity relevant to and defining biodiversity technology transfer.

Article	Relating to	Biodiversity technology transfer via
12	Research and Training	Training and education in biodiversity techniques (e.g. taxonomy, monitoring, sustainable use of biodiversity)
15	Access to Genetic Resources	Access and benefit sharing
16	Access to and Transfer of Technology	Access and benefit sharing
17	Exchange of Information	Dissemination of research and survey results, provision of training, sharing of specialized, traditional and indigenous knowledge
18	Technical and Scientific Cooperation	Technical and scientific cooperation in conservation and sustainable use of biological diversity
19	Handling of Biotechnology and Distribution of its Benefits	Participation in biotechnology research

1.2 Biodiversity Technology and Biodiversity Technology Transfer

Given the breadth of the possible applications of the term 'biodiversity technology', its use is easily confused. The term technology is often understood as relating to machinery and equipment developed from scientific knowledge. However, biodiversity conservation and sustainable use of resources rely more often than not on education in concepts and techniques and dissemination of results rather than on technological gadgets. According to the Oxford English Dictionary, technology is defined as "***the application of scientific knowledge for practical purposes***" (Oxford University Press 2011). The United Nations Conference on Trade and Development (UNCTAD) defined 'technology' as "***systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service***" (United Nations Conference on Trade and Development 1985). The Intergovernmental Panel on Climate Change (IPCC) defines 'technology' in an equally broad sense as the "***know-how, experience and equipment for mitigating and adapting to climate change***" (Metz *et al.* 2000). Either definition leaves the door open to a wide range of activities which could fall under the term of technology.

In terms of the CBD, 'biodiversity technology' – like much of the terminology in other areas of the convention – has not been subjected to a set definition in order to enable the Convention to fit within the remits of the respective parties' legal and institutional frameworks (R. Höft, *pers. comm.*). In its widest sense, 'biodiversity technology' is defined as both ***hard and soft technologies which are relevant to the conservation and sustainable use of biodiversity, or make use of genetic resources and do not cause significant damage to the environment*** (R. Höft & M. Lehmann, *pers. comm.*). Here, hard technologies stand for technological hardware, while soft technologies incorporate the transfer of know-how relevant to biodiversity conservation and sustainable use. Not surprisingly, the resulting list of possible technologies which can be included in a review such as this is extensive, and incorporates technologies from different sectors, ranging from the conservation sector to biotechnology businesses and from academia to government departments and funding bodies.

Biodiversity technology transfer as defined by the CBD can thus refer to a variety of techniques relating to:

1) *in situ* and *ex situ* conservation;
2) sustainable management of biodiversity resources;
3) monitoring techniques;
4) modern biotechnologies using genetic resources;
5) benefit sharing and access to research results

(Convention on Biological Diversity 2010).

The CBD particularly emphasises the need for cooperation and technology transfer by facilitating technology assessments, strengthening information systems at international, regional and national scales, and enabling the conditions for technological cooperation and capacity building (Convention on Biological Diversity 2007; Convention on Biological Diversity 2010). Transfer between one or more persons, groups, or organisations may occur via correspondence, training, workshops, seminars, conferences, access to databases, publications, and project funding.

1.3 Project aims

The aim of this project is to provide a first rapid review of biodiversity technology transfer to developing countries, transitional economies and UK Overseas Territories by UK-based initiatives. This will assist the UK in understanding patterns in biodiversity technology transfer from the UK, and provides a useful evidence base for future CBD decisions on this topic. It may also aid the development of the capacity building mandate of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).

In order to deliver the best possible input into international strategy formulation, the aim is to provide a working definition of biodiversity technology transfer, as well as a brief overview of its different components, and highlight current patterns in terms of geographical coverage of technology transfer (i.e. which countries receive most/least technology transfer), UK sector involvement (i.e. which sectors are most represented in current technology transfer initiatives and which sectors with the relevant experience and technical know-how are yet under-represented) and types of technology transfer provided (i.e. *in situ* and *ex situ* conservation; sustainable management of biological resources; monitoring techniques; modern biotechnologies; benefit sharing).

We suggest recommendations for best practice in technology transfer programmes and for the incorporation of technology transfer into broader-scale biodiversity projects. We supply case studies of exemplary projects and initiatives from a number of organisations.

2 Rapid overview of specific areas of biodiversity technology

The wide range of activities resulting in biodiversity technology transfer suggests that different UK sectors may specialise in different components of biodiversity technology. The following section provides a rapid overview of the scope of the various components of biodiversity technology, as well as the most likely involvement of different UK sectors within each field (Figure 1), and closes by providing a working definition of biodiversity technology transfer for the purpose of this review.

2.1 In situ and ex situ conservation

In situ and *ex situ* conservation refers to the conservation management of units of biodiversity (most often species) within or outside their natural habitat, respectively. Technologies associated with *in situ* conservation include, for example, the development of species action plans, techniques relating to species, habitat or protected area management, threat mitigation techniques, and tools for the study and management of wildlife-human conflicts. Conservation NGOs are the most likely sectoral candidates to be involved in activities relating to *in situ* conservation and the provision of hands-on technology transfer. The academic sector will be vital in providing technical expertise, and in developing key technologies. *Ex situ* conservation draws on a wealth of expertise created by zoological and botanical gardens, gene and seed banks worldwide, which provide already fully functional cooperative networks working along internationally reputable guidelines provided by the International Agenda for Botanic Gardens in Conservation (Wyse Jackson & Sutherland 2000) and the World Zoo and Aquarium Conservation Strategy (World Association of Zoos and Aquariums 2005). Many of these guidelines also include specific details on technology transfer, information exchange, and technical and scientific cooperation. Technologies relating to reintroductions or translocations of species often provide a link between *ex situ* and *in situ* conservation (Emslie *et al.* 2009).

2.2 Sustainable use of biodiversity resources

Just like biodiversity technology itself, sustainable resource use is often very broadly defined, because of the lack of an adequate terminology for the various concepts falling within the remit of sustainable use (e.g., use, sustainability and incentives, Hutton & Leader-Williams 2003). Sustainable resource use combines a number of components, such as biological, social, cultural and economical factors (IUCN 2000; Milner-Gulland & Rowcliffe 2007). Taking these factors into account, the CBD defines sustainable use as "***the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations***" (CBD 1992). As a result, technologies aiding the sustainable use of biological resources reflect the broadness of this definition and the complexities within it, and include a wide range of management techniques, from participatory approaches to economic incentives, and from assessments of present sustainability of systems to predictive models of use scenarios. Conservation NGOs as well as government departments are likely to be particularly involved in this component of biodiversity technology, via hands-on technological capacity building

and project funding, since projects on sustainable use are often inextricably linked to poverty alleviation. The academic sector is most likely to be contributing via the provision of technical expertise on the underlying concepts of sustainable use.

2.3 Biodiversity monitoring

As with the other components of biodiversity technology, biodiversity monitoring is a broad subject area, which encompasses monitoring at all spatial scales, from local to global monitoring, and from species to population or ecosystem-level. Correspondingly, there is a lot of technology available in the field of biodiversity monitoring. For example, a suite of global indicators, such as the Red List Index and the Living Planet Index (Butchart *et al.* 2004; Baillie *et al.* 2008; Collen *et al.* 2009), were adopted by the CBD to report on the status and trends of biodiversity. With commitments to global multilateral environmental agreements and conventions generally being implemented at the national or regional scale, it is important that such global techniques are applied at sub-global levels, such as is the case in national Red Listing (Zamin *et al.* 2010). Monitoring is also likely to be the single component of biodiversity technology which most prominently uses hard technology. Monitoring technology includes Geographical Information Systems, satellite mapping, camera trapping, remote tracking devices and novel smart phone applications (Gray & Kalpers 2005; iBats 2006; Collen *et al.* 2011). As such, it is likely that this component has strong involvement of the UK technology business that commercially develops these technologies, as well as the academic sector, which uses and refines these technologies via research.

2.4 Access and benefit sharing

The fair and equitable sharing of benefits derived from the use of genetic resources, which includes technology transfer, is one of the three cornerstones of the CBD (Secretariat of the Convention on Biological Diversity 2002), and is likely to play a major role in any strategy for reducing biodiversity loss after the failure to meet the 2010 target (Secretariat of the Convention on Biological Diversity 2010). However, it has also been noted that the development of access and benefit-sharing (ABS) regulations has been slow, despite the potential of positive incentives resulting from such systems (Secretariat of the Convention on Biological Diversity 2010). The *Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising Out of Their Utilization*, although not legally binding, previously provided assistance to stakeholders in developing ABS strategies (Secretariat of the Convention on Biological Diversity 2002).

The recently agreed Nagoya Protocol now provides the legally binding framework for access and benefit sharing in the CBD context (Secretariat of the Convention on Biological Diversity 2011). Stakeholders involved in ABS are most likely to be governments as well as the agricultural sector (e.g. via the International Treaty on Plant Genetic Resources for Food and Agriculture, FAO 2009), biotechnology, pharmaceutics and cosmetics industries as well as botanic gardens transferring germplasms between countries (Secretariat of the Convention on Biological Diversity 2008). Technology transfer, collaboration and cooperation within the context of ABS agreements is specified in Article 23 of the Nagoya Protocol, urging parties to "promote and encourage access to technology by, and transfer of technology to, developing country parties" (CBD 2010). Where possible, such technology transfer should be achieved by collaborative activities taking place in the country providing the genetic material (CBD 2010). Examples of technology transfer stemming from ABS agreements are still few and far between (Secretariat of the Convention on

Biological Diversity 2008), particularly with regard to less developed countries where capacity for technical collaboration is often lacking.

2.5 Unrecognised technology transfer

While in most of the cases discussed above, biodiversity technology transfer is recorded as part of conservation, sustainable use or ABS strategies, there are some instances in which technology transfer between countries may occur, but may be unrecognised. In these cases, the outcome from this transfer may still benefit biodiversity, but the participants do not necessarily recognise their activities as biodiversity technology transfer within the remit of the CBD. Good business practice which promotes a greater monetary return can, for example, bring with it biodiversity benefits by providing incentives for sustainable use, as well as providing alternatives to activities which may be harmful for biodiversity. Certification schemes, such as for example that of the Marine Aquarium Council which creates conservation benefits and works to promote sustainable livelihoods and responsible management of marine resources, may play a role here: they are driven by market forces yet often involve capacity building and some transfer of technologies. However, certification bodies are often not single-country based, or not based in the UK, so fall outside the scope of this review.

The pet industry may already play a role in such unrecognised technology transfer activities: hard technology transfer enabling improved holding systems for ornamental fish in *in situ* locations in Africa and the Philippines, carried out for commercial reasons, has the potential to open up markets, add value to the fish resource and encourage its sustainable use for future generations (K. Davenport *pers. comm*.). Similarly, improving ornamental fish holding facilities in the Amazon basin may provide an alternative market to destructive activities such as deforestation (K. Davenport *pers. comm*.). Yet, because such activities are carried out for commercial reasons, this type of biodiversity technology often remains unrecorded or unrecognised. However, mainstreaming of biodiversity into business through such and other voluntary best practice activities has become a recent focus for the CBD, as exemplified at the recent *Third Business and the 2010 Biodiversity Challenge Conference* held in Jakarta in late 2009 (CBD 2009).

2.6 Expected stakeholder involvement in biodiversity technology transfer

Figure 1 summarises schematically the kind of UK stakeholder involvement in biodiversity technology transfer which we are expecting to observe in this study. Funding from governments and research councils is likely to provide the main financial resources for both academic research and applied conservation on issues pertaining to the CBD. Both academia and conservation NGOs (via training and capacity building programmes and workshops) are likely to have a major input in the CBD's goals of conserving biological diversity and promoting sustainable use of biological resources. Yet it is expected that these sectors differ in their implementation of biodiversity technology transfer; academia is likely to provide the knowledge base via research, which is then disseminated at conferences and in the published literature, while conservation NGOs are likely to be more directly involved in hands-on technology transfer via capacity building, training programmes and workshops.

ABS activities provide a mostly separate stream of technology transfer activities, mainly involving the industrial sector (pharmaceutical, biotechnology, agricultural, live animal and plant industries), with framework assistance from government offices. Academic and other bodies using genetic resources non-commercially are likely to

have ABS agreements in place for the use of genetic resources, which provide technology transfer instead of monetary benefits. However, the extent of involvement by academic and other non-commercial users of genetic resources is currently difficult to gauge. Similarly, bodies involved in seed banking, such as botanic gardens (here classified under the academic sector due to their large role in plant research and science-based conservation) may also be involved in this stream, with technology transfer rather than monetary benefits as the main benefit.

2.7 Definition of biodiversity technology transfer

For the purpose of this review, we closely follow the CBD's definition of biodiversity technology transfer. We define it as the ***deliberate transfer and sharing of technology, techniques and know-how which aid the conservation and sustainable use of biodiversity***. As such, we are eliminating the need to account for unrecognised technology transfer, but include the range of activities outlined in sections 2.1 to 2.4. Transfer mechanisms are as varied as biodiversity technology itself, and include technological support, capacity building and training programmes, project funding, pertinent seminars and workshops, facilitation of networks and cooperative work.

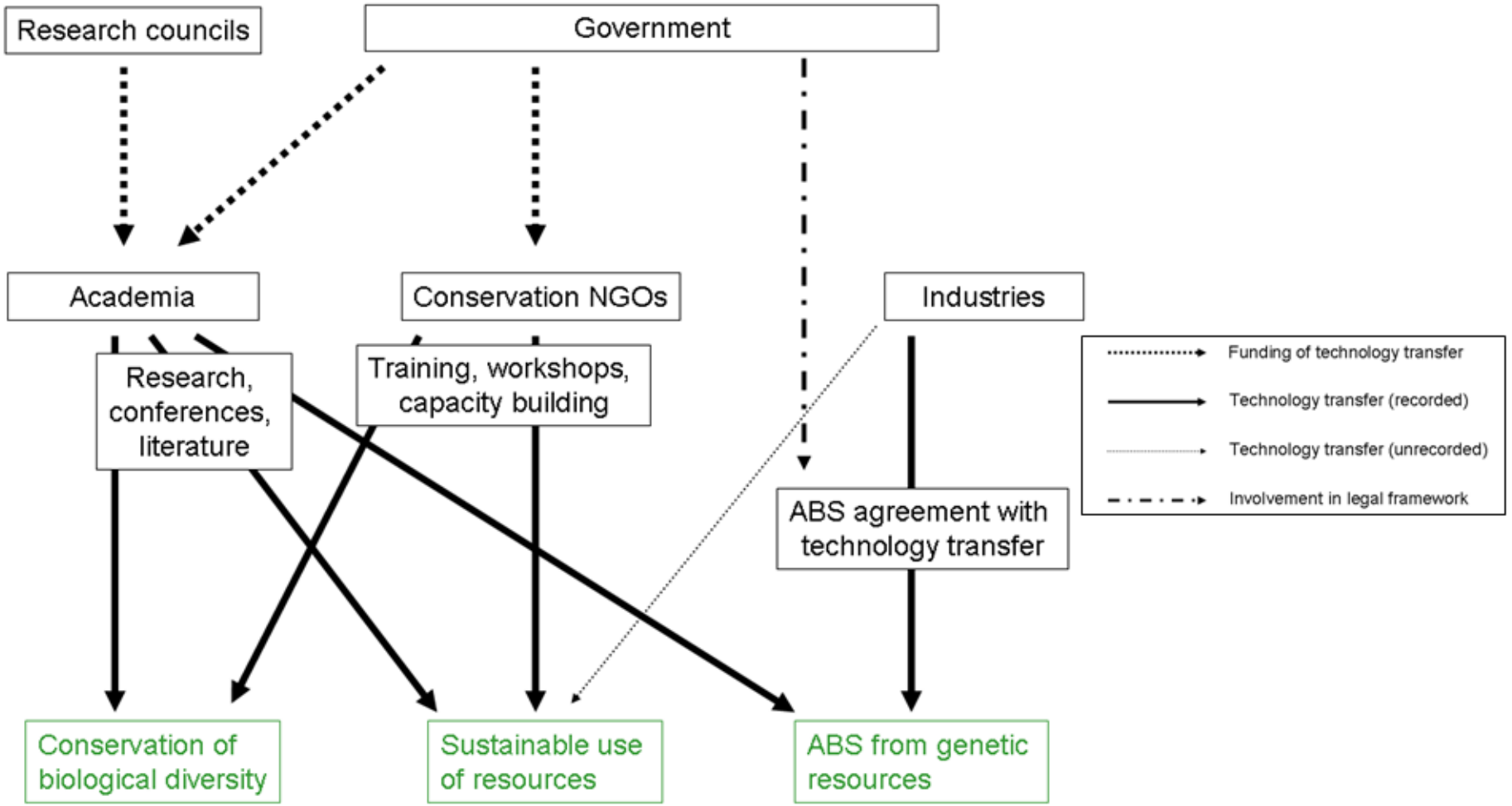

Figure 1. Expected involvement of stakeholders in biodiversity technology transfer initiatives in the UK. Organisations are classed into sectors as indicated in Appendix 2.

3 Methods

3.1 UK organisations potentially involved in technology transfer

We initiated the review with internet searches and literature searches using a number of relevant keywords (Table 2) in order to compile a list of potential organisations, departments, research institutes and initiatives which may have involvement in biodiversity technology transfer to other CBD signatories. Subsequently, this list was expanded through feedback with the project board at Defra. This list formed the basis for the subsequent review.

3.2 Initial review of candidate organisations

We reviewed each of the candidate organisations with regard to their remit or mission statement and biodiversity technology expertise in order to assess scope for involvement in each type of biodiversity technology: 1) *in situ* and *ex situ* conservation; 2) sustainable management of biodiversity resources; 3) monitoring techniques; 4) modern biotechnologies using genetic resources; 5) benefit sharing and access to research results. Different sectors are likely to specialise in different areas (see section 2.6), so that we expect, for example, that zoos and conservation organisations will have a major input in *in situ* and *ex situ* conservation techniques, while academic departments are likely to have a larger involvement in developing monitoring techniques and biodiversity indicators.

We collected basic details for each organisation, such as contact information, mission statements and remits, type of biodiversity technology (see above), and, where possible, specific details on any biodiversity transfer activities, such as commencement of any technology transfer schemes, means of technology transfer (e.g. workshops, training, provisioning of resources, etc.), recipient countries of transfer activities, numbers of projects potentially involving some form of technology transfer, the funding sources, available budgets, whether transfer was directed to benefit any particular species, habitats or ecosystems and whether there were any other UK organisations involved in the projects.

Table 2. Keywords used in initial web-searches to define list of potential organisations involved in biodiversity technology transfer. Keywords were used in conjunction as indicated in the table (e.g. UK and Biodiversity* and Capacity building*).

Keyword 1	Keyword 2	Keyword 3	Keyword 4
UK	Biodiversity technology	Transfer	
	Biodiversity Conservation Sustainable management Genetic resources Biotechnology Benefit sharing	Cooperation	
		Monitoring	
		Capacity building	
		Technology needs	
		Training	
		Dissemination	Information
			Data
		Seminar	
		Symposia/um	
		Networks	
		Research centre	
		Developing countries	
		Overseas territories	
	Biodiversity	University	
	Convention on Biological Diversity		
	Millennium Development Goals		
	Conservation research		
	Conservation organisation		
	Conservation charity		
	Zoo	Conservation	

3.3 Development of a follow-up questionnaire and follow-up visits

The information obtained during our initial review was then used to develop a targeted follow-up questionnaire to obtain all the relevant information from each of the candidate organisations and to standardise our data collection for subsequent graphical display and analysis (for questionnaire, see Appendix 1). The questionnaire contains seven sections targeting information about:

1. the type of organisation;
2. areas of biodiversity expertise (e.g. *in situ* conservation, sustainable resource use, monitoring, biotechnologies) of the organisation and the means of technology transfer (e.g. technological support, capacity building, funding, pertinent seminars or workshops, etc.);
3. the geographical coverage of transfer initiatives;
4. the scale of involvement into technology transfer (e.g. duration of transfer activities, number of projects, staff time);
5. the representation of specific components of biodiversity within the activities (e.g. tailored towards plant, animal, fungi conservation, or ecosystem processes);
6. funding of transfer initiatives;
7. collaboration with other UK partners.

Each organisation was initially contacted by email or phone in order to find a suitable contact, prior to sending the questionnaires. The questionnaires were complemented with phone follow-ups in order to compile information from as broad a range of organisations as possible, obtain specific examples of technology transfer and answer any queries respondents may have. Data collected from both the initial review as well as the questionnaire follow up were stored in a database. This information was then used to evaluate the potential and actual role of the various UK sectors in biodiversity technology transfer. Follow-up visits and phone calls were also set up with a number of organisations which were identified during the initial review as potential case studies and best practice examples.

3.4 Project databases as sources for biodiversity technology transfer initiatives

We examined available databases on technology transfer and associated projects, such as the CBD's Technology Transfer and Cooperation Information Database (CBD 2011), the Darwin Initiative project database (The Darwin Initiative Project Database 2011a), and the UK Overseas Territories Conservation Forum project database (UK Overseas Territories Conservation Forum 2011) for their usefulness as a source of information on existing UK biodiversity technology transfer schemes.

4 Results

4.1 Potential UK organisations, initiatives or programmes initiatives for biodiversity technology transfer

A list of 113 candidate organisations, departments, programmes, partnerships and networks was drawn up for further research (see Appendix 2 for a full list). These were classified into six different sectors (Figure 2): academic departments and institutions (including research councils and museums; 45 organisations); governmental institutions, departments and executive agencies (14); conservation, research and education NGOs (28); business and industries (including consultancies and industry representative bodies, 12 organisations); multi-organisation partnerships (7); other sectors (e.g. non-departmental public bodies [NDPB, 2], networks [2], intergovernmental organisations [2], and programmes [3]).

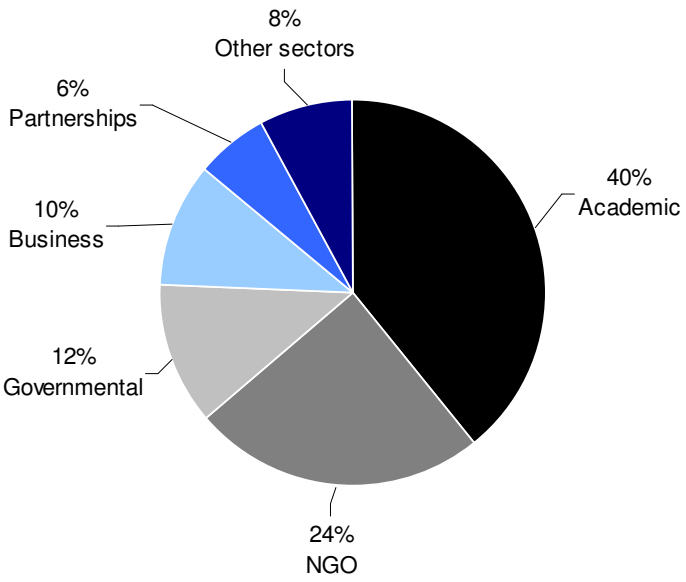

Figure 2. Representation of different sectors in the list of UK organisations, departments, programmes and partnerships used in this review (n=113).

4.2 Results from rapid review of potential UK organisations

A rapid review of the remits, mission statements, and objectives of all organisations (n=113), as well as an overview of current projects, showed that 86% of multi-organisation partnerships and 71% of NGOs specifically mentioned some form of biodiversity technology transfer in their web documentation (Figure 3A), although this may relate to domestic transfer only. Sixty-seven percent of organisations in the business sector, 51% of academic institutions and 46% of government departments specifically listed some form of biodiversity technology transfer (Figure 3A).
In terms of transfer to other countries, the number of organisations specifically mentioning such activity dropped to 68% of NGOs and 24% of academic institutions (Figure 3B). Percentages remained the same for all other sectors.

Participation in different types of biodiversity technology varied by sector. Analysis from web-based research suggests that academic departments play a particularly large role in research on biodiversity monitoring, with NGO focus predominantly on both monitoring and conservation (both *in situ* and *ex situ*; Figure 4). The industrial sector appears particularly important in the practical application of access and benefit sharing, with involvement in conservation, sustainable use and monitoring largely attributable to consultancy businesses. Government departments and agencies have a very balanced representation across biodiversity technologies, showing that they are meeting key obligations on biodiversity technology within the context of the CBD.

Similarly, utilisation of different transfer techniques varied between sectors. The business sector shows large potential for involvement in technological support, while

NGOs are at the forefront of capacity building in the field (Figure 5). Partnerships, by their very nature, are important in facilitating cooperation and networks for technology transfer. Government departments are also vital in establishing cooperative environments, capacity building and training, and providing funding for technology transfer. Technology is transferred from the academic sector primarily via workshops, seminars and data sharing.

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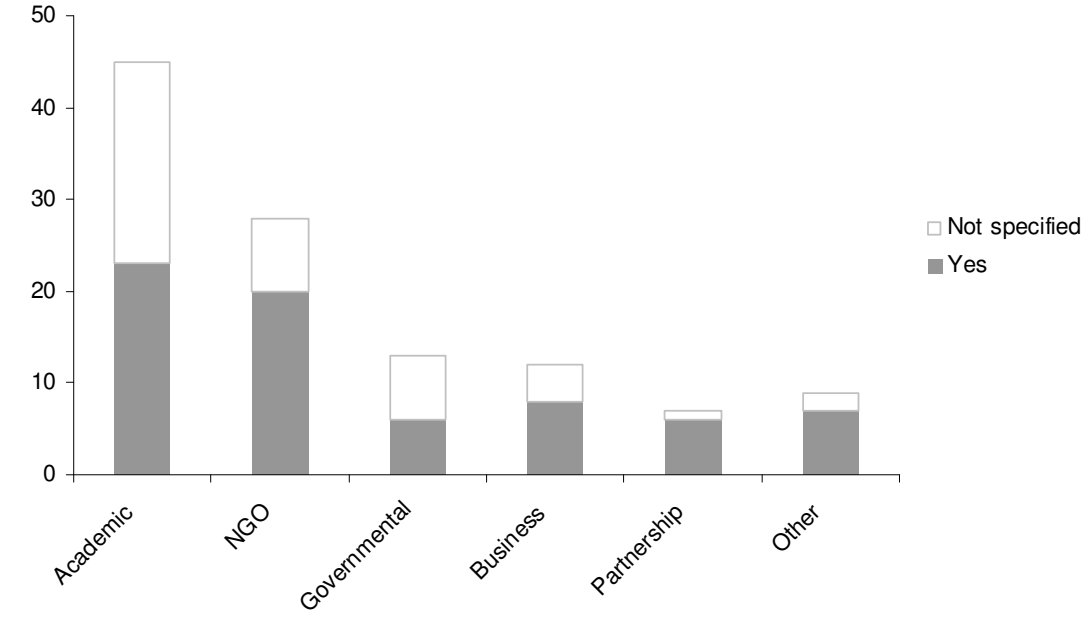

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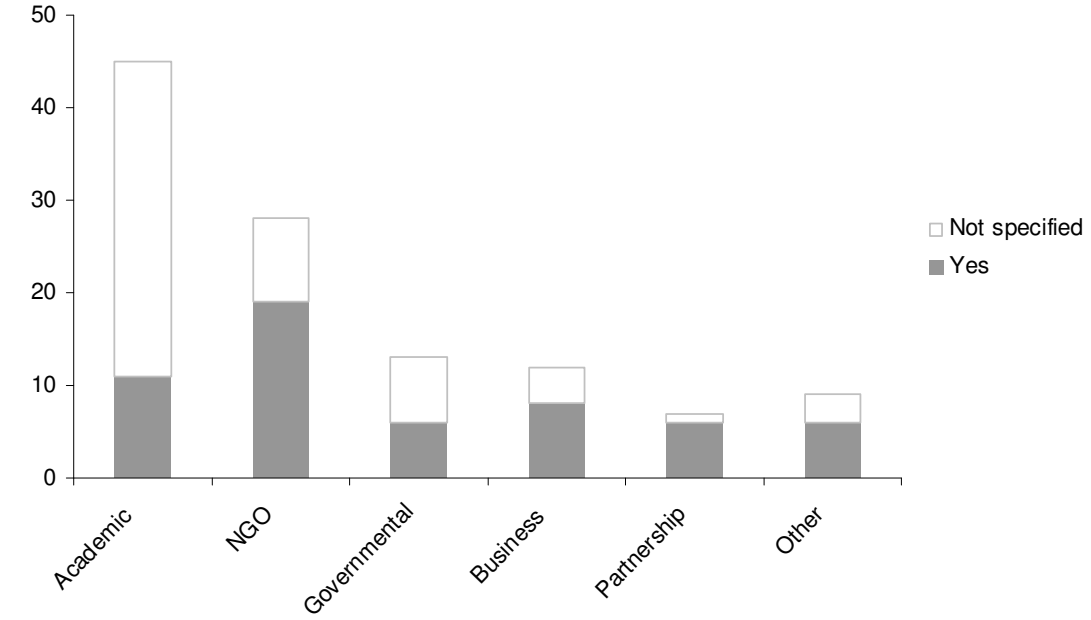


Figure 3. Number of organisations mentioning technology transfer specifically, or forms of technology transfer as part of individual projects, on their websites, as depicted by type of organisation. **A** any biodiversity technology transfer (may be domestic transfer only); **B** biodiversity technology transfer to other countries. *Not specified* – does not mention technology transfer on the website, yet may in fact provide technology transfer.

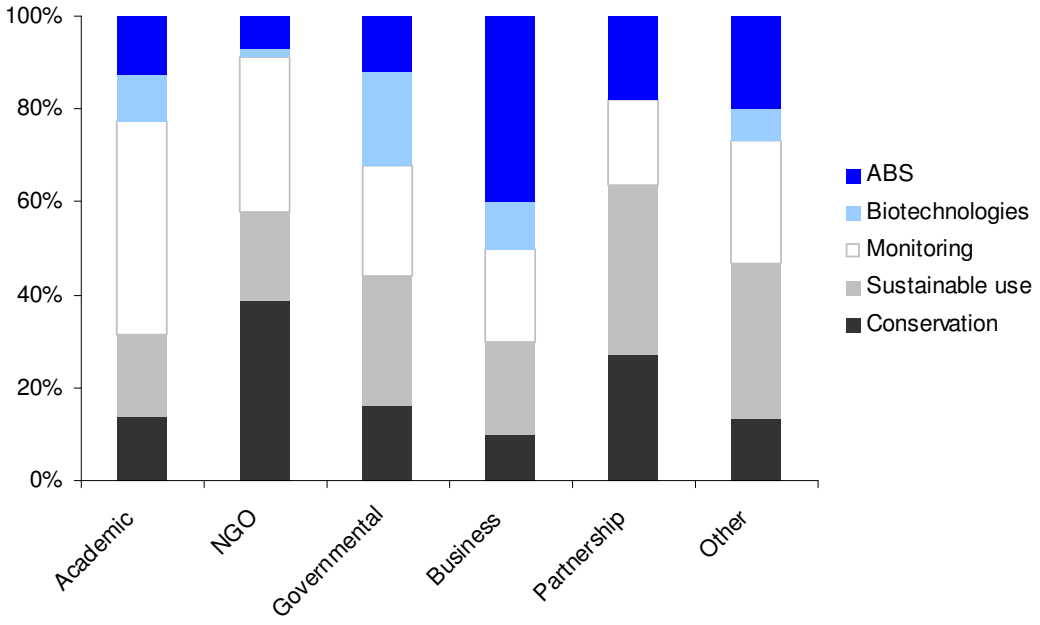


Figure 4. Potential percentage contribution of UK sectors to the different types of biodiversity technology, based on web-based research.

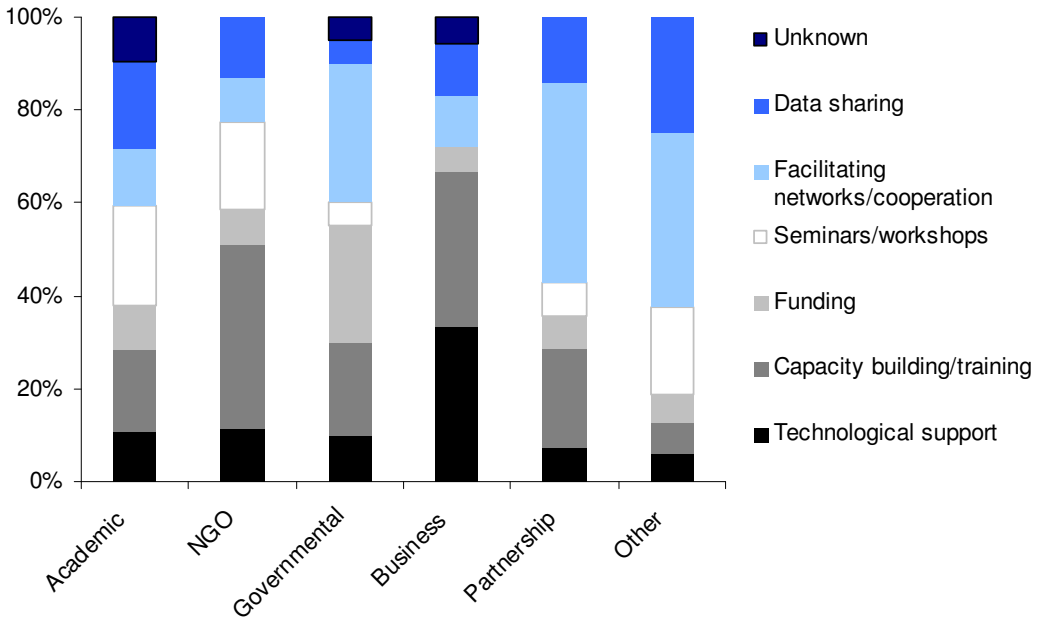


Figure 5. Potential percentage contribution of UK sectors to the different types of biodiversity technology, based on web-based research.

4.3 Results from follow-up survey on biodiversity technology transfer

Of the 113 organisations contacted, 41 replies were received from 36 organisations (Table 3). A small proportion of these were multiple responses from the same organisation, responding on behalf of different projects or departments at the same organisation. The breakdown of respondents by sector (Figure 6) shows that the academic sector was under-represented (40% of 113 organisations contacted versus 10% of respondents), while the government sector was over-represented (12% out of 113 organisations versus 24% of respondents). There were also fewer replies than hoped for from business organisations (10% out of 113 organisations versus 4% or respondents, including consultancies).

Respondent's involvement in biodiversity technology transfer covered the whole spectrum of biodiversity technology components (Figure 7). *In situ* and *ex situ* conservation and monitoring were the most frequently addressed components of biodiversity technology transfer, followed by sustainable management of resources and benefit sharing and access to research results. Involvement in technology transfer relating to the use of genetic resources for biotechnology was stated in only 8% of cases. Technology transfer was most commonly achieved via training and capacity building, followed by facilitation of cooperative work and networks and pertinent workshops and seminars (Figure 8). Other mechanisms listed included predominantly indirect involvement in technology transfer via partner or member organisations.

Technology transfer was aimed at destinations worldwide, particularly Africa and Asia (Figure 9). A large proportion of transfer was also aimed at Europe, including the transitional economies of Eastern European states. South America was least represented amongst respondents. Terrestrial systems and plants are the main beneficiaries of technology transfer among the respondents, with the relatively new field of ecosystem services still lagging behind the more traditional study systems of terrestrial plants and animals (Figure 10).

The length of time that survey respondents had been involved in biodiversity technology transfer projects was highly variable, though with a mean length of engagement of around 30 years. However, excluding extreme values of 100 and 200 years – which most likely represent the age of the organisation rather than the length of engagement in technology transfer – the average figure was close to 15 years and within the lifetime of the CBD.

Table 3. Respondents to the follow-up questionnaire survey. In some cases, the survey was completed more than once per organisation, summarising technology transfer involvement for different programmes or sub-units within the organisation. Where this is the case, this has been indicated in the table.

Organisation or programme	Where multiple completion of survey or completion for a specific project only, number of individual projects or sub-units represented in survey
British American Tobacco Biodiversity Partnership	-
British Trust for Ornithology (BTO)	-
CABI Bioservices	-
Centre for Environment, Fisheries and Aquaculture Science (CEFAS)	-
Centre for Middle Eastern Plants (CMEP)	-
Darwin Initiative	-
Department of Energy and Climate Change (DECC)	-
Durrell Institute of Conservation and Ecology (DICE)	-
Durrell Wildlife Conservation Trust	-
Fauna & Flora International (FFI)	1 (Conservation Leadership Programme)
Field Studies Council	2
Hawk Conservancy Trust	-
Intellectual Property Office (IPO)	-
IUCN	2 (Freshwater Biodiversity Unit; Shark Specialist Group)
John Innes Centre	-
Joint Nature Conservation Committee (JNCC)	-
Living with Environmental Change (LWEC)	-
National Museum of Wales	-
Royal Botanic Gardens Edinburgh	-
Royal Botanic Gardens Kew	-
Royal Society for the Protection of Birds (RSPB)	2
Save the Rhino	-
Science and Advice for Scottish Agriculture (SASA)	-
Senova Ltd	-
UK Collaborative on Development Sciences	-
UK Overseas Territories Conservation Forum	-
UNEP-WCMC	-
University of Birmingham, School of Biosciences	-
University of Reading, Centre for Agri-Environmental Research	-
Whitley Wildlife Conservation Trust (WWCT)	-
WildCRU	-
Zoological Society of London (ZSL)	3 (EDGE of Existence programme; Conservation Breeding and Reintroduction; Wildlife Picture Index)

Table 3 continued.

Organisation or programme	Where multiple completion of survey or completion for a specific project only, number of individual projects or sub-units represented in survey
Late replies and not included in analysis	
Durham University	-
Centre for Ecology and Hydrology (CEH)	-
Food and Environment Research Agency (FERA)	-
Wildfowl and Wetlands Trust (WWT)	-

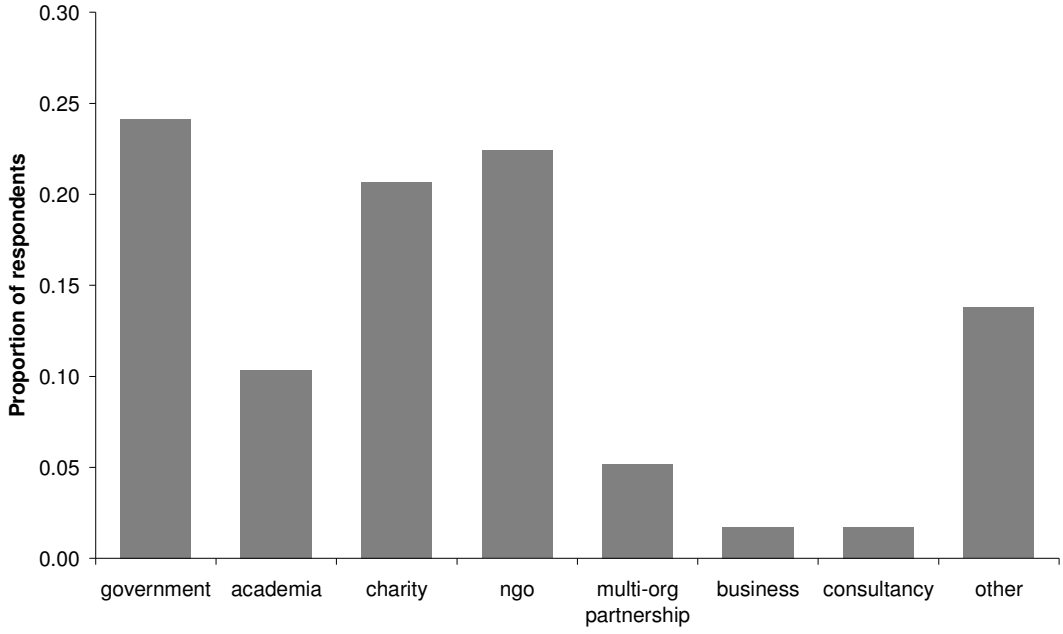


Figure 6. Distribution of survey respondents by sector. Proportions based on 41 survey responses.

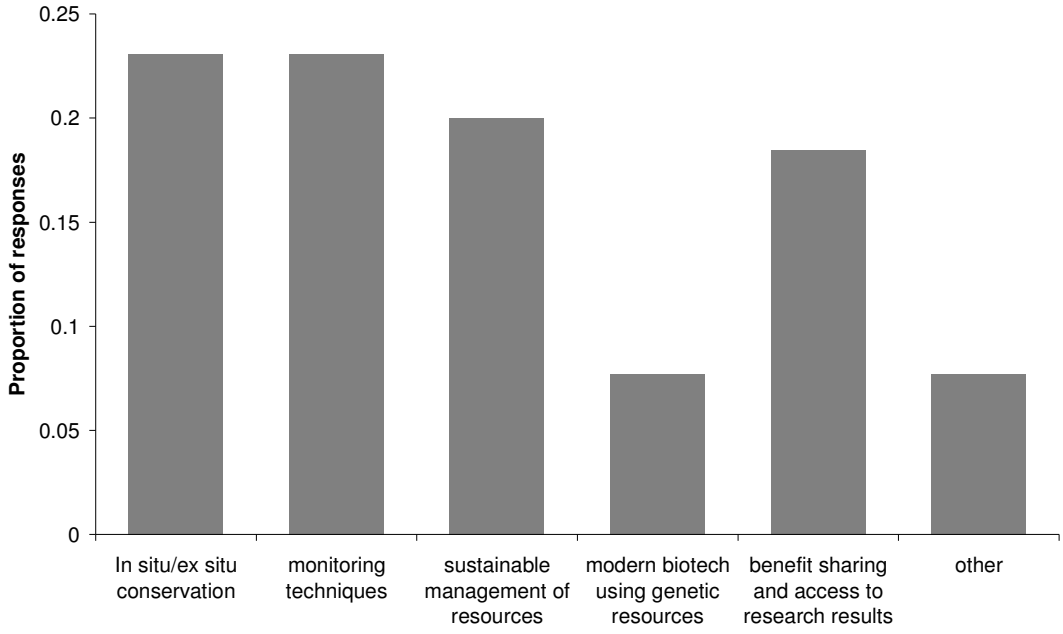


Figure 7. Biodiversity technology areas in which respondents to the survey are working.

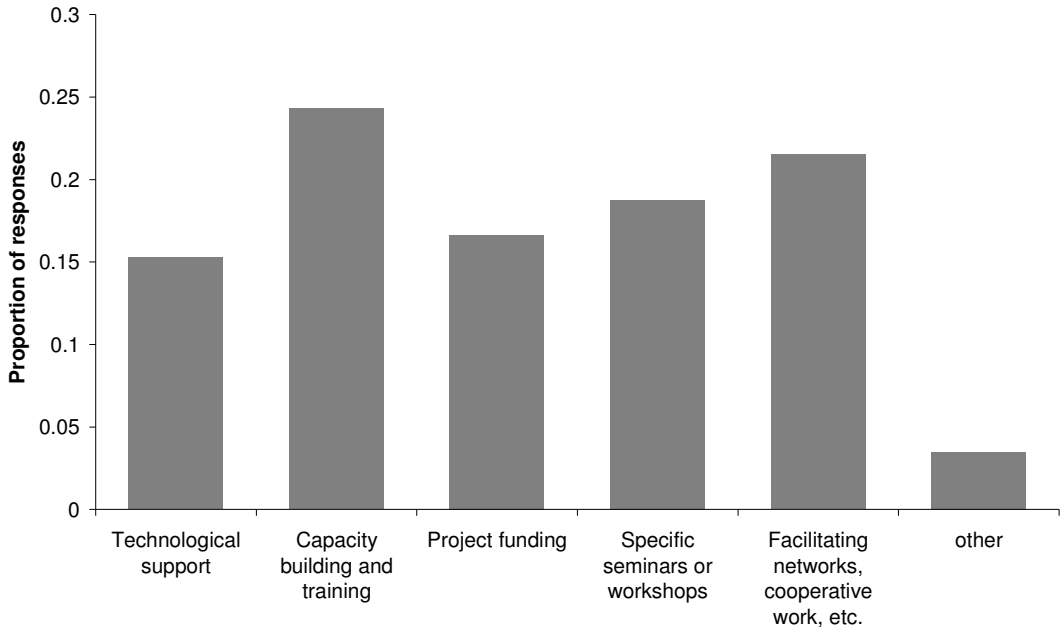


Figure 8. Thematic areas of biodiversity technology in which respondent organisations engage in biodiversity technology transfer.

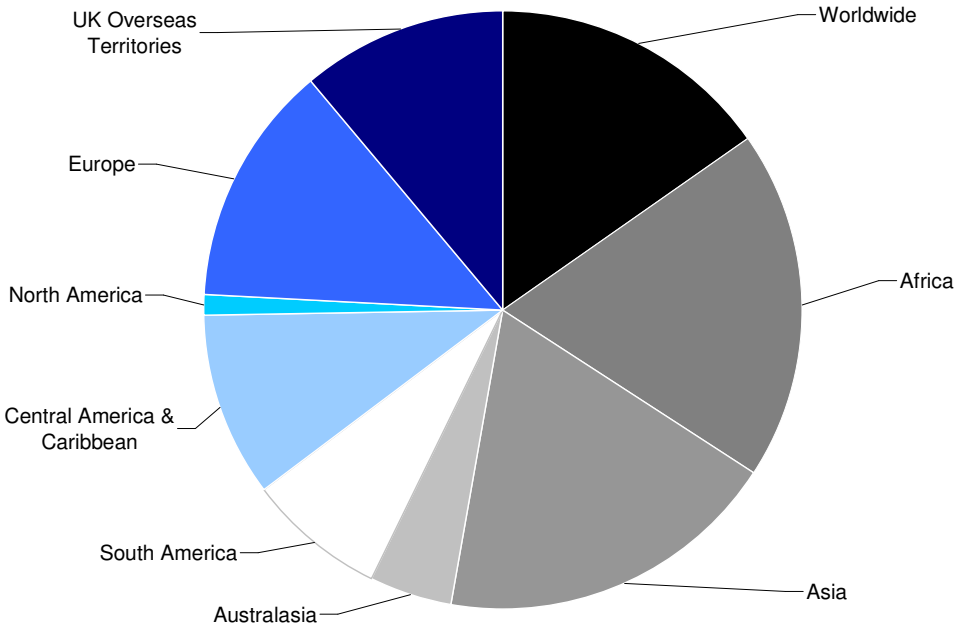


Figure 9. Recipient regions of UK based organisations' biodiversity technology transfer.

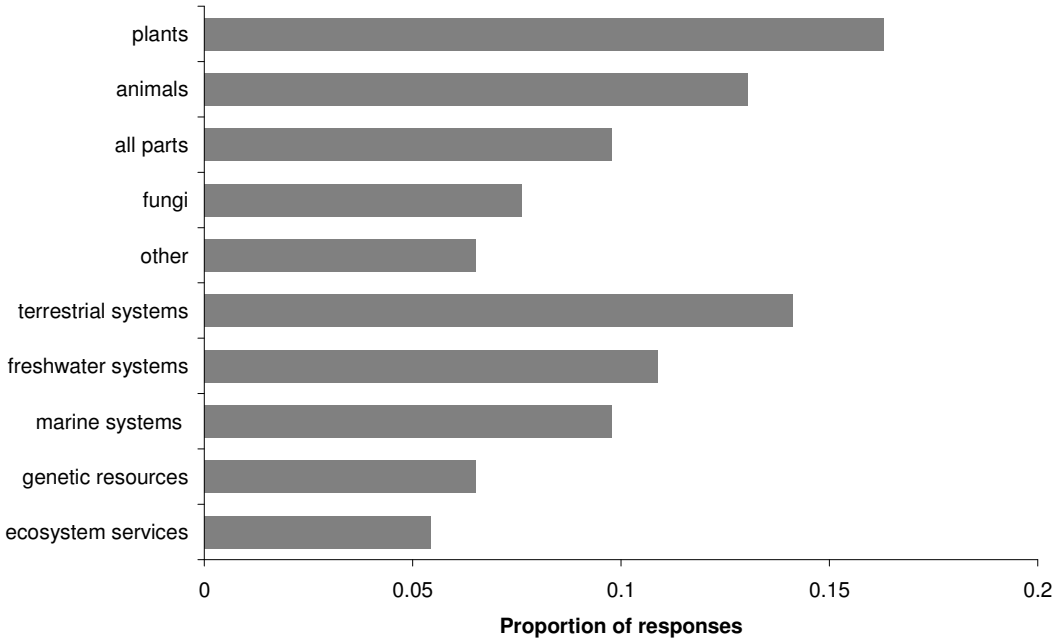


Figure 10. Area of biodiversity targeted by UK biodiversity technology transfer schemes.

4.4 Project databases as sources of information on UK biodiversity technology transfer initiatives

There are a number of existing databases that could be used to extract data on UK biodiversity technology transfer initiatives. We briefly review three possible databases from the CBD, UK Darwin Initiative and the UK Overseas Territories Conservation Forum.

4.4.1 CBD Technology Transfer and Cooperation Information Database

The development and strengthening of national, regional and international clearing houses for relevant information on technology transfer and technical and scientific cooperation is a central element of the CBD's work plan in this area (Secretariat of the Convention on Biological Diversity 2006). Its aim is to "provide access to information on national technology needs, available relevant proprietary technologies and technologies in the public domain, including access to databases of existing technologies, and information on best-practices to create enabling environments for technology transfer and technology cooperation" (Secretariat of the Convention on Biological Diversity 2006).

At present, the CBD database comprises 235 documents and websites, relating to technology transfer and scientific and technical cooperation worldwide, only two of which refer to technology based in the UK. However, the CBD Secretariat relies greatly on the provisioning of input from the Parties to the Convention to implement this as a meaningful database (Secretariat of the Convention on Biological Diversity 2006). National databases could therefore provide an easy and meaningful way to link additional information to this centralised clearing house.

4.4.2 The Darwin Initiative project database

The Darwin Initiative, established in 1992 at the Rio Earth Summit by the UK government, is one of the key activities by which the UK government addresses its obligations to the CBD. Its scope is to "assist countries rich in biodiversity, but poor in financial resources to meet their objectives" – not just of the CBD – but "under one or more of the three major biodiversity conventions", the CBD, the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS) (DEFRA 2010). It does so by drawing on UK expertise to work with local partners in less developed countries to achieve the three central goals of the CBD: conservation of biological diversity, sustainable use of biological resources, and the fair and equitable sharing of benefit arising from the utilisation of genetic material (DEFRA 2010).

The central focus of the Darwin Initiative is the specific need for technical and scientific cooperation, highlighted in Article 18 of the CBD (CBD 1992), specifically between the UK and developing countries. As such, every project funded via the Darwin Initiative falls within the wide remit of biodiversity technology transfer, as defined by the CBD. It has thus invested around £80 million in nearly 700 projects in more than 150 countries between 1993 and March 2010 (DEFRA 2010).

Darwin Initiative projects contribute to all articles of the CBD. Apart from the central remit of technical cooperation stated in Article 18, five other articles fall within the field of biodiversity technology transfer as defined in this study, namely Article 12, 15, 16, 17 and 19 (see section 1.1). Table 4 gives an overview of the number of projects contributing to each of the articles of the CBD. Since 1993, 152 out of a total of 724

projects (21%) have provided input into Article 12 on research and training, the second largest contribution per article after Article 18.Twenty-six projects (4%) have specifically addressed access to and transfer of technology (Article 16), with less than 1% of projects addressing Articles 15 (access to genetic resources) and 17 (exchange of information) (The Darwin Initiative Project Database 2011a). No project specifically contributes to Article 19 on handling of biotechnologies and the distribution of its benefits.

In terms of geographical coverage, the majority of Darwin Initiative projects target Sub-Saharan Africa, East Asia and South America (Table 5). The Darwin Initiative is also a major contributor towards biodiversity conservation in the UK Overseas Territories (DEFRA 2010), through 19 main projects as well as other funds directed at UK Overseas Territories, particularly those in the Southern Atlantic and the Caribbean. Figure 11 details the breakdown of Darwin Initiative projects by country (in those cases where projects were aimed at specific countries rather than regions).

Table 4. Breakdown of the number of Darwin Initiative (DI) projects contributing to the different articles of the CBD (The Darwin Initiative Project Database 2011a). Grey shading indicates articles relevant to biodiversity technology transfer as defined in this review.

Article	Description	No. DI projects
6	General measures for conservation & sustainable use	59
7	Identification & monitoring	105
8	*In situ* conservation	56
9	*Ex situ* conservation	20
10	Sustainable use of components of biodiversity	54
11	Incentive measures	35
12	Research and training	152
13	Public education & awareness	74
14	Impact assessment & minimising adverse impacts	19
15	Access to genetic resources	6
16	Access to and transfer of technology	26
17	Exchange of information	7
18	Technical and scientific cooperation	ALL
19	Handling of biotechnology & distribution of its benefits	0
20	Financial resources	1
21	Financial mechanism	14
22	Relationship with other international conventions	18

Table 5. Breakdown of Darwin Initiative (DI) projects by region out of a total of 724 projects (The Darwin Initiative Project Database 2011b). The majority of projects in the *International* category provide courses and training to Darwin fellows or other research scientists from around the globe, often held at UK academic institutions, or are projects developing training materials, handbooks and guidelines for use worldwide. Note: some projects may be focussing on more than one region.

Region	No. DI projects	% of DI projects (N=724)
Caribbean	18	2.5
Central America	50	6.9
East Asia	133	18.4
Europe & Central Asia	74	10.2
Middle East	13	1.8
North Africa	9	1.2
Pacific	31	4.3
South America	126	17.4
South Asia	73	10.1
Sub-Saharan Africa	209	28.9
UK Overseas Territories	33	4.6
International	*22*	*3.0*

Equally, the Darwin Initiative project database allows for assessments of effort by ecosystem or biome, production system, and by biodiversity threats (The Darwin Initiative Project Database 2011a). Because of its standing as a long-running and well-documented initiative, it has been previously noted that the Darwin Initiative provides a large and useful database for study and analysis of conservation initiatives and success (Howe 2009). Similarly, it offers a broad overview of the scope and geographic scale of biodiversity technology transfer and the involvement of the different sectors for rapid biodiversity technology assessments. Most importantly, it provides a general overview of the academic/research, non-governmental, governmental and other organisations that are providing biodiversity technology transfer along the CBD guidelines (see Appendix 3 for additional organisations which may be of interest to future research; Table 6). Academic and other research organisations as well as non-governmental organisations provide the bulk of technology transfer via the Darwin Initiative, with an estimated 77 academic and research institutions participating in nearly 450 projects, and 50 NGOs in around 230 projects.

Table 6. Breakdown of the academic/research, non-governmental, and other organisations involvement in biodiversity technology transfer, as indicated by the Darwin Initiative (DI) project database (The Darwin Initiative Project Database 2011c). Multiple entries per organisation were combined, organisations with main offices abroad were excluded and organisations which could no longer be traced were removed.

Type of organisation	No. organisations	No. DI projects
Non-governmental organisation	50	232
Academic/research	77	441
Other*	19	64

* consultancies, governmental, partnerships, learned societies, inter-governmental organisations

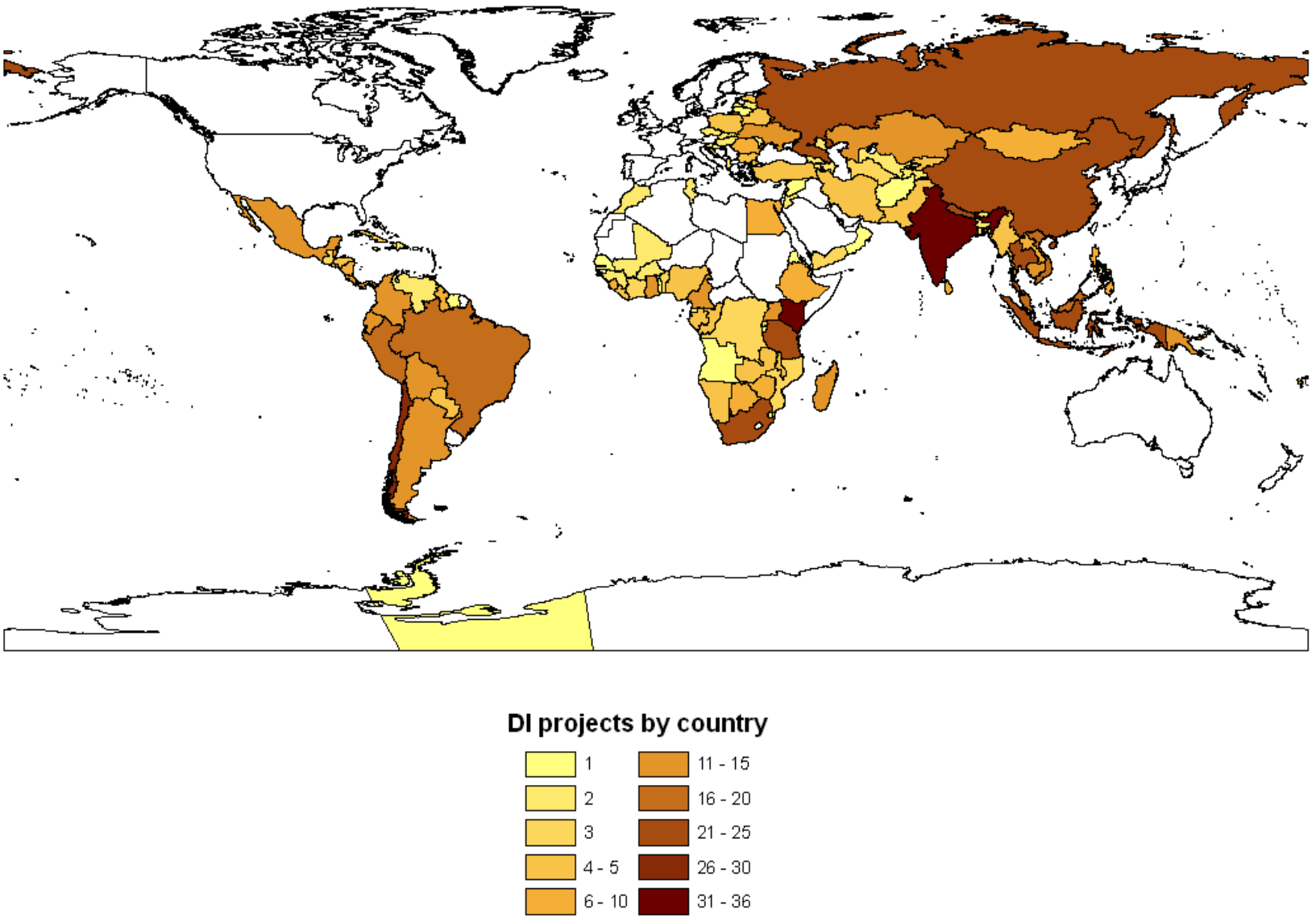


Figure 11. Global coverage of all Darwin Initiative projects since the initiation of the project in 1993. Only projects which target a specific country are included.

4.4.3 The UK Overseas Territories Conservation Forum (UKOTCF) project database

The UKOTCF database contains general information, environmental education resources, site-specific information on management and threats, and conservation priorities for the UK Overseas Territories, as well as information on funding sources and projects carried out in the Overseas Territories (UK Overseas Territories Conservation Forum 2011). It therefore provides a valuable resource for conservation practitioners in the Overseas Territories. For the purpose of this review, it is difficult to distinguish which projects fall within the remit of biodiversity technology transfer from the UK. However, the database provides the functionality to identify some components of biodiversity technology transfer such as capacity building and facilitating communication and information flow. Using these as indicators of technology transfer, 88 current projects (excluding archived items) involve biodiversity technology transfer to the UK Overseas Territories. The Overseas Territories Environment Programme – a joint programme between the Foreign and Commonwealth Office (FCO) and the Department for International Development (DFID) to support the implementation of Environment Charters in the UK Overseas Territories – funds the majority of these projects (61%; Table 7), followed by the Darwin Initiative (14%). While some projects have a remit across all UK Overseas Territories, many are territory-specific.

Table 7. Involvement of funding bodies in UK Overseas Territories (UKOTs) projects involving biodiversity technology transfer via capacity building and facilitating communication and information flow.

Funding body	No. projects	UKOTs
OTEP	54	All
Darwin Initiative	12	All, particularly in Southern Atlantic & Caribbean
Others	14	All, particularly St Helena, Bermuda and Cayman Islands
Unspecified	8	All, specific projects in TCI, Montserrat, Cayman Islands, St Helena

5 Case studies

5.1 Tailored capacity building for biological conservation – the role of conservation NGOs

Countries poor in financial resources often do not have the technical capacity to effectively implement on-ground conservation work. Building such capacity relies greatly on developed countries providing the technical know-how necessary to support country initiatives. As seen in section 4.4.2, government initiatives can provide targeted funding schemes for technology transfer. These schemes tap into the technical expertise found in the academia and conservation NGOs to provide and transfer technical expertise to less developed countries and countries with transitional economies. Conservation NGOs can play a particularly important role in linking the theoretical know-how from academia to direct hands-on capacity building in the field. More often than not, this requires taking an approach tailored to *in situ* circumstances in order to establish conservation capacity via both soft and hard biodiversity technology transfer. This case study focuses on one such organisation in order to highlight the wide range of biodiversity technology transfer potential harboured by conservation charities.

Fauna and Flora International (FFI) has been in operation as a conservation charity since 1903. Its remit is to "conserve threatened species and ecosystems worldwide, choosing solutions that are sustainable, based on sound science and take into account human needs". It thus works towards the CBD goals of biological conservation and sustainable use of resources. FFI's specific activities currently focus on 33 countries in five continents. However, there is additional involvement in overarching themes such as business and biodiversity, conservation capacity, environmental markets and conservation, livelihoods and governance, and as partners in multi-organisation initiatives, such as the British American Tobacco Biodiversity Partnership.

Large parts of FFI's work involve biodiversity technology transfer in form of capacity building via training and workshops, often in countries where conservation capacity has been much reduced (for example as a result of recent conflict). A Darwin Initiative-funded project in Tajikistan has developed a National Conservation Training Programme to address the lack of capacity within the country's conservation sector (FFI 2010; The Darwin Initiative Project Database 2011d). Tajikistan is part of the Mountains of Central Asia Biodiversity Hotspot (Conservation International 2007) and holds a large number of charismatic mega fauna, particularly ungulates such as the markhor and the Marco Polo sheep (Weinberg *et al.* 1997; Schaller & Kang 2008). However, forests have virtually disappeared over the past century and factors such as civil war and one of the lowest GDPs of the former Soviet states have caused an exodus of scientists and a lack of new capacity to fill this gap. The National Conservation Training Programme was developed with the help of experts from both Tajikistan and the UK through a number of workshops; initial workshops defined the particular training needs, with later workshops tailoring materials developed by UK experts to the particular circumstances encountered in Tajikistan (The Darwin Initiative Project Database 2011d). Particular emphasis was given to modules on protected area management and biodiversity monitoring. Module delivery itself is transferred to Tajik experts throughout the project in order to achieve continuity of the programme into the future (The Darwin Initiative Project Database 2011d). FFI also supervises and mentors five postgraduate students from Tajikistan on a Darwin scholarship (FFI 2010).

Other capacity building projects include the transfer of both hard and soft technology. For example, effectiveness of gorilla monitoring was increased via a ranger-based monitoring programme which was developed as a key management tool to aid conservation of the mountain gorilla in Virunga and Bwindi (Gray & Kalpers 2005). Overseen by the International Gorilla Conservation Programme (IGCP, of which FFI is a member, together with the African Wildlife Foundation and WWF), this programme combines simple protocols with training and the provisioning of hard technology such as GPS units, databases, Geographic Information Systems (GIS) and associated satellite and other base maps in order to enable park rangers to collect basic information on the whereabouts of the gorilla groups, other key species, signs of illegal activity etc. while on patrol. Integration of this information with GIS analysis provides for a strengthened park management which can, for example, target patrol coverage to deal with specific threats and illegal activities (Gray & Kalpers 2005).

Project funding and facilitation of support networks is another means by which biodiversity technology can be transferred. As part of the Conservation Leadership Programme – a partnership of four organisations (BirdLife International, Conservation International, FFI and the Wildlife Conservation Society) – FFI is part of a programme providing a range of awards, training, advice and sustained support to the next generation of conservationists via an active international network of practitioners (Herbertson 2007). The three-tiered funding system is designed to allow for a natural progression from basic ecological research to networking, decision-making, and advocacy to long-term conservation capacity

in the project area. As a result of the programme, around 200 species have so far been discovered or rediscovered, around 50 protected areas have been established and 20 NGOs set up (S. Paterson, pers. comm.). Furthermore, knowledge transfer includes scientific writing workshops, awards to attend the Society of Conservation Biology's international congress and international training course on project planning, management, and behavioural chain strategies.

5.2 Access and Benefit Sharing for plant conservation – the role of botanic gardens and seed banks

The Nagoya Protocol on Access and Benefit-sharing provides the legally binding framework for the access to and sharing of monetary and non-monetary benefits arising from the use of genetic materials (Secretariat of the Convention on Biological Diversity 2011). Studies tracking technology transfer stemming from ABS agreements are still relatively rare (Secretariat of the Convention on Biological Diversity 2008), specifically with regard to industrial use of genetic resources. However, with the recent agreement of the Nagoya Protocol, interest in studying the nature of ABS agreements and following their outcomes in terms of technology transfer between countries is likely to increase. Already, big pharmaceutical companies, such as AstraZeneca, are involved in research and development agreements with external partners, and ABS agreements form part of the landscape of commercial biodiversity use in a number of other industries, such as agricultural and biotechnological industries (Secretariat of the Convention on Biological Diversity 2008). However, technology transfer components of such ABS agreements may again be obscured by a lack of clarity as to what biodiversity technology transfer actually entails.

Botanical gardens, holding vast collections of plant material from all over the globe, have already been practicing ABS as part of their responsibility to the CBD's third main component, that of fair and equitable sharing of benefits arising from the use of genetic resources. While in this case the benefits are rarely monetary, ABS gives rise to a large amount of technology transfer and capacity building. Benefits shared with relevant stakeholders – individuals, organisations or groups which are "affected by, or with an interest in the activities relating to the acquisition, use or supply of genetic resources, their progeny or derivatives" – can include access to collections and information sources, soft and hard technology transfers, in-kind benefits, collaborative projects and publications, technical assistance and advice, and monetary benefits derived from the use of plant collections for commercial purposes (Wyse Jackson & Sutherland 2000).

The Royal Botanic Gardens at Kew, supported by Defra, have the mission to inspire and deliver science-based plant conservation worldwide. This is achieved through partnership and collaboration, founded on capacity building, education and training in the organisation's specific areas of expertise – plant diversity, science, collections, conservation, environmental sustainability, horticulture and education. The Millennium Seed Bank Partnership (MSBP) is Kew's largest technology transfer project, working with partners worldwide to save seeds and safeguard plant biodiversity. Currently, it involves over 100 organisations in 50 countries worldwide, involving around 600 people (C. Trivedi pers. comm.). The partnership has already successfully secured seed collections of over 30,000 plant species, and is now working to conserve 25% of the world's flora and enable use of these collections for habitat restoration and sustainable utilisation (C. Trivedi pers. comm.).

In accordance with the CBD, every partnership is underpinned by a formal Access and Benefit Sharing Agreement (ABSA) which sets out the mutually agreed terms for access to plant material and the fair and equitable sharing of the benefits of its use. All ABSAs take into account national and institutional circumstances while clearly stating that "partners will

work together to share, fairly and equitably, any benefits that arise from the collection, study and conservation of the material" (Millennium Seed Bank Project Kew 2003).

With seed banking involving a large number of different soft and hard technologies relating to seed storage and seed management, technology transfer between partners is a key benefit. Elements of technology transfer and technological co-operation are stated as benefits to be shared and transfer inputs are specifically designed (based on training needs and technical needs assessments) to meet the requirements of each partner institute (C. Trivedi pers. comm.). Benefits are shared multi-directionally, from Kew to its partners, between partners and from partners to Kew (Millennium Seed Bank Project Kew 2003).

Training in seed bank technology, delivered via training courses (both in-country and residential at Kew), workshops, joint expeditions, and collaborative research, is central to the Millennium Seed Bank's commitment to technology transfer, with a full-time Training Manager co-ordinating all training activities (Millennium Seed Bank Project Kew 2003). However, transfer of knowledge on hard technologies for seed banking, technology needs assessments and facilitating access to species data and information also play a vital role in the work.

To date, more than 1,500 people have received training from the Millennium Seed Bank Partnership, including over 50 post-graduate students which have been supported. Furthermore, Kew's expertise in seed conservation training is often used by other organisations. For example, Kew has recently worked with the United Nations Food and Agriculture Organisation (FAO) to build the capacity of African gene banks to conserve and use more than 200 species, important to local livelihoods, identified as causing problems for gene banks (C. Trivedi, pers. comm.).

5.3 A tool for national conservation planning: Mongolia

It is at regional and local scales that human actions most obviously drive biodiversity loss. Threatened species lists, based on extinction risk classification such as the IUCN Red List are becoming increasingly influential. While it has long been clear that priority setting is a societal process, and that risk assessment (as a scientific endeavour) should not be confounded (Mace & Lande 1991), there is a clear need for regional, national, and local level biodiversity information as part of the conservation planning tool kit. Consequently, interest in producing regional and national threatened species lists has soared (Miller *et al.* 2007; Collen *et al.* 2008; Zamin *et al.* 2010).

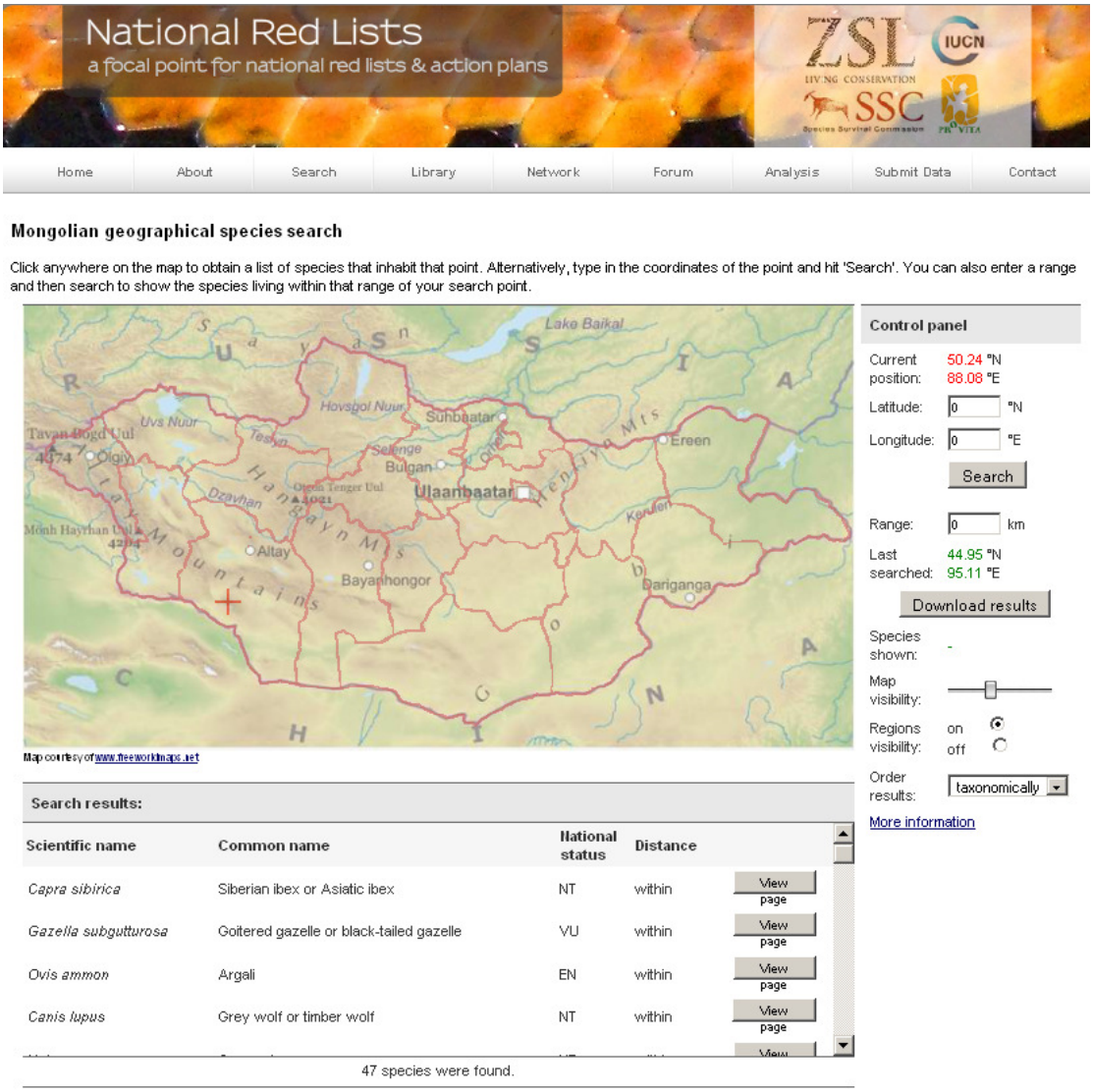
The importance of national level monitoring of biodiversity trends is now enshrined more than ever in global biodiversity policy, with the overarching biodiversity protection framework of the CBD incorporating national monitoring and action plans into its 2020 Strategic Plan (Convention on Biological Diversity 2011). Relating biodiversity trend data to economic trend data, for example, is one way to support national strategic planning and further helps to mainstream biodiversity into political decision making. In many cases, however, a gap exists, not least in the coverage of national level biodiversity data (Collen *et al.* 2008), but in the implementation of national schemes to redress this issue. Obtaining reliable biodiversity trend data therefore presents the first step in informing the national-level decision making process.

The Zoological Society of London (ZSL) was founded in 1826 and is a world-renowned centre of excellence for conservation science and applied conservation. The society's mission is to promote and achieve the worldwide conservation of animals and their habitats. This is realised by carrying out field conservation and research in over 80 countries across the globe, much of which is integrated with academic research via ZSL's

academic arm, the Institute of Zoology. Biodiversity monitoring and assessment presents such a case. ZSL has been working with a number of nations to develop national threatened species lists as baseline data for conservation strategies. One nation where this process has been noticeably successful in generating biodiversity technology transfer is Mongolia.

In collaboration with the National University of Mongolia, ZSL have helped to coordinate a national Red Listing process for Mongolian mammals, freshwater fish, reptiles and birds (e.g., Clark *et al.* 2006). This process has involved capacity building and the transfer of both hard and soft biodiversity technology. Species assessment workshops involved bringing together groups of species experts from all over Mongolia and the broader region of surrounding countries, and training them in the national Red Listing process. The resultant database of species conservation assessments and supporting information is housed and maintained in the National University of Mongolia, with support from ZSL's Steppe Forward Programme. The construction of this threatened species list has led to enhanced national protection of threatened species as species protection of the Mongolian designated species becomes passed into law. Further, the geographical species search tool (Figure 12) enables interested parties to generate species lists for areas of interest at the click of a button, a list which also provides them with the threatened status of the species, as well as other ecological information. This tool is being employed by the Mongolian government to reduce the impact of new mining operations.

Figure 12. The Mongolian geographical species search tool



6 Discussion and recommendations

6.1 Defining biodiversity technology

Biodiversity technology, as defined by the CBD and in this review, brings together hard and soft technologies from the very different fields of sustainable use of resources, biodiversity monitoring, biotechnology and access and benefit sharing. As a result, the single concept of biodiversity technology involves a large variety of stakeholders. Correspondingly, many stakeholders hold very different views of what biodiversity technology may entail, and this may have a bearing on any study involving stakeholder feedback on biodiversity technology transfer initiatives. For example, soft technologies are commonly believed to lie outside the field of biodiversity technology, despite their obvious importance in improving biodiversity conservation in developing countries. For example, the Centre for Middle Eastern Plants, based at the Royal Botanic Gardens Edinburgh, is

providing training to build a core foundation of basic skills in the Middle East in a number of ways, one of which is via online learning programmes. Without this basic understanding, any other technological training will not be effective, so that such soft technologies rightly fall within the remit of biodiversity technology.

However, this complexity creates a conundrum when considering an overarching initiative on biodiversity technology transfer, similar to the Climate Technology Initiative, of how to cater for both hard and soft technology, as well as the relatively new technological concept of access and benefit sharing. Any such initiative would have to clearly redefine biodiversity technology and its scope within this large field to make it more user-friendly. Similarly, while the CBD's broad definition of biodiversity technology can provide for an informative and general first overview of UK biodiversity technology transfer initiatives, any future in-depth work should focus on a specific sub-section of biodiversity technology, or on a single component of the CBD (biological conservation, sustainable resource use or equitable and fair sharing of benefits).

6.2 The role of government initiatives in biodiversity technology transfer: policy frameworks and funding

Our review included fourteen government departments and executive agencies and four research councils with a potential remit in biodiversity technology and its transfer (see Appendix 2). Overall, the different types of biodiversity technology are represented relatively equally across government departments, Government departments are vital in establishing cooperative environments, capacity building and training, and providing funding for technology transfer. DEFRA, the Department for International Development (DFID) and the Foreign and Commonwealth Office (FCO) appear to be the key players in biodiversity technology transfer – the former via the Darwin Initiative, and the latter two via the Overseas Territories Environmental Programme (OTEP). The Department of Energy and Climate Change (DECC) also engages in technology transfer, though with a primary focus on climate technology. The Darwin Initiative is a particularly important source of funding for NGOs and academic research, and so plays a major role in the activities of these sectors in technology transfer. However, quantification of the dependence of NGOs and academia on Darwin Initiative and other relevant government funding for technology transfer projects is complex and beyond the scope of this initial study.

Much of the involvement of research councils in biodiversity technology transfer appears to be indirect via the forging of international research interactions. However, specific calls and programmes which may entail technology transfer do exist, such as the Ecosystems Services for Poverty Alleviation (ESPA) programme which is jointly funded by NERC, ESRC and DFID and which to date had scoping studies and capacity building calls. This programme is focussing on four major regional areas, Southeast Asia, China, Sub-Saharan Africa and Amazonia, all of which are relevant with regard to the CBD and technology transfer. Three of its research themes may be directly relevant to the CBD, focussing on biodiversity, forests and coastal ecosystems. Specific programmes and research calls tailored to include a technology transfer remit can thus play an important role by increasing the involvement of the academic sector in biodiversity technology transfer. Other research councils, such as the Medical Research Council, often have a more peripheral interest in biodiversity technology. In this specific case, the interest lies predominantly in ABS arrangements, such as their implications for access to pathogenic material for medical research. However, in addition to this, the Medical Research Council has been championing open access publishing which is particularly valuable in disseminating research results to a worldwide audience free of charge and can thus play a major part in generating knowledge in other countries. However, in this example, knowledge generation benefits predominantly medical research and not biodiversity conservation, so falls outside the remit of the CBD. Yet similar movements towards open-

access publishing can enhance knowledge transfer for biodiversity conservation, but are such a subtle and indirect form of technology transfer that they may often go unnoticed.

Defra's Darwin Initiative provides the most effective way in which the UK government addresses its obligations of the CBD, and other biodiversity conventions, such as the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and the Convention on Migratory Species (CMS). All projects provide biodiversity technology, since Article 18 of the CBD lies at the core of any Darwin Initiative-funded projects. By assisting countries rich in biodiversity, but poor in financial resources, it has been involved in 95 projects in 2009/10 alone, with a total annual budget of £7 million. Over the years, particular focus has been on projects in Southeast Asia, Eastern and South Africa and parts of South America, as well as projects in the UK Overseas Territories. Funding is mostly aimed at academia and non-governmental organisations, which means that the Darwin Initiative has a particularly large input in technology transfer related to *in situ* and *ex situ* conservation and monitoring of biodiversity. Access and benefit sharing and biotechnology aspects of the CBD, on the other hand, are not well represented, primarily because this does not fall within the direct remit of Article 18, and because ABS activities are most often associated with commercial ventures rather than non-commercial and academic activities.

The Darwin Initiative's project database offers the most comprehensive resource available on biodiversity technology transfer activities from the UK to other countries. Linking this information to the CBD's database on Technology Transfer and Cooperation may provide a simple and effective way to significantly strengthen the CBD's database and give a more balanced overview on transfer from the UK.

ABS activities as set out by the CBD are clearly also very much within the remit of some government departments. However, instead of promoting technology transfer directly, government departments often play an indirect role by promoting awareness about biodiversity issues and relevant conventions such as the CBD. For example, the Intellectual Property Office, while not having any direct involvement in the type of technology transfer described in this review, is engaged in ongoing negotiations to develop international instruments which could protect genetic resources and traditional knowledge from misappropriation using prior informed consent and mutually agreed terms. The Government Office for Science similarly promotes awareness of biodiversity issues instead of providing technology transfer *per se*. Similarly, the Department for Business, Innovation and Science (BIS) funds the UK Research Councils which are involved in biodiversity technology transfer, and ensures that access and benefit sharing is taken into account. The Department of Health is involved in ABS relating to pathogens such as pandemic flu, but these are specifically cut out from the CBD, as human pathogen access issues are controlled by the World Health Organisation (Secretariat of the Convention on Biological Diversity 2011). Integration of the Nagoya Protocol into government departments needs to be made a priority in order to strengthen the UK government's fulfilment of the CBD obligations.

6.3 The role of the academic community in biodiversity technology transfer: the need to tap into repositories of knowledge

A large number of UK academic departments, institutions and research councils have the capabilities and expertise to be involved in international biodiversity technology transfer. The largest contribution of academic departments to biodiversity technology is likely to lie in the transfer of monitoring technology and skills to other CBD signatories. However, they were the least likely to have technology transfer explicitly within their remit. Furthermore, only 24% of academic institutions specifically mentioned involvement in biodiversity technology transfer overseas within their remits. Traditionally, academic institutions are

measured on their publication record, and dissemination of results via the peer-reviewed literature or at conferences presents the main method of sharing knowledge. However, such technology transfer goes generally unrecognised, so that the impact of UK academic research on biodiversity technology transfer may be underestimated. Similarly, UK academia provides training to students from developing countries, transitional economies and overseas territories via degree courses based in the UK, often financed by technology transfer-based schemes such as Darwin fellowships, yet again this contribution may generally go unrecognised and hence is likely to be significantly underestimated.

However, academia appears to be lagging behind in the provision of specific overseas transfer activities, such as direct capacity building, training within the recipient country and technological support, as highlighted during the web-based research (Figure 3). This could reflect a real shortage of transfer activities by academic departments, particularly universities, or a lack of importance given to the reporting of such activities via electronic media such as the internet. If the latter is the case for the lag observed in Figure 3, it becomes apparent that there is an immediate need to increase reporting on biodiversity technology transfer by academia. We know that a number of universities and university departments have in the past received Darwin Initiative funding and therefore have been engaged in biodiversity technology transfer. All major recipients of Darwin Initiative funding were in fact contacted for this study. Unfortunately, response rates to our questionnaire from university departments were very low (overall, only three questionnaire responses came from universities or university departments), so that it was impossible to verify or dismiss the observations from our web-based research. It therefore appears that response rates may have been low as a result of perceived non-involvement in biodiversity technology transfer by the universities and their departments. This could again be a result of the broad definition of technology transfer and could be overcome by a tightening of the definition as well as future studies focussing on specific components of biodiversity technology transfer only.

One way to effectively address the potential shortage of technology transfer coming out of academia is via collaboration with conservation or development NGOs, which can provide the link between academic knowledge and application of this knowledge in the field. As can be seen from this analysis, the building of partnerships can be key to biodiversity technology transfer, with technology transfer firmly established within the remits of such partnerships (Figure 3). Similarly, section 5.3 showed that the interplay between academic research and in-field activities can greatly enhance biodiversity technology and its transfer to field situations. Similar examples can be found in organisations which work along similar lines, combining academic conservation research with what traditionally is the work of NGOs, i.e. direct action in the field.

A number of academic departments are directly involved in pertinent technology transfer, specifically via linking into NGO work. For example, the Centre for Wetlands, Environment and Livelihoods (CWEL), based at the University of Huddersfield, is involved in work undertaken collaboratively with universities and NGOs in the European Union and developing countries. It specialises on providing training and research on sustainable use of wetland ecosystems, which was initially aimed at Eastern and Southern Africa. Other examples of biodiversity technology transfer involve organisations which are primarily scientific institution, but with a much wider-reaching remit than pure research, e.g. botanic gardens, museums, and zoos. Similar integration of research and applied work in the field need to be encouraged via the strengthening of academic and NGO partnerships.

6.4 The role of NGOs: biodiversity technology transfer in action

Non-governmental organisations working in conservation and field training make up the bulk of overseas technology transfer initiatives in the UK, with a particular focus on *in situ*

conservation and biodiversity monitoring. Provision of training and capacity building appears to be the main focus of technology transfer throughout. Some NGOs, such as Fauna and Flora International (see section 5.1), have been running a large number of capacity-building projects in different parts of the world, and under different prevailing circumstances. Clearly, there is no better repository of knowledge on the actions and approaches which facilitate successful biodiversity technology transfer than the large number of UK NGOs working on biodiversity-related issues. Similarly, NGOs also hold immense knowledge on how to adapt best practice to local circumstances.

While academic institutions are measured against publication output, NGOs are rated by the long-lasting success of their projects. As such, NGOs are aware that the most important aspect of their work is to create long-term legacies, and these can only be achieved via effective technology transfer to in-country practitioners or NGOs. In the survey, several respondents stated explicitly that workshop scenarios and encouragement of direct peer-to-peer exchange provide the best means of technology transfer. Conservation programmes such as ZSL's EDGE (Evolutionary Distinct and Globally Endangered) programme are particularly successful when good relationships are established between the donor and recipient of technology transfer, often through direct contact at workshops and training courses.

However, because of restricted resources, there is a limit to the number of people who can receive technology via direct workshop training. Online learning and the development of web-based technology for resource provision can help to deliver technology to a wider audience. In essence, there is no single approach to technology transfer for capacity building. However, best practice guidelines and case studies from NGO work may provide a very useful resource from which other sectors which are less experienced in biodiversity technology transfer can draw from.

6.5 The role of business and industries: implementing the Nagoya Protocol

More than half of all the businesses included in this study stated an involvement in technology transfer that may be relevant to the CBD. They are the most likely candidates for involvement in access and benefit sharing mechanisms and are providing much of their technology transfer via technological support and training. However, despite this potentially vital role in ABS, there was a comparatively low response rate from the business sector to our survey. This may be partly due to the fact that the Nagoya Protocol, which was only agreed in late 2010, still has to be fully translated into action. Another factor may be that biodiversity technology transfer provided by the business sector may still go largely unrecognised. For example, good business practice, implemented for financial reasons and therefore with the potential to go unnoticed, may in fact entail biodiversity benefits by providing incentives for sustainable use, as well as providing alternatives to activities which may be harmful for biodiversity. With the agreement of the Nagoya Protocol, it is of particular importance to effectively implement ABS as part of business practice of industries working with genetic resources and to establish a reporting mechanism with which to inform CBD targets relating to ABS agreements.

6.6 Conclusions

Existing biodiversity technology transfer initiatives in the UK cover the whole spectrum of biodiversity technology components and employ many different techniques to enable technology transfer. Biodiversity technology transfer also involves a large range of different UK sectors, mirroring the broad definition of what biodiversity technology entails. As such, the UK effort to provide biodiversity technology transfer to less developed countries is already highly significant, broad-ranging and involves a multitude of sectors. CBD-focussed schemes such as the Darwin Initiative no doubt play a major role in funding such

activities, particularly in terms of securing NGO and academia involvement in technology transfer. Overall, the main conclusions from this first review on biodiversity technology transfer initiatives in the UK relate to the subjects of definition of biodiversity technology transfer, the structure of biodiversity technology transfer within the UK, and the potential to enhance such activities via increased coordination and cooperation.

1. ***The definition of biodiversity technology transfer.***
   The definition, as given by the CBD and used in this light touch review, includes a wide and varied field of activities all of which may be considered to be part of biodiversity technology. This broadness of the subject matter is likely to allow for multiple interpretations by different stakeholders as to what biodiversity technology entails and hence affect any overall findings of studies such as this review. Similarly, it has become apparent from conversations with representatives of various different organisations, that biodiversity technology is as of yet a little understood subject. This holds particularly true for the roles of soft technologies and ABS in technology transfer. In order to push forward transfer initiatives which are beneficial to halting biodiversity loss, it is vital that the concept of biodiversity technology is widely promoted. Furthermore, for the purpose of the CBD and reporting on biodiversity technology transfer initiatives by signatories, it would be advisable to revise the current definition of biodiversity technology or clearly define sub-components of biodiversity technology on which to base reports. Similarly, any future in-depth reviews building on this current work should focus on specific sub-components of biodiversity technology, or on a single component of the CBD (biological conservation, sustainable resource use or equitable and fair sharing of benefits), particularly since crossing over of stakeholders between access and benefit sharing and any of the other components of the CBD is likely to be minimal.

2. ***Large existing involvement of UK bodies could be improved by increased co-ordination.***
   There is a large existing pool of biodiversity technology transfer initiatives originating from the UK, involving a range of different sectors and funding streams (though the Darwin Initiative is the major player in funding of biodiversity technology transfer), as well as different levels of involvement by different bodies (from indirect promotion of biodiversity issues relating to the CBD and encouragement of cooperative work to project funding and active dissemination of technology and knowledge). These findings corroborate the expected involvements of different UK sectors and bodies as schematically shown in Figure 1. However, coordination of efforts could enhance biodiversity technology transfer services provided, by providing direct linkages between the different sectors involved. Increased coordination between UK funding bodies would limit the amount of duplication in research, increase synergies between domestic researchers and, as a result, may aid facilitation of technology transfer with overseas partners. Additionally, better coordination of UK technology transfer efforts may help to place more emphasis on technological cooperation with the BRIC countries (Brazil, Russia, India and China). These large emerging economies provide an increasingly important platform with which the UK needs to engage with specifically with the large scope for cooperative biodiversity technology research and development.

   NGOs have a large repository of expertise in *in situ* transfer which can provide potentially less involved sectors, such as the academic sector, with guidance on how to engage efficiently in technology transfer to less developed countries. Similarly, partnerships between NGOs and academia should be encouraged to enable most effectively the transfer of academic knowledge to on-ground action, by combining academic rigor with long-term outreach. Following the agreement of the Nagoya Protocol in late 2010, it is also vital to further promote the implementation

of the protocol in order to encourage biodiversity technology transfer and reporting of such transfer from currently less visible sectors, such as industry.

3. ***Assessing the effectiveness of biodiversity technology transfer from the UK is the next step.***
   This initial review has specifically not addressed the effectiveness of biodiversity technology transfer initiatives. However, this represents the next logical step towards a complete understanding of existing biodiversity technology transfer originating from the UK and should be addressed in the future. The Darwin Initiative database contains a wealth of information on how to achieve biodiversity technology transfer most effectively, particularly with regard to the two CBD components covered in Article 18 on Scientific and Technological Cooperation; biological conservation and sustainable use of biological resources. This could provide a first-stop repository for background information on the effectiveness of initiatives. However, in order to ensure best possible results in an effectiveness study, it should be considered to focus on specific sub-components of biodiversity technology, or on a single component of the CBD, as suggested under point 1 above.

4. ***The value of an overarching biodiversity technology transfer initiative.***
   The results of this initial rapid and light-touch review of biodiversity technology transfer originating from the UK suggest that the effectiveness of a centralised biodiversity technology transfer initiative, for example similar to the Climate Technology Initiative (CTI), would be seriously affected by the CBD's broad definition of biodiversity technology and the number of different organisations and initiatives involved in biodiversity technology transfer. It is highly likely that the broadness in remit of an all-encompassing biodiversity technology transfer initiative would make this body difficult to operate in practice, unless the broad concept of biodiversity technology and its transfer is more widely promoted and understood and integrated into cooperative initiatives between the different sectors. Alternatively, reworking of the definition of biodiversity technology may help in overcoming this problem. Other workable solutions could include the splitting off of ABS-related technology transfer, which often falls outside the general understanding of what technology transfer entails. ABS-related technology transfer could be addressed by a separate body with access to the vast knowledge on technology transfer generated by organisations involved in biodiversity conservation or sustainable use of resources.

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Appendix 1 – questionnaire to organisations

Web: www.defra.gov.uk

13th April 2011

Dear Sir/Madam,

Re: Biodiversity Technology Transfer Project Quick Questionnaire

At the 10th Conference of Parties (COP) of the Convention on Biological Diversity (CBD) in Nagoya in October 2010, the decision was made to look into the possible establishment of a Biodiversity Technology Initiative, which would aid the transfer of technology between countries – in particular to developing countries and countries with transitional economies. As part of this decision, an invitation was made to signatories of the CBD to submit information on already existing biodiversity technology transfer initiatives. The review we are carrying out is the first step in evaluating what initiatives are already out there, which countries receive this transfer, the scope of the initiatives, their funding arrangements etc. and which UK organisations and research institutes are involved in biodiversity technology transfer.

As part of this research, DEFRA has commissioned a survey, carried out by the Institute of Zoology, to establish the breadth of biodiversity technology capacity available in the UK, and the scope of any existing transfer activities pertinent to biodiversity technology. This will allow a rapid assessment of what kinds of technology are available, how transfer of these technologies is achieved, the geographic regions receiving biodiversity technology, the scale of any such transfer initiatives, the part of biodiversity these initiatives are targeting, and any existing cooperation between UK institutions to deliver biodiversity technology transfer. This information will then be fed to the Convention on Biological Diversity (CBD) in order to inform the potential for establishing a Biodiversity Technology Transfer Initiative to coordinate and facilitate best practice technology transfer.

Your institution was selected for this **voluntary survey** because of its involvement in one or more of the distinct fields which potentially contribute to biodiversity technology transfer: conservation/biodiversity research/sustainable management/biotechnologies/ access and benefit sharing. Ideally, the survey should be completed by a suitable member of your team who is involved in biodiversity technology and its transfer.

The survey should take no longer than 20 minutes to complete. We appreciate that in some cases, many different projects and schemes may be run by a single organisation, in which case it would be sufficient to highlight a representative project for the organisation's involvement in biodiversity technology transfer. Please state that this is the case. **To complete the survey please visit *http://www.surveymonkey.com/s/RZQPR3V*. Please could you look to complete the survey before 19th April 2011.**

The data in this survey is collected and collated by the Institute of Zoology on behalf of DEFRA. The data will be stored in accordance with the Data Protection 1998 Act. The data will be used and published on Defra research web pages as part of the project titled "Rapid Review of Biodiversity Technology Transfer" and in a scientific publication in an appropriate academic journal.

If you have any questions regarding the survey please contact **Dr Monika Böhm on +44 (0)20 7449 6676.**

Yours faithfully,

Dr Ana Delgado

Questionnaire: Rapid Review of UK Biodiversity Technology Transfer Initiatives

At the 10th Conference of Parties (COP) of the Convention on Biological Diversity (CBD) in Nagoya in October 2010, the decision was made to push forward a Biodiversity Technology Initiative, which would aid the transfer of technology between countries – in particular to developing countries* and transitional economies**. As part of this decision, an invitation was made to signatories of the CBD to submit information on already existing biodiversity technology transfer initiatives. The review we are carrying out is the first step in evaluating what initiatives are already out there, which countries receive this transfer, the scope of the initiatives, their funding arrangements etc. and which UK organisations and research institutes are involved in biodiversity technology transfer.

* developing countries, as defined by the World Bank, includes all low to middle income (by Gross National Income) countries

** transitional economies are countries whose economy is undergoing transformation from centrally planned economy to a free market

Definitions:

We realise that biodiversity technology is a wide-ranging concept, incorporating hard and soft technologies from a large range of fields. In the context of this survey, we use the following broad definitions:

Biodiversity technology: Technology, techniques and concepts which aid the conservation of biodiversity, relating to:

i. In-situ and ex-situ conservation;
ii. Sustainable management of biodiversity resources;
iii. Monitoring techniques;
iv. Modern biotechnologies using genetic resources;
v. Benefit sharing and access to research results.

Biodiversity technology transfer: the sharing of technology between two or more parties, by means of:

i. Support for technology needs assessments and regulation including capacity-building for technology assessments;
ii. Pertinent capacity-building and training courses;
iii. Pertinent seminars and symposia;
iv. Information dissemination;
v. Other implementation activities including match-making and catalysing or facilitating the establishment of research-centre networks, alliances or consortia, joint ventures, twinning arrangements, or other proven mechanisms, on technologies of relevance to the Convention.

Section 1. Organisational background

Q1.1 Organisation name, contact name and email address:

Q1.2 Which of these best describes your organisation?

- ❑ Governmental
- ❑ Academic
- ❑ Charity
- ❑ NGO
- ❑ Multi-organisation partnership
- ❑ Business
- ❑ Consultancy
- ❑ Other (please specify):

Section 2. Areas of biodiversity technology and means of transfer

Q2.1 In which of these biodiversity technology areas is your organisation involved in?

- ❑ In situ/ex situ conservation
- ❑ Monitoring techniques
- ❑ Sustainable management of resources
- ❑ Modern biotechnologies using genetic resources
- ❑ Benefit sharing and access to research results
- ❑ Other (please specify)

_____

_____

_____

Q2.2 How does your organisation engage in biodiversity technology transfer?

- ❑ Technological support
- ❑ Capacity building and training
- ❑ Project funding
- ❑ Specific seminars or workshops
- ❑ Facilitating networks, cooperative work, etc.
- ❑ Other (please specify)

_____

_____

_____

Section 3. Geographical coverage of biodiversity technology transfer

Q3.1 Where are technologies transferred to, by geographical region?

- ❑ Worldwide
- ❑ Africa
- ❑ Asia
- ❑ Australasia
- ❑ South America
- ❑ Central America & Caribbean
- ❑ North America
- ❑ Europe
- ❑ UK Overseas Territories
- ❑ Other

Please specify recipient countries, if possible:

_____

_____

_____

Section 4. Scale of involvement in biodiversity technology transfer

Q4.1 How long has your organisation been running activities incorporating biodiversity technology transfer (give number of years)?

a) To developing countries* or transitional economies**:
b) To UK overseas territories:
c) Elsewhere:

Q4.2 Please provide information to the following questions in the text box below.

a i) Please give the approximate total number of projects your organisation was involved with in 2009/10?

a ii) Please give the approximate total number of projects specifically incorporating biodiversity technology transfer (by any of the methods stated on page 2) your organisation was involved with in 2009/2010.

b i) What is the approximate overall size of your organization in full time equivalents?

b ii) Approximately how many full time equivalents in your organization are involved in biodiversity technology transfer?

c) Please comment on the mechanisms which your organisation has found successful in facilitating biodiversity technology transfer and explain why you think they have been successful

Section 5. Representation of biodiversity components in technology transfer

Q5.1 Which part of biodiversity or ecosystem is targeted by your organisation' biodiversity technology transfer schemes?

- ❑ All parts of biodiversity
- ❑ Animals
- ❑ Plants
- ❑ Fungi
- ❑ Genetic resources
- ❑ Other (please specify)
- ❑ Terrestrial systems
- ❑ Freshwater systems
- ❑ Marine systems
- ❑ Ecosystem services

Section 6. Funding of biodiversity technology transfer

Q6.1 Please specify the funding source for your biodiversity technology transfer projects and - if possible - give a rough estimate of the average spending on biodiversity technology transfer components per project.

Section 7. UK partnerships for biodiversity technology transfer

Q7.1 Do your biodiversity technology transfer projects involve other UK partners?

- ❑Yes
- ❑No

If yes, please specify which organisations and their type of involvement.

Appendix 2. List of organisations/partnerships/governmental and research institutions which may play a role in biodiversity technology transfer and which were included in this review.

Organisation name	Sector	Activities	Based at
Aberdeen Marine Laboratory	Academic	Research	
Aspinall Foundation	NGO	Conservation	Howletts Zoo
Aviagen	Business	Poultry genetics	
Biodiversity Indicators Partnership	Multi-organisation partnership	Research	
Biodiversity Institute	Academic	Research	Oxford University
BioDiversity International Ltd.	Business	Consulting	
Bioscience Knowledge Transfer Network	Network	Knowledge Transfer	Bioscience Network Ltd
Biotechnology and Biological Sciences Research Council (BBSRC)	Research council	Funding	
Botanic Gardens Conservation International (BGCI)	Multi-organisation partnership	Conservation/Education	
Bristol Conservation and Science Foundation	NGO	Research/Conservation	Bristol Zoo
British American Tobacco Biodiversity Partnership	Multi-organisation partnership/business	Conservation	
British Antarctic Survey (BAS)	Academic	Research	NERC
British Council	NDPB	International relations	
British Ecological Society (BES)	Academic	Research	
British Society for Plant Breeders Ltd (BSPB)	Business	Industry representation	
British Trust for Ornithology (BTO)	NGO	Research	
CABI	NGO	Research/Education	
Cambridge Cluster	Business	Biotechnology	
Cambridge Conservation Initiative	Multi-organisation partnership	Research	University of Cambridge
Centre for Agri-Environmental Research	Academic	Research	University of Reading
Centre for Ecology and Hydrology (CEH)	Academic	Research	NERC
Centre for Ecology, Evolution and Conservation (CEEC)	Academic	Research	University of East Anglia
Centre for Environment, Fisheries and Aquaculture Science (CEFAS)	Executive agency	Research	DEFRA
Centre for Marine Biodiversity and Biotechnology	Academic	Research	Herriott Watt University
Centre for Middle Eastern Plants (CMEP)	Academic	Research	Royal Botanic Gardens Edinburgh
Centre for Wetlands, Environment and Livelihoods (CWEL)	Academic	Research	University of Huddersfield
Chester Zoo	NGO	Research/Conservation	
Commonwealth Foundation	Governmental	Education	Commonwealth Secretariat
Darwin Initiative (DI)	Governmental	Funding	

Organisation name	Sector	Activities	Linked to
Department for Business, Innovation and Skills (BIS)	Governmental	Industry representation	
Department for International Development (DFID)	Governmental	Development	
Department of Health	Governmental	Health care	
Durrell Institute of Conservation and Ecology (DICE)	Academic	Research	University of Kent
Department of Energy and Climate Change	Governmental	Climate change strategy	
Durrell Wildlife Conservation Trust	NGO	Conservation	Jersey Zoo
Economic and Social Research Council (ESRC)	Research council	Funding	
Ecosystem Services for Poverty Alleviation (ESPA)	Programme	Research	NERS, ESRC, DFID
Edinburgh Consortium for Rural Research (ECRR)	Multi-organisation partnership	Facilitation	
Environmental Change Institute (ECI)	Academic	Research	University of Oxford
Fauna and Flora International (FFI)	NGO	Conservation	
Field Studies Council (FSC)	NGO	Training, education	
Food and Environment Research Agency (FERA)	Executive agency	Research	DEFRA
Foreign and Commonwealth Office (FCO)	Governmental	International relations	
Global Crop Diversity Trust	NGO	Conservation	
Government Office of Science	Governmental	Science representation	
HTSPE	Business	Consulting	
Institute of Zoology (IOZ)	Academic	Research	ZSL, University of Cambridge
Imperial College London, Life Sciences	Academic	Research	
Institute of Biological, Environmental and Rural Sciences (IBERS)	Academic	Research	Aberystwyth University
Intellectual Property Office (IPO)	Governmental	Intellectual Property	Department for Business, Innovation & Skills
International Biocontrol Manufacturers Association	Business	Industry representation	
International Institute for Environment and Development (IIED)	Academic	Research	
International Union for the Conservation of Nature (IUCN)	Intergovernmental organisation	Research/Conservation	
John Innes Centre (JIC)	Academic	Research	
Joint Nature Conservation Committee (JNCC)	Governmental	Conservation	
Living with Environmental Change (LWEC)	Programme	Research	
Macaulay Land Use Research Institute (MLURI)	Academic	Research	
Marine Conservation Society (MCS)	NGO	Conservation	
Marine Resources Assessment Group (MRAG)	Business	Consulting	
Marwell Wildlife	NGO	Conservation	
Medical Research Council (MRC)	Research council	Funding	
Millennium Seed Bank	Academic	Conservation	Royal Botanical Gardens Kew
National Museum Wales	Academic	Research	

Organisation name	Sector	Activities	Linked to
National Museums Scotland	Academic	Research	
Natural Environment Research Council (NERC)	Academic	Funding	
Natural History Museum (NHM)	Academic	Research	
Natural Resources Institute	Academic	Research	University of Greenwich
Oceanlab	Academic	Research	University of Aberdeen
Ornamental Aquatic Trade Association Ltd (OATA)	Business	Industry representation	
Overseas Development Institute (ODI)	Academic	Research	
Overseas Territories Environmental Programme (OTEP)	Programme	Conservation	FCO, DFID
Plymouth Marine Laboratory	Academic	Research	
Research Into Use (RIU)	Programme	Research	DFID
Rothamsted Research/International	Academic/business	Research	BBSRC
Royal Botanic Gardens Edinburgh (RBGE)	Academic	Research/conservation	
Royal Botanic Gardens Kew	Academic	Research/conservation	
Royal Horticultural Society (RHS)	NGO	Research, education	
Royal Society	Academic	Research	
Royal Society for the Protection of Birds (RSPB)	NGO	Research/Conservation	
Royal Zoological Society of Scotland	NGO	Research/Conservation	Edinburgh Zoo
Save the Rhino	Charity	Conservation	
Rufford Foundation	NGO	Funding	
Russell Group	Academic	Research	
Save the Rhino	NGO	Conservation	
School of Ocean Science	Academic	Research	University of Bangor
Scottish Agricultural College (SAC)	Academic	Research	
Scottish Agricultural Science Agency (SASA)	Governmental	Scientific advice	
Sir Alister Hardy Foundation for Ocean Science	NGO	Research	
Southampton Marine Laboratory	Academic	Research	
Technology Strategy Board	NDPB	Technology innovation	
The David Shepherd Wildlife Foundation	NGO	Conservation	
The Hawk Conservancy Trust	NGO	Conservation	
The Orang Utan Foundation	NGO	Conservation	
TRAFFIC	NGO	Conservation	WWF, IUCN
Treweek Environmental Consultants	Business		
Tropical Biology Association (TBA)	NGO	Research	
UK Collaborative on Development Science (UKCDS)	Multi-organisation partnership	Research	
UK Overseas Territories Association	Network	Facilitation	

Organisation name	Sector	Activities	Linked to
UK Overseas Territories Conservation Forum (UKOTCF)	Multi-organisation partnership	Conservation	
University of Bangor, Environment, Natural Resources and Geography	Academic	Research	
University of Birmingham, School of Biosciences	Academic	Research	
University of Cambridge, Zoology	Academic	Research	
University of Edinburgh	Academic	Research	
University of Leicester, Molecular Cytogenetics Research	Academic	Research	
University of Oxford, Plant Sciences	Academic	Research	
University of Sheffield, Animal & Plant Science	Academic	Research	
University of York, Department of Biology	Academic	Research	
Wellcome Trust	NGO	Research	
Whitley Wildlife Conservation Trust (WWCT)	NGO	Research/Conservation	Paignton/Newquay Zoo, Living Coasts
Whitley Fund for Nature	NGO	Funding	
WildCRU	Academic	Research	University of Oxford
Wildfowl and Wetlands Trust (WWT)	NGO	Conservation	
World Conservation Monitoring Centre (WCMC)	Intergovernmental organisation	Research	United Nations Environment Programme
Zoological Society of London (ZSL)	NGO	Conservation/Education	

Appendix 3. Additional organisation which may be of interest for future research and which have been involved in Darwin Initiative projects.

A Rocha International
Aberystwyth University
African Conservation and Development Foundation
AMBIOS
Anglia Ruskin University
Bees for Development
BioNet International (Egham)
British Bryological Society
Bucks New University
Buglife
Butterfly Conservation
Cardiff University
Coral Cay Conservation
Cranfield University
Earthwatch Institute
East Malling Research
Eden Project
Education for Conservation Ltd
Elephant Family
Falklands Conservation
Federation of Zoological Gardens of GB and Ireland
Field
Fieldfare International Ecological Development
Forest Peoples Programme
Foundation for Ethnobiology
Friends of Conservation - UK
Galapagos Conservation Trust
Game Conservancy Trust
Garden Africa
Garden Organic, formerly HDRA
Global Canopy Programme GCP
Global Diversity Foundation
Grasslands Trust
Harrison Institute
HTS Consultants
Imperial College
King's College London
LEAD UK
Living Earth Foundation
Manchester Met University
Nature Conservation Bureau
Open University
Operation Wallacea Trust
Overseas Development Institute
Oxford Brookes University
Queens University Belfast
Raleigh International
Roehampton University
Royal Geographical Society
Royal Holloway University of London
Scientific Exploration Society
Sir Alistair Hardy Foundation for Ocean Science
Sir Harold Hillier Gardens and Arboretum
Society for Environmental Exploration/Frontier
Swansea University
TRACE Wildlife Forensic Network
Transrural Trust
Tree Council
Tusk Trust
University College London
University of Bournemouth
University of Bradford
University of Brighton
University of Bristol
University of Cumbria
University of Dundee
University of Durham
University of Essex
University of Exeter
University of Glasgow
University of Hull
University of Lancaster
University of Leeds
University of Liverpool
University of London Marine Biological Station
University of London QMUL
University of London Wye
University of Loughborough
University of Newcastle
University of Nottingham
University of Plymouth
University of Portsmouth
University of Southampton
University of St Andrews
University of Stirling
University of Strathclyde
University of Sunderland
University of Sussex
University of Wales
University of Wales, Swansea
University of Warwick
Wales Environment Research Hub
Wild Resources Ltd
Wildlife Vets International
World Pheasant Association
WWF – UK