Repatriation of biodiversity information through Clearing House Mechanism of the Convention on Biological Diversity and Global Biodiversity Information Facility; Views and experiences of Peruvian and Bolivian non-governmental organizations

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This Master's thesis is about repatriation of biodiversity information or in other words information sharing with countries of origin. The actual definition of repatriation is returning of an entity to its country of origin, but this Master's thesis only considers repatriation of biodiversity information and data. Reasons and demands for repatriation of biodiversity information are rooted deep in the history. Since the European colonisation of most of the rest of the world the developing megadiversity countries have lost a lot with biopiracy, and it seems only fair to give back to them as much as possible. Repatriation has many potential benefits to the whole scientific community, but also faces series of problems and hurdles including the lack of funds and technology. Successful repatriation effort usually involves capacity building and other related efforts, and often repatriation is a component of a larger process. Most of this Master's thesis is based on scientific literature, articles, Memoranda of Understanding, reports and the Convention text. Roles of CHM of CBD and GBIF in repatriation are analyzed. Also ENBI, IABIN and cooperation of the organizations are studied. A questionnaire survey study is included. It studies the views and experiences of Bolivian and Peruvian NGOs on repatriation, CHM and GBIF. The results support the previous studies by showing that a great amount of interest exists for repatriation, but the actual experience is still minimal. NGOs had some knowledge on CHM and equally on GBIF, which proves that the OCB of GBIF has already reached some of its goals making the GBIF known to the world.

CONTENTS

1. Introduction

1.1 Studying the world's biodiversity

Biodiversity is essential to maintain life on Earth, and should be highly valued. So far approximately 1.75 million species have been described (Bisby 2000, UNEP 2000c). Most of them are small species, such as insects (UNEP 2000c). The taxonomists and systematists estimate the real number of species to be about 10-13 million, but the estimates range from 3 to 100 million, or even up to 200 million (Stork 1988, Edwards *et al*. 2000, UNEP 2000c, Wilson 2000). The real number can only be guessed to the nearest magnitude. Biodiversity assessments are limited to a few taxonomically relatively well-known and highly visible groups, such as the vascular plants, vertebrates and a small number of invertebrates like corals and butterflies. Further, the number of species profoundly studied for conservation purposes for instance, is minimal. (Wilson 2000.) To find, describe and classify all the surviving species of the world deserves to be one of the greatest scientific goals of the century, but there are very few people actually doing the job. A mismatch exists between the geographical locations of taxonomists and biodiversity (Gaston & May 1992). According to a survey by the Association of Systematic Collections, in North America only 3000 Ph.D.-level researchers are active in the exploration and description of the world's fauna and flora (Wilson 2000). In addition, most existing biodiversity information is not dynamically accessible in digital format. To be able to use biodiversity information to its full potential, for both scientific and societal applications, it will be crucial to digitize the primary species- and specimen-level biodiversity data and to make these data available in an integrated shared information infrastructure. This is a complex task and there are

many organizations involved. It is also essential to coordinate and prepare for exciting future applications when biodiversity data can be studied in combination with data from other information domains such as molecular sequences, climate or geography. (ENBI 2002.)

1.2 Using the biodiversity information data

Despite of the relatively few species described, the accumulated volume of biological information and data collected over the past 250 years is massive (Blackmore 2002). Approximately three billion specimens of organisms are held in the world's natural history collections (Edwards et al. 2000, Schnase *et al*. 2003). Specimens should include associated data, including, at the minimum, the scientific name of the specimen, when and where it was collected and by whom, but in reality many old specimens do not hold any associated information or only the country or the continent of origin (Ilari Sääksjärvi 2004, personal communication). Some specimens have other kinds of associated information, including pointers to other physical samples derived from the specimen (e.g. frozen tissues, DNA extracts, hosts, and parasites), photographs, recordings of mating calls or other behavior and the field notes of the collectors. (Edwards *et al*. 2000). Retrospective digitization of collections requires most investment, that is, digitizing already existing, sometimes very old, collections that only have hand-written associated data on them. Type specimens (specimens that serve as a permanent reference point to a scientific name) and access to their images is one of the highest priorities. (Blackmore 2002.) The development of scientific methods and the establishment of new scientific disciplines have, in a stepwise historical process, interactively enhanced our ability to further apply old biodiversity data (Laihonen 2003).

Improving methods for organizing, storing and retrieving the collection records is extremely critical (Edwards *et al.* 2000). Digitization of biological collections ought to be considered a top-priority. For example, over 750 million specimens and their accompanying data and metadata remain to be digitized in the United States alone (Schnase *et al*. 2003). Thus, in most cases, the only way a potential user can find out about the data is to travel physically to the place where the specimen is housed, or to contact the repository where a relevant specimen may be housed, and to borrow it (Edwards *et al.* 2000). Digitization of collection data has many potential benefits, including repatriation of information to the countries of origin, which is the topic of this Master's thesis.

Although the collection of data is an important and a necessary task, it has to be kept in mind that the data alone does not add to the knowledge about biodiversity. For that, it is important to have the tools that make the information useful to the politicians, decision makers and other interested parties. Information on biological diversity is found mainly in published scientific books and articles, in the minds of the specialists and at the centers of knowledge, which are the research institutes and universities. Metadata that provides describing information of the institutions involved is also important. The information is widely dispersed, and its' collection and maintenance can be difficult. (BIODAMAZ 2001a.) Thus far we know only little about the generation of knowledge and wisdom through Internet-based biodiversity information clearing-houses, since all information systems in this field are young (Laihonen *et al.* 2004). Along with the increasing weight of biodiversity issues in international policy, biodiversity information has become increasingly relevant for many other interest groups besides scientists (Laihonen 2003). As data is used in complex and potentially controversial political,

economic and environmental discussions and decision-making, issues of data security, data sharing policies, intellectual property rights, quality assurance and reuse of data should be considered (Schnase *et al.* 2003). One of the big obstacles is the lack of access to information in the reach of the users in a rapid, efficient and economical form. This causes that planning, decision making, environmental education and many other tasks lack the technical input that could be reached from the original sources of information. (BIODAMAZ 2001b.) Historical data from collections already play a powerful role in planning and development for example in Mexico and could do so universally. Biological collections may represent an inadequate sample of past and present biota, but they are the only identified and authenticated samples available. Biological recording and collections are complementary, not competing, sources of knowledge about the world, with the latter enabling repeatable observations and entirely new kinds of investigation. (Blackmore 2002.) Ultimately, for science to continue building and progressing, flow of data and information must not be restricted or conditioned. Furthermore, conservation of biodiversity must also be linked to sound policy making, which in turn, requires solid scientific foundations to which information and data networks significantly contribute. As a general principle, the Convention on Biological Diversity (CBD), and other international instruments, recognize that the generation and exchange of information is a key and critical instrument through which conservation and sustainable use of biodiversity can be supported, enhanced and ultimately, achieved. (Ruiz 2004.)

1.3 Reasons for repatriation

Repatriation is an issue of considerable and growing interest in the realm of biodiversity. Most of the world's biological diversity is found in the tropics, and therefore in developing countries. (Ruiz *et al*. 2000.) These biodiversity-rich, the so called megadiversity countries (Mittermeir *et al.* 1997) , often lack detailed information about their biodiversity resources, whereas countries holding most of the world's biodiversity information are usually situated in biodiversity-poor areas (Gaston & May 1992, Laihonen *et al*. 2000). Scientific information about biodiversity is largely concentrated in major centers in developed countries, especially in the scientific collections of the world's natural history museums, herbaria and microorganism repositories. At present it is more likely that information on the plants of a particular part of Africa is stored in a herbarium in Europe, for example, than in its source country. (Edwards *et al*. 2000.) These developed country institutions maintain samples of a considerable portion of the world's known biodiversity, as well as data and information related to it, of which a significant portion has been obtained from developing countries. (Ruiz *et al*. 2000.) About 70% of existing biodiversity information is estimated to lie in the possession of the OECD countries (Laihonen *et al*. 2002). The division between megadiversity countries as possessors of biodiversity resources and the OECD countries as biodiversity information holders is well recognized in several connections. Due to this disparity and since there are major expectations in utilitarian benefits of biodiversity, both from the point of view of environmental conservation per se and its commercial outcomes, the issue of global biodiversity information, including repatriation of information, is gaining increasing weight as a scientific and a political matter. This is expressed in a variety of

manifold international biodiversity information projects and initiatives emerged during the last decade. (Laihonen *et al*. 2004.)

The situation of division is the result of many years of movement and flows of biological resources or their components from one continent to another (Ruiz *et al.* 2000). As former colonial powers, many OECD countries possess biological collections with material from megadiversity countries dating back to as far as the 18th century (Laihonen *et al.* 2002). The origins are in European exploration and colonization of much of the rest of the world, which began in earnest in the 16th century and coincided with the rise of natural sciences as a major pursuit in the West. The collections have been maintained and used for research in some cases for well over centuries. The wealth of knowledge, expertise and know-how generated over the years in the institutions has proved critical for the development and advancement of natural sciences worldwide. It has also enhanced the national capacities of the countries in which these institutions are based. (Ruiz *et al.* 2000.) Since the collections hold potentially important information usable in exploitation of biodiversity today, the issue of repatriation of information to countries of origin has been raised. This has caused political contradictions in major international processes, such as ratification and implementation of the CBD, or preparation of the Global Biodiversity Assessment. (Laihonen *et al*. 2002.) An important part of the biodiversity debate involves access to and sharing of the benefits arising out of the commercial and other utilization of genetic material. Historically, plant genetic resources were collected for commercial use outside their region of origin or as inputs in plant breeding. Foreign bioprospectors have searched for natural substances to develop new commercial products. Often, the products would be sold and protected by patents or other intellectual property rights, without fair benefits to the source countries. (UNEP

2000c.) Genetic resources were considered as a common heritage of mankind. The CBD now recognizes biodiversity as a common concern of mankind instead of common heritage (UNEP 1992h). Since the signing of the CBD, the developing countries that before did not demand any collection permits, have become aware of the need to protect their genetic heritage, and have set laws on research and collecting of specimens (Pohja 2002).

1.4 Repatriation today

Repatriation of biodiversity information is already happening. For example, most type specimens of the birds in Mexico, and the accompanying descriptive and ecological data, are held in museums in United States, Canada and Europe. The World Bank funded a project to transfer that data to Mexico, and the relevant Mexican authorities used the information to plan conservation areas to secure the future of the birds. (Thwaites 1998.) Also many *ex situ* institutions are likely to be carrying out various activities (e.g. data dissemination or technology transfer) that can be a form of repatriation, or have a repatriation component (Ruiz *et al*. 2000). Recent international agreements such as the CBD and the Global Biodiversity Information Facility (GBIF) have called for increased mutual transfer of biodiversity and biotechnology between poor and rich countries. In recent years, instruments enforcing intellectual property rights (IPRs), such as patents and trade secrets, have received attention as mechanisms by which biodiversity resources may be maintained while promoting sustainable development and more equitable distribution of the resulting benefits among nations. Most of the world's biodiversity-rich countries are developing countries and lack the necessary technologies to transform biological resources into products yielding significant measurable benefits.

With little or insignificant *in situ* market value, biodiversity rich wildlands may be expected to succumb to pressure from development activities. (Bhat 1999.) In many circumstances, data and information are closely linked to private enterprises and economic benefit, as potentially useful commercial or industrial products may be derived from them. These products may subsequently be exploited, often with no or limited recognition of the sources of data and information, and the data sources or providers may be excluded from the economic benefits generated through the use of the data. (Ruiz 2004.) Intellectual property rights including repatriation of biodiversity information about material collected from biodiversity-rich areas have become a crucial topic at a general political level in the relations between the developing and industrialized world. (Laihonen 2003.)

A number of international initiatives has been made to improve the accessibility of the world's biodiversity data and information using tools provided by modern information and communication technologies. In this Master's thesis I have chosen to study especially the Clearing House Mechanism (CHM) of the Convention on Biological Diversity (CBD) and the Global Biodiversity Information Facility (GBIF), and their roles in repatriation of biodiversity information. CHM and GBIF are both important initiatives using mainly the Internet as a biodiversity information distribution method. The CHM is clearly a policy-related initiative with adjoining administrative procedures and traditions, whereas the GBIF has emerged from scientific and economic interests represented by the initiating organization and its member countries. Due to these differences, the CHM is run mainly by administrators and politicians and focuses on conservation and sustainable use of biodiversity, while GBIF is governed mostly by the scientific community and emphasizes economic growth and social outcomes. The CHM

has good facilities to focus on commanding the entire information process and emphasizes cooperation and information networking with the purpose of conservation of biodiversity, and the GBIF has the best prospects in biodiversity data processing and focuses on biodiversity information as a resource supporting economic growth and social outcomes. (Laihonen *et al.* 2002, Laihonen 2003.)

Most of this thesis is based on scientific literature, articles, publications, reports and convention texts. In addition I have concluded a small survey study on Peruvian and Bolivian non-governmental organizations (NGOs) on their views and experiences on repatriation of biodiversity information, CHM and GBIF. I wanted to study repatriation in general, the concept, its benefits and problems, and the historical dimension. I wanted to find out how different innovations, especially CHM and GBIF, promote repatriation of biodiversity information, and what has been done in that area so far. I chose the neighboring countries Peru and Bolivia for my study mainly because of personal interest and the time I have spent in these countries. Also the governments of Finland and Peru have been working together in relation to biodiversity issues, and University of Turku together with Biota BD and *Instituto de Investigaciones de la Amazonía Peruana* (IIAP) have designed a project BIODAMAZ for conservation and sustainable use of the Peruvian Amazonian biodiversity. Peru is one of the megadiversity countries, while Bolivia is not. Bolivia is also poorer than Peru, economically speaking one of the poorest countries in Latin America. I wanted to find out whether many differences exist between these two countries on knowledge and experience in repatriation. I wanted to establish differences between CHM and GBIF, how known they are, and how high the NGOs value them when considering repatriation.

2. Repatriation

2.1 Definition of repatriation

The primary definition of repatriation is the return of a physical entity (a painting, a manuscript, an artifact, a seed or a plant, or even a person), generally after a considerable period of time, to where it originally came from or was obtained. Usually, a clear link or bond exists between the entity and the source country. Increasingly, however, repatriation is also used to describe the transfer to source country of information, knowledge and experience generated on the basis of material obtained from and experience gained in the source country. (Ruiz *et al.* 2000.) In the context of the CBD, in addition to repatriating individual samples, repatriation could be defined as a process of transfer of biodiversity related information, data, knowledge and expertise to a source country of the material which was originally obtained from that country and upon which this information, data, knowledge and expertise has been built (Ruiz 2004). A good and clear example of a repatriation project is the Richard Spruce project executed by the Natural History Museum, London and the Royal Botanic Gardens Kew. They are digitizing the information of the Spruce's collections held in their respective herbaria and transferring the information to the countries of origin. (The Natural History Museum and the Royal Botanic Gardens, Kew 2004.) I want to emphasize that this Master's thesis is about repatriation of biodiversity INFORMATION, not the collections or samples themselves. Hence, the problematic legal issues of repatriating physical entities are not discussed.

I also want to specify the meanings of other words related to repatriation of biodiversity information. CBD defines the "Country of origin of genetic resources" as a country which possesses those genetic resources *in situ* condition. "Country providing genetic resources" means the country supplying genetic resources collected from *in situ* sources, including populations of both wild and domesticated species, or taken from *ex situ* sources, which may or may not have originated from that country. (UNEP 1992b.) Decision-making uses knowledge that is produced out of data and information (Laihonen *et al.* 2004). But what are data, information and knowledge? Data generally refers to observations or descriptive methods of one particular process or entity. Data is captured and transferred easily. Information is normally data that has been organized, integrated and in some cases analyzed. Knowledge is received from information trough additional analysis, interpretation and understanding. It is a produce of the human mind. It includes reflection, synthesis and a context. It is difficult to capture, build and transfer. (BIODAMAZ 2001a.)

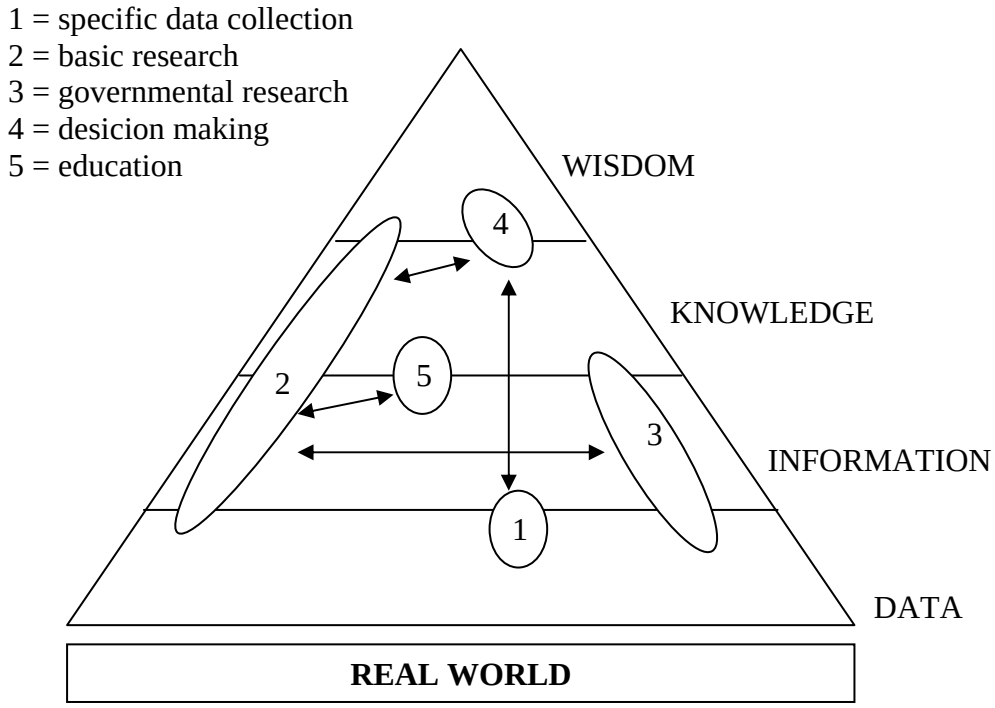

Figure I: Biodiversity information hierarchy. (Modified from the original, source: Laihonen *et al.* 2003.)

Biological diversity or biodiversity is the richness of genes, species, communities and ecosystems, but many times incorrectly referred to as meaning only the species diversity (Ilari Sääksjärvi 2004, personal communication). According to the CBD it means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species, communities and ecosystems. (UNEP 1992b.) So, what is meant with the information of biological diversity? In one part it referrers to the collections of plants in the herbaria and animals in the zoological museums that are taken from the field. Also articles and books of biodiversity published are an important source of information, as well as the specialists in different fields of flora and fauna up to geography, geology and climatology. (BIODAMAZ 2001a.) This is important to remember, as for example in a study made by Inter-American Biodiversity Information Network (IABIN) of repatriation of biodiversity information, all the included institutions related "repatriation of information" with information only from the museum specimens, not from the publications, databases and all the bibliography related to biodiversity, even though they are also important (IABIN 1999).

There is certainly an element of added value and intellectual input which makes the repatriation issue much more complex. Scientific knowledge has contributed to make these tangible materials valuable (from a strictly scientific and sometimes economic perspective). But in some cases, like in ethnobotany, materials have also flowed with extremely useful and valuable indigenous information which has served the scientific process. Therefore the issue is hardly clear cut and self explanatory. Developing countries and their institutions have not benefited from the knowledge, expertise and

know-how housed in *ex situ* centers and research institutions in developed countries as much as they have contributed with a continued supply of biodiversity samples (and information) to build these collections. (Ruiz 2004.) Repatriation should not be considered an end in itself, but should respond to identified needs regarding conservation and sustainable use of biodiversity in the source country. To meet this end, a repatriation project may well include other components which would not necessarily be classified as repatriation. (Ruiz *et al*. 2000.)

2.1.1 "Repatriation" or "Data sharing with countries of origin"

An issue has been raised whether it is correct to talk about "repatriation" of information or data. The term has undergone critique and GBIF has opted for referring to "data sharing with countries of origin". However, the term "repatriation" is still being widely used.

The GBIF adopted the term in their recently published Study on Data-sharing with Countries of Origin (Canhos *et al*. 2004). Canhos *et al.* explain the reasons for the change as follows:

"The study that was requested was specifically contracted as a "Study on data repatriation", but at an early stage there was a change, not only rewording the term "repatriation" to "data-sharing", but an overall change of concept. "Repatriation" during the first discussions at the CBD meant (to many) actually transferring scientific holdings to countries where the specimens had been collected. With the evolutions of information and communication technology the term "data" was added to the term "repatriation" to mean a specific action concerning transfer of access to data to the

country where the specimens had been collected. This continues to be a one-way action, and has, in our opinion, a paternalistic attitude. A much broader concept that was adopted in this work was "data-sharing with countries of origin". The idea behind this is that all have something to contribute. If we wish to change the pattern of destruction and loss we have today one must necessarily share, not only data, but experience, know-how, time, expertise, resources, information and knowledge. This issue was discussed with the GBIF secretariat and the term "data repatriation" was changed to "data sharing with countries of origin"."

GBIF opted the term "Data sharing with countries of origin" as a way to stress the importance of collaboration and sharing among countries. The experience is seen as a great example of for instance North-South collaboration and a win-win situation at the scientific level. The term "repatriation" is seen by some people as a source of potential controversy or a "can of worms". This is based on museum experiences with art objects and indigenous artifacts, and the fact that there have been historical requests for the physical repatriation of objects or materials. As GBIF focuses on making biodiversity data available via the Internet, it does not deal with any physical or material objects. (Beatriz Torres 2004, personal communication.)

I have chosen to use both terms side by side in this Master's thesis. I have chosen to use the term "repatriation", but especially when discussing the GBIF's work on repatriation, I will also use "data-sharing with countries of origin". I have also chosen to use the word "repatriation" in my questionnaire to the NGOs. I acknowledge that for some people the word "repatriation" can have a paternalistic attitude, and to a certain extent I agree, but I also resent some other words, for example "developing" and "developed" countries, and

still choose to use them simply because they are widely used in my source literature, and I do not find them directly offensive. Following the same logic, I use the word "repatriation" meaning the repatriation of biodiversity information or data, even though "information or data sharing with countries of origin" probably would be the more correct term to discuss the issue.

2.2 Repatriation in practice

During the preparation of this Master's thesis, the only actual repatriation manual I came across with was the one from the Royal Botanic Garden, Kew. In this repatriation manual Ruiz *et al*. (2000) mention the following stages for a repatriation effort to proceed:

1. A needs assessment of the country or institution concerned is carried out. This will identify a "wish list" of material for repatriation.
2. A supply assessment is done. This will identify institutions outside the country that may have materials identified in the needs assessment, and will itemize those materials.
3. Specific links are established with the most appropriate *ex situ* institutions.
4. A repatriation project is elaborated in collaboration with the appropriate *ex situ* institutions. This identifies the materials intended to repatriate and also identifies constraints on repatriation.
5. A budget is elaborated and funds sought.
6. The material is selected and prepared.
7. The repatriation is executed.
8. Follow-up mechanisms are put in place. This is the most important stage, as it ensures that the repatriation project is part of an ongoing process and not simply a one-off effort.

In practice, any given repatriation project may well not adhere strictly to this framework. A project is most likely to arise out of existing collaboration between institutions in different countries, rather than as a result of broad needs and supply assessments. (Ruiz *et al*. 2000.) Also, for a developing country institution it may be almost impossible to identify historical collections held in developed countries. Many historical collection samples lack the associated data, the label stating for example only the continent of origin. (Ilari Sääksjärvi 2004, personal communication.)

BIODAMAZ (2001a) mentions two specific phases of repatriation:

1. Identifying the institutions and locations that possess the major collections of biological samples from the wanted area. The tools for this phase are personal or other contacts, written information from publications and the Internet.

2. The real repatriation of data. This can include for example the digital repatriation of the collection images. Roughly the process is as follows:

a. Finding the data through documentation, and interviewing curators of the museums and specialists in taxonomy.

b. Contacting the entities. Designing contracts of information exchange or training.

c. Compilation of information (geographical validation and repatriation of digital images and databases).

d. Devolution of georeferenced data.

e. Databases in web servers.

One example of some steps taken in the repatriation of data can be found in a process executed by the Mexican *Comisión Nacional para el Conocimiento y Uso de la Biodiversidad* (CONABIO) with New York Botanical Garden (NYBG). This

repatriation included the case of computerized data and non-computerized data. Phase one was the repatriation of computerized data. It included sending the database from NYBG to CONABIO, and processing the information (georeferensation). Phase two was with non-computerized data. It included sending personnel to herbaria in New York for getting digital images of all the samples and identifying the samples without a label. (BIODAMAZ 2001a.)

BIODAMAZ (2001a) also lists actions for repatriation of bibliographic data:

1. Searching the bibliographical collections, making contacts with directors and librarians of the documentation centers and libraries that contain information on biodiversity.
2. Searching the relevant articles on biodiversity in the wanted area.
3. Establishing a relevant literature database.
4. Prioritizing the materials to be acquired.
5. Defining the entities where to find and acquire relevant literature.
6. Realization of the buys and other forms of getting the material needed.

Different institutions have different needs for repatriation. Institutions in some countries with very limited capacity may have basic taxonomic training and general information in biodiversity in that country as their highest priorities. Others may have more precisely defined requirements in terms of materials of particular taxonomic groups, specialized forms of equipment or data, such as ethnobotanical or pharmacological information. The needs should be identified. Raising awareness of repatriation in institutions in source countries in the context of the CBD could pave the way towards developing the national planning process. The awareness-building can be undertaken by numerous actors: the

national focal point of the CBD, NGOs, conservation and research institutions or even institutions in the developed countries themselves. (Ruiz *et al*. 2000.)

Who takes the initiative in developing repatriation strategy will vary according to specific circumstances. In some cases an institution in a source country may have a very clear idea of the material and information it would like to have repatriated, and where these can be found, and can therefore contact appropriate partners or counterparts. In other cases, a repatriation initiative might be suggested by an *ex situ* conservation or research institution to a specific institution in a source country. Joint initiatives can also result from historic or ongoing collaborative relationships among institutions. Such relationships form a good base for development of repatriation programs or projects. In developing new links one should consider whether a potential partner institution has explicit policies or guidelines on repatriation (or information exchange). How the repatriation effort or strategy initially develops will depend a lot on the leverage, interest and position of the persons or institutions contacted. In the light of the initial consideration of opportunities and constraints, both the institution considering repatriation and the institution to which material will be repatriated should evaluate whether they both wish to proceed with a repatriation exercise. Particularly those in a source country should evaluate very carefully whether such an exercise is genuinely an institutional or national priority. It may be that scarce conservation funds are better spent in some other way. When determining this in decision-making, it should be kept in mind, that any repatriation exercise will require continuing costs, for example in the updating of information to ensure that it remains updated. As mentioned before, repatriation is not an end itself, but should be viewed rather as a part of an ongoing process to enhance the capacity of developing countries to conserve and sustainably use

their biodiversity. For this reason, follow-up to any given repatriation project is important. It is necessary to have a clear idea of the objectives of any given repatriation effort. Only if a specific function is identified, a repatriation effort is likely to be successful in the long term. (Ruiz *et al.* 2000.)

2.3 Importance and benefits of repatriation

All countries are both providers and recipients of genetic resources (Laihonen *et al.* 2004), but most of the world's *in situ* biodiversity is found in the tropics, mainly developing countries, and in a group of maybe ten or so megadiversity countries. In contrast, most of the world's largest, best managed and financially stable *ex situ* conservation and research institutions are located in developed countries. These institutions maintain a considerable sample of the planets biodiversity data and information related to it. A significant proportion of these samples have been obtained from the megadiverse, developing countries, which is the result of historical flows of biodiversity. (Gaston & May 1992, Mittermeir *et al.* 1997, Ruiz 2004.) It can be argued that developing countries and their institutions have not benefited from the knowledge, expertise and know-how housed in collections in developed countries as much as they have contributed in terms of a continued supply of biological resources for both basic and applied research (Ruiz *et al.* 2000). Concern for biodiversity benefit sharing by developing countries is understandable. Emergence of several globally recognized programs to enhance the exchange of biodiversity information indicates how important the subject actually is. Information about biodiversity has become an important form of biodiversity ownership. Intellectual property rights, including repatriation of biodiversity information about material collected from biodiversity-rich areas, have also become a

crucial topic at general political level in the relations between the developing and industrialized world. (Laihonen *et al*. 2004.)

The value of global biodiversity information systems for end-users is yet a nearly unstudied area in scientific literature (Laihonen *et al*. 2004), but repatriation can be said to be one mechanism through which biodiversity information imbalance can be addressed. This is important not only as a matter of equity and recognition of the needs of institutions in developing countries, but also in response to the new international environment created by the entry into force of the CBD. Repatriation can serve a number of different ends. It can play a vital role in capacity-building in developing countries through revitalizing national conservation and research institutions, and it can strengthen the links between scientific institutions in developed and developing countries, thereby through better basic research improving international coordination of work on conservation and sustainable use of biological diversity. (Ruiz *et al*. 2000, Ruiz 2004.)

More information on biodiversity is definitely needed. For instance in Bolivia and Peru, like in most of the developing nations, access to international scientific knowledge is limited, or in fact almost non-existent. Ordering a number of journals with even a reasonable thematic cover is not affordable. Also with most scientific publications the knowledge is represented in a form that only facilitates a narrow group of users since the traditions and theoretical rules of a specific field of science are guiding the knowledge producing process. (Mäki 2003b.) Also the language is a problem. At least in the mostly Spanish-speaking Latin America, very few people (professionals or non-professionals) speak any English at all, which makes it impossible for them to follow scientific magazines even if they would have access to them. The result is that because

biodiversity information is not immediately at hand, it is often not applied in policy or management decisions, nor is that information readily accessible for research scientists (Edwards *et al*. 2000).

In certain circumstances, repatriation of data could become a useful process to serve a number of different but interrelated goals, for instance it can assist conservation programs in developing countries (Ruiz 2004). Directly or indirectly repatriation of biodiversity information can help to solve many environmental problems that require understanding of the structure, function, and interactions of ecosystem dynamics. Ecologists are aware that biodiversity-poor landscapes may recover more slowly from floods, droughts or fire, and that they may also be less able than biodiversity-rich ones to resist invading species or the spread of emerging diseases. The challenge to policymakers is to design effective measures to maximize ecosystem services in a sustainable way. Pollination, the production of clean water, and maintenance of productive fisheries and forests are examples. Tropical forests may be converted and cut clear or they may be let to grow. To decide what best sustains humankind generally and the surrounding communities locally requires important decisions, which should not be done without proper information derived from basic research. (IABIN 2004a.) Some of this information can be provided by repatriation.

So, biodiversity information exchange promotes the use of basic scientific information for conservation and for example bioprospecting. Biodiversity is still very poorly known in many developing countries, so basic research and information derived from it forms a crucial part of future development projects. Description and classification of species should be one the major objectives of this century. Databases of the biological

collections constitute a fundamental aspect of the information on biological diversity. They are essential to produce a whole picture of the biota. They hold information on the taxonomy, geographical location, habitat use, genetics, and traditional use. The biological collections play an important role together with the associated bibliography, constituting the principal tools for the basic investigation and the evaluation of biological diversity. Still, it is difficult to evaluate the value of these collections globally or regionally without knowing the capacity of the databases. (BIODAMAZ 2001a.)

Recently also the important issue of observational data has been raised (BIODAMAZ 2001a). Observational data was not first considered a priority in GBIF, for example, but its DIGIT program expects that observational records will be included in its future phases. ENBI has included observational data from the beginning. One of its work programs (WP 13) is concentrated in observational data. Observational data consists of systematic and directed surveys, and the databases provide very extensive datasets. Many times they go unrecorded. Since several species observed are for example sensitive climate change indicators, changes in their distribution are important to know, and observational data will probably receive more attention in the future. (ENBI 2002.)

It is always important to consider who the users of the information are. A number of potential biodiversity information users can be mentioned. These include for example schools, universities, research centers, researchers, public institutions, NGOs, communicators, protected areas and political leaders. (BIODAMAZ 2004a.) If information that exists only in biological collections can be computerized, users everywhere will share the benefits (Blackmore 2002). Repatriation does not benefit only the developing countries, but also the *ex situ* collection holders who may wonder why

they should bother to engage in potentially time-consuming and expensive repatriation exercises. The international law, moral considerations, and also self-interest are the answers. Institutions with dynamic research programs are very likely to gain future access to *in situ* specimens and those in *ex situ* collections abroad, as well as to collaborate in research projects with overseas partners. Those institutions not considered good partners may, understandably, cease to be welcomed abroad. (Ruiz *et al*. 2000.) Benefits of digitization that are directly important for the information provider include improved reporting, expanded data sets for research, larger data sets for web display, greater access to specimen data, improved data management, reduction of mailing costs and risks for loans, and less time needed to answer individual queries and loan requests (Canhos *et al*. 2004).

Benefits of repatriation will be presented throughout this Master's thesis. For example, I will discuss the GBIF demonstration project, where concrete benefits of data sharing for land use planning in the Amazon region are demonstrated.

2.4 Problems in repatriation

It is important that full account is taken at an early stage of likely constraints on a repatriation project. Without this, the planning period is likely to be unnecessarily protracted, and the likelihood of successful completion of the project is diminished. Most botanic gardens and herbaria attempt to maintain a policy of as open access as possible to their collections (including information and databases). However they are subject to a series of practical, financial and legal constraints, so that some materials and data may be subject to restrictions on their access or use. These may be for legislative or

contractual reasons, because of the powers or mandate of the institution or because the information forms part of work in progress that is intended to result on future publications. In consequence, institutions may have information and databases that are restricted to access only by staff members or named individuals. (Ruiz *et al*. 2000.)

In their study on data-sharing with countries of origin, the GBIF mapped the institutions' views on the problems in repatriation. On their questionnaire, the problems and hurdles were categorized as financial constraints, bureaucratic red tape, technological problems, human resources constraints, training, tools, languages and others. Financial constraints were the most mentioned (72%), followed closely by technological problems and human resources constraints (67%). "Bureaucratic red tape" which could have been expected to be more significant with such a new technology as is the Internet, was relatively small, having only been mentioned by four institutions. (Canhos *et al.* 2004.)

2.4.1 Financial issues

Money is always an important factor. It is important with the big information sharing initiatives as well as with small individual projects. Almost any repatriation activity, however simple, will incur some costs and a major repatriation project will be an expensive and time-consuming business both for the *ex situ* institution concerned and the institution in the source country. It is important that these costs are quantified as early as possible in the planning of a project so that unrealistic expectations are not raised and the project can be designed and executed in as cost-efficient a manner as possible. Many *ex situ* institutions are likely to be carrying out various activities (e.g. data dissemination or technology transfer) that can be a form of repatriation, or have a

repatriation component. In some cases, costs for these activities may already be covered, at least on part, by core funds, or dedicated project funding. However, even in wealthy developed countries, core funding for *ex situ* institutions is often in short supply, and many of these institutions are under-staffed and under-resourced. There is therefore a limited amount that can be carried out without additional, dedicated funding. (Ruiz *et al.* 2000.) Since the Rio Earth Summit and the launching of the CBD, the need for reliable taxonomic data has rapidly increased. Museums are confronted with an increasing amount of requests for co-operation. The coinciding rapid development of information technology and the Internet forces museums to create databases and think about the accessibility of these databases. The investments in these technologies have to be financed some way or another, so there is an obvious drive towards invoicing all of those that make use of these data. The many different initiatives for information exchange through databases and the Internet, and the relatively short life-span of some of these initiatives, explain much of the reservations made by curators. European museums suffer from lack of funding and manpower, and the curators worry about the commercial use of data. (IABIN 2001.)

2.4.2 Internet and capacity building

Nowadays with Internet, information can be cheaply and efficiently transferred and repatriated (IABIN 2004a). Still, the use of Internet is not without problems and from the global point of view, the Internet as a means of biodiversity information exchange is somewhat controversial (Laihonen *et al*. 2004). Although most of the research and educational institutions, public and private, like NGOs, politicians and enterprises have access to Internet, for example only 5-7% of the Peruvian population has the privilege

(BIODAMAZ 2001a). The least developed countries (LDCs), which represent 10% of the world's population, comprise only 0.3% of the world's Internet users. Also the gap between the LDCs and other countries is growing. Favoring information exchange modalities other than the Internet would be one way of diminishing the effects of the Internet gap. In fact, inequality with respect to information has been recognized during the preparations of the CHM, and at least one developed country (New Zealand) has chosen to run the national CHM with means other than the Internet. (Laihonen *et al*. 2004.) Describing the situation well is the state of national CHM web sites. For example, 36.4% of the Latin America and Caribbean CBD parties have a CHM web site, whereas in Western Europe it is 74.4%, and in Asia and the Pacific 13.2%, the total average being 32.3% (UNEP 2004i). The GBIF has been accused of further deepening the information gap between developed and developing nations because of its Internet dependency (Geerders 2004).

Similarly, cartography provides appropriate tools for representing complicated spatial knowledge required in land use planning, but despite rapidly evolving cartographic tools, the publication of maps printed on paper are still necessary in many parts of the developing world such as the Amazon region (Mäki 2003b). An important consideration in the design of any repatriation project is the capacity of the institution in the source country to absorb, maintain and make full use of whatever is repatriated. There is little sense in, for example, repatriating data in the form of a complex database if computing facilities in the institution are inadequate to support the database. Such constraints should be addressed through limiting the scope and ambition of the repatriation project when necessary, but more positively by incorporating relevant capacity-building components into the project. (Ruiz *et al*. 2000.)

2.4.3 Fears, attitudes and hesitations

Although most museums show interest in repatriation projects, reluctance to share information can be a problem (GBIF 2002b). Not all data information centers recognize the universal need to produce and disseminate useful and reliable scientific information and make it especially available to developing countries. Many are unaware of the existence of information centers. The GBIF acknowledges the need for disseminating and raising awareness of its existence and operations (including through non Internet related means), which is critical to ensure its success in and use by developing country institutions and individuals. Part of GBIF's role is to train and build capacities in developing country institutions to make use of available data and information. (Ruiz 2004.) In 2003, the IABIN with support from the GBIF, World Bank, and the OAS completed seven subregional reports that analyzed the users and providers of biodiversity information. These reports highlighted that information has increasingly been treated as a commodity subject to new proprietary restrictions such as intellectual property rights. Referred to as the "second enclosure" movement, even conservation NGOs are hesitant to make their data and information freely available given intense fundraising competition. Nevertheless, intellectual property rights are incompatible with free, equitable and universal access to essential information and therefore data for all members of the biodiversity international community should remain in the open access domain. (IABIN 2004a.)

2.4.4 Language

Also language can be a problem to many. For example, in mainly Spanish and Portuguese speaking Latin America, English is not widely understood, and most scientific publications are commonly disseminated in international journals in English. Language barrier further narrows the access to knowledge (IABIN 2004a).

2.4.5 Time constraints

Another big issue is time. The time taken to carry out the preliminary work for a repatriation project is extremely variable. At one extreme, it has been calculated that it would take about 10 minutes per specimen to enter into a database each of the 68 million specimens of plants, animals and microorganisms held at the NHM in London, England. A complete database of all specimens in the museum would therefore take at minimum nearly 6.000 person-years. At the other extreme, obtaining a list of plants in living collection that has already been catalogued could just take few minutes. The timescale for each particular activity in a repatriation project should be assessed. This will be vital in costing the project, and in constructing a realistic timetable. Where a complex, large-scale project is planned, it should be divided, if at all possible, into separate phases, in order to minimize the administrative and technical burdens on the institutions involved. (Ruiz *et al*. 2000.) In the future, time will probably become less of a problem with introductions of facilitating innovations like bar codes attached to the specimen labels (Ilari Sääksjärvi 2004, personal communication).

2.4.6 Political situations

A big problem to a specific country can be unstable political situation. This has been sited in for example IABIN workshops (IABIN 2002), where the workshops in Bolivia and Ecuador were affected by changes of personnel in governmental positions caused by the unstable political situation (IABIN 2004a). The political will of persons in power can also have an effect. For example, I do not think many expected the CBD to be ratified by the U.S.A. during the George W. Bush administration.

3. CBD and repatriation

3.1 History, structure and goals of the CBD

In 1972, the United Nations Conference on the Human Environment in Stockholm resolved to establish the United Nations Environment Programme (UNEP). In the 1970´s governments signed a number of regional and international agreements to tackle specific issues, such as the protection of wetlands and regulation of the international trade of endangered species (Ramsar and CITES conventions respectively). In 1992, the largest-ever meeting of the world's leaders took place at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. A historic set of agreements was signed at the "Earth Summit" including two binding agreements, The Convention on Climate Change and the Convention on Biological Diversity (CBD). Along with the CITES Convention and Ramsar Convention, the CBD became the global agreement on conservation and sustainable use of biological diversity gaining rapid and widespread acceptance. Over 150 governments signed the document at the Rio conference. (UNEP 2000c.) In March 2004, the Convention had 188 Parties with 168 signatures, of which a large majority were developing countries. The only country that has signed the Convention, but not ratified it, is the United States of America. (UNEP 2004a.)

The Convention establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from the use of genetic resources. The Convention covers the rapidly expanding field of biotechnology, addressing technology development and transfer, benefit-sharing and biosafety. Importantly, the Convention is legally binding. Countries that join are

obliged to implement its provisions. The CBD, as an international treaty, identifies a common problem, sets overall goals, policies and general obligations, and organizes technical and financial cooperation. However, the responsibility for achieving the goals rests largely with the countries themselves. (UNEP 2000c.)

Under the Convention the governments are required to conserve and sustainably use their biodiversity. They are required to develop national biodiversity strategies and action plans, and to integrate these into broader national plans for environment and development. Each government that joins the Convention is to report on what it has done to implement the accord, and how effective this has been in meeting the objectives of the Convention. These reports are submitted to the Conference of the Parties (COP), which is the governing body bringing together all the countries that have ratified the Convention. The reports can be viewed by citizens of all the nations. The Convention secretariat works with national governments to help strengthen reporting and to make the reports of various countries more consistent and comparable. (UNEP 2000c.) Nearly 70% of all CBD parties have published at least one country report and approximately one third at least one thematic report. Nearly 30% of the parties have not published any reports at all. (Laihonen *et al*. 2002.)

COP is the Convention's ultimate authority. It reviews progress under the Convention, identifies new priorities, and sets work plans for members. The COP can also make amendments to the Convention, create expert advisory bodies, review progress reports by member nations, and collaborate with other international organizations and agreements. The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) is a committee composed of experts from member governments competent in

relevant fields. It makes recommendations to the COP on scientific and technical issues. (UNEP 2000c.)

3.2 CBD's role in repatriation

The CBD establishes a formal framework for the reciprocal transfer of biological resources, knowledge and technology between nations. The convention promotes the idea of biodiversity as a global common heritage which, therefore, requires biodiversity-rich countries to allow access to biological resources to other countries on "mutually agreed terms", and the technology-rich countries to encourage transfer of technology to biodiversity-rich, developing countries. (Bhat 1999.)

One of the three objectives of the CBD is the "*fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding"* (UNEP 1992d). This objective is linked to Article 15 of the CBD (Access to Genetic Resources), Article 16 (Transfer of technology), Article 17 (Exchange of information), Article 19 (The handling of biotechnology and distribution of benefits), and Articles 20 and 21 (Financial resources and financial mechanisms) (UNEP 2002a).

So, benefit-sharing is among the cornerstones of the Convention, and repatriation of biodiversity information to countries of origin is a major premise (Laihonen 2003). Economic interests related to biodiversity are important for developing countries which expect benefits from access to genetic resources as agreed in Article 15 of the CBD

(Laihonen *et al*. 2004). The Convention recognizes national sovereignty over all genetic resources, and provides that access to valuable biological resources be carried out on "mutually agreed terms" and subject to "prior informed consent" of the country of origin. When a plant, animal or a microorganism is used for a commercial application, the country from which it came from has the right to benefit. Such benefits can include cash, samples of what is collected, the participation or training of national researchers, the transfer of biotechnology equipment and know-how, and shares of any profits from the use of the resources. For example in 1991 the pharmaceutical company Merck signed a research collaboration agreement with the Costa Rican *Instituto Nacional de Biodiversidad* (INBio) agreeing to pay one million dollars in the initial two years of the program for the opportunity to screen soil samples, micro-organisms and plants for bioprospecting. A percentage of the money went directly to the cost of preserving nature. Merck has continued to work with INBio and in 2001 Merck provided an additional grant to raise awareness of bioprospecting in the educational INBio park. (Merck 2004.)

At least dozen countries have established controls over access to their genetic resources, and an equal number of nations are developing such controls. For example the Countries of the Andean Pact (Colombia, Ecuador, Bolivia, Peru and Venezuela) have adopted laws and measures to regulate access to their genetic resources. (UNEP 2000c.) The bioprospectors and researchers are required to meet certain conditions, such as submission of duplicate samples of genetic resources collected to a designated institution; including a national institution in the collection of genetic resources; sharing existing information; sharing research results with the competent national authority; assisting in the strengthening of institutional capacities; and sharing specific financial

and related benefits. In some countries the collecting permit system is very strict and well controlled. (UNEP 2000c, Sääksjärvi 2001.) When the Convention was adopted, developing countries emphasized that their ability to take national actions would depend on financial and technical assistance. Thus bilateral and multilateral support for capacity building and for investing in projects and programs is essential for enabling developing countries to meet the Convention's objectives. (UNEP 2000c.) The CBD can also help countries to assess their repatriation needs. Through its provisions in Article 6 on general measures for conservation and sustainable use, the CBD has triggered a worldwide effort in the development of national biodiversity strategies, which are ideal for addressing country's repatriation needs (Ruiz *et al.* 2000).

The overall questions of IPR, including utilization of existing biodiversity information for commercial purposes and data repatriation to counties of origin, have been a major area of interest throughout the CBD process (Laihonen *et al*. 2004). Repatriation is also an issue of growing interest, although it has not been discussed in depth in CBD COP or SBSTTA meetings (Ruiz 2004). In its decision V/16 (Annex III, element 3, task 15) on Article 8j the COP asked the Ad Hoc Working Group to develop guidelines that would facilitate repatriation of information, including cultural property, in accordance with Article 17, in order to facilitate the recovery of traditional knowledge of biological diversity (UNEP 2000b). In their latest (seventh) meeting, the COP requested the Executive Secretary to develop guidance for implementation by national clearing-house mechanism nodes for common or similar framework for identifying the availability of relevant technologies, to enhance international cooperation, and to facilitate the interoperability with relevant existing systems of national and international information exchange. COP also requested for the Executive Secretary to foster an enabling

environment in developing and developed countries for cooperation as well as transfer, adaptation and diffusion of relevant technologies. (UNEP 2004d.)

3.2.1 Article 17

Article 17 is the most important one in the Convention text when considering repatriation. It is about exchange of information and has two points: 1. "*The Contracting Parties shall facilitate the exchange of information, from all publicly available sources, relevant to the conservation and sustainable use of biological diversity, taking into account the special needs of developing countries."* and 2. *"Such exchange of information shall include exchange of results of technical, scientific and socio-economic research, as well as information on training and surveying programmes, specialized knowledge, indigenous and traditional knowledge as such and in combination with the technologies referred to in Article 16, paragraph 1. It shall also, where feasible, include repatriation of information."* (UNEP 1992c). Articles 16, 18 and 26 are related to Article 17 (UNEP 2003).

To date, COP has not specifically addressed Article 17. However, exchange of information has formed an important component of COP's work to date and the COP has made numerous references to repatriation of information in its decisions. (UNEP 2003.) In decision III/10 COP recommended the parties to explore ways to make taxonomic information housed in collections world-wide readily available, in particular to countries of origin (UNEP 1996). In its decision IV/1, D, on the Global Taxonomy Initiative the COP took into account the urgency for the taxonomic information transfer to countries of origin and the need of developing countries to develop national

collections and human and institutional capacities in taxonomy. The COP in its decision IV/1 (Annex, paragraph 7) states that the parties of the CBD should report on measures adopted to strengthen national capacity in taxonomy, to designate national reference centers, and to make information housed in collections available to countries of origin. (UNEP 1998.)

Article 17 makes a subtle distinction between the need for sharing and exchanging biodiversity data and information, and its repatriation. In Article 17(1) the publicly available sources refer to databases and information centers run by public or publicly funded institutions in opposition to private institutions and databases which might be subject to specific proprietary rights or policies which restrict access to them. Article 17(2) sees the exchange of information and programs as a form of benefit. As has been noted, international scientific access to specimens and on field research projects can be predicated on returning equity to countries of origin in the form of technology transfer and in kind assistance. Seminars and courses, equipment, co-authorship, student and professional exchanges, assistance with collections development and maintenance, and assistance with fundraising and writing projects, could all lead to prolonged collaboration and the building of mature scientific partnerships. (Ruiz 2004.)

3.2.2 CHM

Efficient exchange of information has been recognized as one of the necessary preconditions for improvement of the global biodiversity conservation. For this purpose, the clearing-house mechanism (CHM) of the CBD was established. The idea of the global CHM functioning as a platform for national clearing-houses was a considerable

milestone in the history of biodiversity information sharing. Establishing of Nation Focal Points (NFP) by the parties of the convention has been underway since then. (Laihonen *et al.* 2004.) The term "clearing-house" originally referred to a financial establishment where checks and bills were exchanged among member banks so that only the net balances needed to be settled in cash. Today, its meaning has been extended to include any agency that brings together seekers and providers of good services or information, thus matching demand with supply. Because the expertise in managing information and technology varies enormously from country to country, the Convention established CHM to ensure that all governments have access to the information and technologies they need for their work on biodiversity. The mechanism's first priority was to ensure universal access to the Convention's official records. The CHM is based on the philosophy that broad participation and easy access must be top priorities. The CHM mission is to promote and facilitate technical and scientific cooperation, within and between countries, to develop a global mechanism for exchanging and integrating information on biodiversity, and to develop the necessary human and technological network. The CHM seeks to support the Convention's thematic and cross-cutting programs of work by promoting cooperation in six key areas: tools for decision-making, training and capacity building, research, funding, technology transfer, and the repatriation of information. (UNEP 2004c.)

CHM is mentioned in the Convention text, Article 18 on technical and scientific cooperation. It states: "*The COP, at its first meeting, shall determine how to establish a clearing house mechanism to promote and facilitate technical and scientific cooperation"*. Article 18 also states that parties are to pursuit cooperation in the training of personnel, exchange of experts, and establishment of joint research programs.

Technical and scientific cooperation should be promoted in particular with developing countries. In 1999, the key strategic documents for the CHM were produced. An independent review of the pilot phase of the CHM, as well as a strategic plan and longer-term program of work, gave the CHM a systematic development plan to carry out the mission stated in Article 18. By this time most of the world's countries had ratified the CBD and thereby agreed to establish their own National Focal Points, responsible for the operative functions of the national clearing-houses. (UNEP 1992e.)

The CHM is coordinated by the Executive Secretary and overseen and guided by an Informal Advisory Committee (IAC) set up by the parties of the Convention. In addition, a network of national focal points for the mechanism has been established to address matters relating to technical and scientific cooperation. The parties have recently emphasized to strengthen the role of the focal points. During its first years, the CHM gained popularity relatively slowly among the CBD parties, and some still have not nominated their national CHM focal point. (Laihonen 2003.)

Decisions to support the CHM have been made in every COP meeting so far. In their fifth meeting the COP decided that the strategic plan for the CHM shall become a component of the strategic plan of the CBD. It also decided to further develop CHM to assist developing country parties to gain access to information in the field of scientific and technical cooperation, in particular repatriation of information. Governments should also develop initiatives to make information available through the CHM more useful for researchers and decision-makers. (UNEP 2000d.) In their latest meeting, the COP noted with satisfaction the concrete steps taken towards making the clearing-house mechanism an effective tool for promoting technical and scientific cooperation among parties. COP

called upon the parties to contribute resources for the translation and maintenance of the secretariat web site and the CHM toolkit in the six official languages of the United Nations. It invited developed country parties to assist developing countries through CHM, in efforts to implement and use new information technologies, including the establishment of websites. COP requested the Executive Secretary to use the CHM, in collaboration with the IAC, to continue to strengthen collaboration with international parties and organizations for review at the eight meeting of the COP, and to report on collaboration, including an elaboration of the relative roles of the CHM and information facilities including IABIN hubs, BioNet LOOPs (Locally Owned and Operated Partnerships), NatureServe CDCs (Centers for Data Conservation), nodes of the GBIF, Species 2000 and the Integrated Taxonomic Information System's Catalogue of life. (UNEP 2004b.)

According to the studies done by Laihonen *et al*. (2004), although the basic idea of the national CHM has been realized fairly well, the information provided by the national web sites is scarce and unprocessed. Especially the amount and processing of taxonomic, ecological and spatial information needs to be increased. In most participating countries of the CBD, constructing of national clearing-houses has not reached a stage where accurate and integrant information would be provided for decision-makers. A distinct group of countries has taken an active role in the field of international biodiversity information issues. Laihonen *et al*. (2004) collected research material from national CHM websites (in July-August 2001) to analyze the properties and outcomes of the CHM ten years after the CBD was signed, and to search novel viewpoints for its further development. The overall results of the study reveal that the CHM still operates at a relatively general and preliminary level. As the demands of the expert groups grow, the

capability of the CHM to meet the demands declines. The study confirms that the idea of CHM has reached several important milestones, facilitating further development of the system. Since the Rio Convention in 1992, most of the necessary work has been done to prepare the breakthrough of the idea. Yet, the operative work is rather tentative. At the time of the study, out of 181 CBD parties only 40 had operating national CHM web sites, their quality varying a lot. Collection of primary data and initiation of cooperation among data holders can be difficult especially in countries with less developed data production infrastructure. Correspondingly, old structures of administration and management may prevent efficient use of multiple data bases in countries with longer traditions of data production. Even after cooperation has been initiated, significant amounts of resources are needed to put in use the methods and practices that would ensure efficient processing and rapid sharing of information. Lack of capacity is clearly a problem in several developing countries who nevertheless aim to establish CHMs. According to Laihonen *et al* (2004) three major tasks can be formulated for further development of the CHM: (1) general command of the biodiversity information process; (2) introduction of core biodiversity information, i.e. taxonomic and ecosystem information serving especially operational and tactical decision-making, in the process; and (3) development of means of information exchange to meet demands of all countries including those with less developed ICT infrastructure. Moreover, there is an obvious need to refine the roles and currently unclear relations between the international CHM, GBIF and related initiatives of biodiversity information.

3.2.3 Global Taxonomy Initiative

The Global Taxonomy Initiative has been established by the COP to address the lack of taxonomic information and expertise in many parts of the world, and thereby to improve the decision-making in conservation, sustainable use and equitable sharing of the benefits derived from genetic resources. The GTI is specifically intended to support implementation of the work programs of the CBD on thematic and cross-cutting issues. The purpose of the GTI is to remove or reduce the knowledge gaps in our taxonomic system, the shortage of trained taxonomists and curators, and the impacts these deficiencies have on our ability to conserve, use and share the benefits of our biological diversity. The program of work consists of five operational objectives, of which the third one goes: "*Facilitate an improved and effective infrastructure/system for access to taxonomic information with priority on ensuring that countries of origin gain access to information concerning elements of their biodiversity"*.

At its sixth meeting, the COP endorsed the program of work for the GTI and emphasized the need to coordinate its implementation with existing national, regional, sub-regional and global initiatives, partnerships and institutions such as the GBIF. Capacity building at the national and regional levels was identified as a driving force in implementing the program of work. Parties and other governments were urged to promote and carry out the program of work, designate national focal points for the GTI, provide updated information about legal requirements for exchange of biological specimens and about current legislation and rules for access and benefit-sharing in terms of the needs for the GTI, and to initiate the setting-up of national and regional networks to aid the parties in their taxonomic needs in implementing the CBD. (UNEP 2002b.)

3.2.4 The Bonn Guidelines

A major achievement of COP VI was the adoption of the Bonn guidelines on access to genetic resources and the fair and equitable sharing of the benefits arising out of their utilization. The guidelines are to assist parties, governments and others involved in developing an overall access and benefit-sharing strategy, and in identifying the steps involved in the process of obtaining access to genetic resources and benefit sharing. (UNEP 2002a.) The guidelines will help countries distinguish between access to genetic resources for taxonomy, collection, research and commercialization (Agres 2003).

COP VI invited the parties and relevant organizations to provide financial and technical assistance to support the developing countries, in particular least developed countries, as well as countries with economies in transition, in implementing the Bonn guidelines. The COP noted that nothing in the guidelines should be interpreted as affecting the rights and obligations related to genetic resources arising out of the mutually agreed terms under which the resources were obtained from the country of origin. “Mutually agreed terms” includes the recognition of the sovereign rights of the country of origin. (UNEP 2002a.) The guidelines are voluntary, which means that their true effects on biodiversity information exchange depend entirely on the political will of the CBD parties to work on the matter (UNEP 2002a, Laihonen *et al*. 2004).

In their sixth meeting the COP also invited parties and governments to encourage the disclosure of the country of origin of genetic resources in applications for intellectual property rights, as a possible contribution to the compliance with prior informed consent and the mutually agreed terms on which access to the resources was granted. The COP

also invited parties and governments to encourage the disclosure of the origin of relevant traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biological diversity in application for intellectual property. (UNEP 2002a.)

At their latest (seventh) meeting, the COP recognized that the Bonn Guidelines are making a useful contribution to the development of national regimes and contract arrangements for access and benefit-sharing, and to the implementation of the objectives of the CBD. It also recognized that some developing countries have encountered constraints, due to inadequate capacity, to utilize the guidelines in the formulation of their national legislation of access and benefit-sharing and related arrangements. The COP stated that it bares in mind the difficulties faced by some developing countries with respect to information technology and related infrastructure. In the latest meeting the COP reaffirmed the sovereign rights of the states over their natural resources, and that the authority to determine access to genetic resources rests with the national governments and is subject to national legislation. COP recalled that the Bonn guidelines indicate that parties and stakeholders may be both users and providers of genetic resources, noting that these terms may still need to be examined and clarified, and that further work is required on a number of issues. COP recognized that a number of critical issues, such as international certificate of origin/source/legal provenance, and disclosure of origin of genetic resources and associated traditional knowledge, need to be addressed to support compliance with national legislation of countries of origin and prior informed consent of the contracting parties providing such resources, including countries of origin. (UNEP 2004f.)

3.2.5 Critique about the CBD

Lately the CBD has undergone some critique. It has been criticized for making scientific investigation very difficult with for example biosafety protocol. The treaty has been called misguided and a disaster for scientists. It has also been said to have negatively impacted agricultural research for plant breeding and sample collection, because collecting of material has become so difficult. (Agres 2003.)

The treaty leaves it to each country to negotiate its own rules for access and benefit sharing. The developing nations can become “bioparanoid” and because of fear of losing benefits, make life for scientists investigating biodiversity difficult. (Agres 2003.) For example Brazil has completely prohibited collecting done by foreign researchers on its soil, causing foreign institutions becoming reluctant to give any specimen loans to Brazil (Ilari Sääksjärvi 2004, personal communication). The accusation is that overvaluing the commercial potential of biodiversity, CBD-based legislation in these countries is impending conservation science. There was much hope after the CBD that developing countries would conserve biodiversity for its economic promise, specifically the potential pharmaceutical profits derived from biological resources. Understandably, the governments of developing countries have responded by hastily framing laws to protect their biodiversity. Although they are mostly intended to facilitate access, many of these laws obstruct biodiversity-related research, rarely differentiating between commercial and conservation science. (Pethiyagoda 2004.) Meanwhile, commercial returns from benefit-sharing in these countries remain trivial compared with their national conservation budgets as the major drug companies have scaled back bioprospecting (Dalton 2004, Pethiyagoda 2004).

One of the first scientific victims of these restrictive regimes is taxonomy. Fewer than 10% of the species have been described, and now access legislation in many developing countries is accused of alienating and criminalizing taxonomists (Pethiyagoda 2004). The adverse impact of CBD on research is being more widely debated, and the CBD has been accused of not working well (Dalton 2004, Pethiyagoda 2004). The International Union of Biological Sciences, at its 28th general assembly in Cairo January 2004, having discussed these issues at one-day workshop, resolved to promote "activities that enhance scientific input to the CBD process". These include the results of biodiversity inventories and population studies based in field exploration, which require access to species concerned. The question has been raised whether the unintended negative consequences of the CBD outweigh its benefits. (Pethiyagoda 2004.) Ironically, many scientists who originally supported the convention have been the ones damaged most by it (Dalton 2004).

4. GBIF and repatriation

4.1 History, structure and goals of GBIF

In Paris 29 science ministers from industrialized countries agreed to create the Global Biodiversity Information Facility (GBIF) (Redfearn 1999). The Megascience Forum of the Organization for Economic Cooperation and Development (OECD) is an inter-governmental committee which deals with science projects too large for any single nation to handle (Thwaites 1998). The concept of GBIF was developed by the Subgroup on Biodiversity Informatics of the Megascience Forum Working Group on Biological Informatics. GBIF came into being first of March 2001. The initial Memorandum of Understanding (MOU) is in effect for five years, and at the end of 2004 there will be an external evaluation of GBIF's structure and progress towards its goals. (GBIF 2003a.) The MOU is not legally binding and will have no effect as a legal or political precedent (GBIF 2000). The first Work Programme for GBIF was approved by the Governing Board in October 2002, and went into effect January 2003. Thus, the five-year Strategic Plan is being regarded as beginning in 2003. (GBIF 2003a.)

The GBIF is an open, independent organization dedicated to making the world's biodiversity data freely available via the Internet. It is open to participation by all countries, economic entities and organizations that can benefit by the open sharing of biodiversity information on a global scale. GBIF will enable scientific research, facilitate the use of scientific data in biodiversity policy and decision-making, and make biodiversity information freely and universally available via the Internet. (GBIF 2003a.) The purpose of the GBIF is to promote, co-ordinate, design and implement the

compilation, linking, standardization, digitization and global dissemination of the world's biodiversity data, within an appropriate framework for property rights. GBIF will work in close cooperation with established programs and organizations that compile, maintain and use biological information resources. The participants, working through GBIF, will establish and support a distributed information system that will enable users to access and utilize considerable quantities of existing and new biodiversity data. GBIF encourages the free dissemination of biodiversity data and seeks to promote the non-exclusive transfer to research institutions in developing countries of such informatics technology as it has available, especially in conjunction with training and capacity development programs. (GBIF 2000.)

All of GBIF's tasks are aimed at making data about individuals, populations and species digitally available (GBIF 2003a). The OECD working group views GBIF as a means whereby the rich nations, which hold most of the world's biological information and museum specimens but are home to a relatively small proportion of the world's species, can provide useful resources to poorer nations, which are responsible for managing much greater variety of organisms. (Thwaites 1998.) GBIF is seen as an open-access facility. It believes that all users ought to have equal access to data in databases affiliated with or developed by GBIF. One of the principles of GBIF is that it will be accessible by individuals anywhere in the world, offering potential benefits to all, while being funded primarily by those that have the greatest financial capabilities (GBIF 2000). This idea, however beautiful, faces many practical problems starting from the lack of Internet access in many developing countries. In fact, the GBIF has been accused of favoring the developed nations, and even viewed by some as a form of neocolonialism (Geerders 2004).

In January 2004 GBIF opened its Biodiversity Data Portal. The site lets users simultaneously search over a million taxonomic records from museum collections, botanical gardens and global storehouses such as FishBase. The portal provides the newest information on classification and nomenclature. Some of the more than 30 linked data sources allow people to browse collection and observation records and use them to map species' distributions. (Leslie 2004.) GBIF expects that within five years its portal will be the most-used gateway to biodiversity and other biological data on the Internet (GBIF 2003a).

GBIF's activities are organized around six integrated thematic areas: Data access and database interoperability (DADI), Digitization of natural history collections (DIGIT), Electronic catalogue of the names of known organisms (ECAT), Outreach and capacity building (OCB), SpeciesBank, and Digital biodiversity literature resources. They all have their own contribution to the developing world. One of the purposes of these programs, especially of the OCB, is to bridge biodiversity information technology "digital divides" through training and capacity building to ensure that people in every country have access to and can easily and freely use the world's biodiversity information.

The governing board of the GBIF consists of one representative from each participant. There are two modes of participation. The voting participants are the ones who have made the predetermined financial contribution, and associate participants are the ones who have not. The latter may take part in the deliberations of the governing board, but are not allowed to vote. The secretariat of the CBD has invited to designate an additional non-voting representative to the governing board. The governing board may also offer

voting or non-voting participation for such period as it deems appropriate to any economy, inter-governmental organization or other organization. (GBIF 2000.) In May 2004, the GBIF had 25 voting participants and 42 associate participants, of which 16 were countries or economies and 26 were organizations. Large majority of voting country participants were developed countries, while the majority of associate participants were developing countries. Peru is a voting participant, Bolivia is not a participant at all. The current list of participants may be viewed at http://www.gbif.org/GBIF_org/participation. The number of GBIF participants increased by more than 15 % during the first half of 2003 (GBIF 2003c).

The key to GBIF's operations are the participant nodes and their associated databases (the "bricks"). In signing the MOU, the participants agree to establish and maintain at least one GBIF node, which is defined as "a staple computing gateway that allows real-time inter-operational search of multiple institutional, national, regional and/or subregional databases containing primary or meta-level biodiversity data.". Participants agree to openly share biodiversity data held by their country or organization. Implicit on this is the promise to fund within-country activities that will help to achieve the digitization of biodiversity information from museums and libraries. The secretariat assists the nodes to carry out the challenging tasks ahead. The nodes interact outwardly, with each other and the secretariat, and inwardly, with the data providers in their countries and organizations. The participant nodes are the channels through which GBIF data and information will flow. (GBIF 2003a.)

4.2 GBIF's role in repatriation

4.2.1 General objectives

A range of issues cut across all of the GBIF work program elements. One is repatriation of data. (GBIF 2002a.) As the number of the developing member countries increases in GBIF, there will be a growing demand to focus on repatriation of information (Laihonen 2003). Also, one of the GBIF's main goals is to enhance the biodiversity informatics capacity and technical skills base of developing countries (GBIF 2003a). GBIF's philosophy of making data openly accessible to all, addresses, in a positive manner, the data repatriation issues. Once the data from specimens and species from countries of origin is openly accessible, it is open to all interest groups from any given country. In the context of genetic resources and the information derived from them the GBIF ensures that CBD rules are complied with. (Ruiz 2004.)

GBIF will aid in advancing scientific research in a host of areas, including systematics, conservation biology, ecology, agriculture, biomedicine and environmental management (Edwards *et al*. 2000). It is a vital step toward accessible species-level information (Blackmore 2002). GBIF can help data to be quickly and effectively repatriated to the countries of origin. It is also focusing on training scientists and staff from developing countries on how to use that repatriated biodiversity data (in conjunction with the one they are generating at the national level) for research and decision-making. Applications of the data can include, for example, planning of protected areas, building predictive models on the impacts of climate change on biodiversity, studying the impact of alien invasive species and effects of diseases and pests which affect agriculture and human

health. (Beatriz Torres 2004, personal communication.) GBIF governing board has established a supplementary fund. The fund is maintained in accounts separate from those of the GBIF core budget, overseen by the Executive Committee of the GBIF governing board, and audited annually by an independent, international auditing firm that reports to the GBIF governing board and to donors to the fund. Purposes of the fund include assisting representatives of developing countries to attend important GBIF meetings; building informatics infrastructure (e.g. in developing countries, natural history institutions, the GBIF secretariat), and furthering one or more of the program areas. (GBIF 2003a.)

The GBIF Experts' meeting on biodiversity data, databases and intellectual property issues was held 1-2 March 2004, in Madrid, Spain. At total of 16 experts attended the meeting together with five GBIF staff members. The experts at the meeting also addressed matters related to "Data sharing with countries of origin (DSCO)". In their deliberations the experts discussed different questions related to repatriation of data. The experts present at the meeting concluded that the major hurdles for institutions that hold collections from other countries to making the collection data available to the countries of origin are potential claims by the countries of origin (North-South concerns, and fear of giving away their rights to benefits to be derived from biodiversity), and non-performance by the country of origin on holding up its side of the data-sharing bargain. The main ongoing experiences in this area according to the experts are African, Brazilian and Indian reticence to share, and Eastern European traditions of non-transparency. However, the recent study on international experiences of sharing data with countries of origin (http://www.gbif.org/prog/ocb/sdco) shows that these concerns do not reflect the ongoing experiences and activities in data sharing. The GBIF

secretariat made a presentation on IPR issues as contained in the study of experiences on data sharing with countries of origin. Experience to date shows that there is an important wealth at on-going experiences in DSCO. Furthermore, in the majority of cases, "non-formal" contracts were established in the sharing of data with countries of origin. The study also shows that the institutions involved in data sharing with countries of origin stressed the need to ensure free flow of scientific data and information, together with acknowledgement of the data providers, disclaimers and data access policies. (OECD 2004b.) More of the study will be discussed later on.

4.2.2 OCB and DIGIT

DIGIT, and especially OCB, are the GBIF work programs that deal most with repatriation issues. The two programs work closely together to gather information about digitization needs and technologies, to produce a best-practices manual for digitization, and to hold training workshops on digitization technology. The workshops will also focus on how to use the data. (GBIF 2002a.) OCB also works with ICT, DADI, and EGAT to provide targeted workshops and training sessions on topics identified and prioritized by the participants (GBIF 2003a).

The vision of DIGIT is to promote digital biodiversity science and to facilitate the expansion of biodiversity knowledge by having legacy and newly acquired primary species occurrence data digitized and dynamically accessible (GBIF 2003a). Improved access to digital specimen data will facilitate the repatriation of data from the developed to the developing world (GBIF 2002a). The digitization of biodiversity specimen data held by institutions in the developed world allows the data to be shared with the

countries of origin of the specimens. Availability of specimen data on the species that occur in a country will assist that country to develop sustainable use of the benefits from those species, and taxonomists in the developing world will have information that they need at their fingertips rather than having to travel to the developed world to gather it. (GBIF 2003a.) The DIGIT program in its initial phase is tasked with facilitating the digitizing of the estimated three billion specimens found in the world's natural history collections, and exploring technologies to make the resulting digitized data easily available, so that it can be analyzed and integrated. In the initial phase, the DIGIT program concentrates on the capture and geo-referencing of basic label data associated with museum specimens, but it is expected that as this task progresses the work program's future phases will expand to include other types of information including digital images, sonograms, field notes and eventually observational records. It is recognized, however, that while it is important to move existing non-digital biodiversity data into a digital format, it is also important to ensure that the vast amounts of new data being recorded each year are being captured and documented using modern information management technologies. While in its initial phase the DIGIT work program will concentrate on retrospective data capture, the DIGIT "Best Practices Handbook" and the DIGIT training modules. (GBIF 2002a.)

The OCB work program focuses on allowing the international community to fully participate, contribute and benefit from GBIF's mission by providing or facilitating adequate institutional and human capacity, and by promoting GBIF widely within the international community, particularly policy- and decision-makers. OCB cuts across and supports the activities of other work areas of GBIF. It also includes repatriation of data and information. (GBIF 2002a.) OCB's vision is to reach out to all countries, and to

ensure that people in every country have open access to and can efficiently use biodiversity information through training and capacity building. OCB's goals and tasks are to develop biodiversity informatics training courses; to work with other organizations to overcome "digital divide" that exists around the world; to increase awareness of GBIF among potential partner organizations; to encourage and promote synergies with biodiversity-related conventions; and to support the further financial expansion of the supplementary fund. OCB is to see that developing countries will receive GBIF benefits, for example, access via the Internet to information that they previously had to travel to the developed world to get, and assistance with the use of repatriated data to benefit their population. OCB encourages the acquisition of Internet connections and promotes the GBIF concept. OCB's goals are that Internet linkages are developed worldwide, GBIF concepts and principles of data-sharing are accepted and adopted globally, GBIF participation increases by 10% or more each year, and that training courses are provided and promoted by GBIF around the world. OCB assists DIGIT and ECAT to identify supporting funds for projects in developing countries. OCB interacts with international biodiversity related organizations and conventions (e.g. CBD) to forge alliances and partnerships to achieve GBIF goals, which will also serve the goals of the other organizations. (GBIF 2003a.)

Many biodiversity-rich countries have expressed their interest in repatriated information. Among others, GBIF participants see that GBIF can and must play a key leading international role in the efforts dealing with repatriation of data and making biodiversity information available through the Internet. GBIF members have expressed that this would be a very concrete contribution of GBIF towards the implementation of the CBD particularly regarding the article 17.2 which deals with exchange of information. In

practical ways the GBIF deals with repatriation of information within a context of training, and scientific and technical cooperation. (GBIF 2002a.) OCB contributions to the 2004 work program of the GBIF included training of staff in data sharing pursuits, and also special components on how to use data for decision-making. The benefits should be that scientists get actively involved in North-South cooperation, training is provided to particularly developing country scientists, and more data is made available electronically, and thus the GBIF network becomes strengthened. (GBIF 2003c.) On repatriation of data and information to countries of origin, the short term goal of the OCB is to provide support to developing countries to repatriate data and information from overseas repositories. The medium term goals are to encourage and implement collaborative initiatives for data repatriation, and to promote the repatriation of data and information to countries of origin by submission of proposals. The long term goal is to encourage repatriation of data and information to countries of origin, which would include project proposals, and would deliver projects in place in collaboration with large collection-based institutions. From 2005 onwards, 20 repatriation project proposals should be implemented in a year. In 2003 the GBIF budget for repatriation was $ 235.000, and in 2004 $ 450.000. (GBIF 2002b.)

4.2.3 Study on Data-sharing with Countries of Origin

OCB work program commissioned a study to analyze experiences on data sharing with countries of origin (in other words repatriation of data). The study was carried out by the Reference Center on Environmental Information (CRIA), and involved selecting and contacting institutions, developing a questionnaire, tabulating answers, analyzing the responses, and writing a report. The questionnaire was sent to 27 institutions from which

18 filled out the forms. An attempt was made to cover all the continents and to include both biological collections and institutions responsible for structuring online information systems. Of the 18 institutions, four were from the U.S.A., eight from Europe, one from India, two from Australia, and three from Latin America. They were important herbaria and natural history museums that curate specimens from practically the whole world, initiatives concerned with digitizing data for their own institutional purposes, and explicit bilateral agreements directly dealing with data sharing with countries of origin.

The report analyzed data sharing, the process, funding, time scale, costs, results and products, problems and hurdles addressed, and recommendations and advice. It was found that most projects were making information freely available on the Internet, and that data-sharing was carried out as a collaborative effort through informal agreements. As to IPR, important issues were proper attribution, or credit to all partners involved, custodianship and ownership (i.e. each contributing museum retains ownership of its records), and acknowledgement. Digitization and data basing collections were considered fundamental for the day-to-day operation of a collection. International collaboration, which has always existed in taxonomy, was thought to be largely enhanced by online dissemination of data and information. Financial constraints, technological problems and human resources constraints were the three problems and hurdles most mentioned. Data sharing with country of origin was seen as a valuable spin-off, the rational being that by making the information freely available, it becomes available not only to the countries of origin, but to anyone else who needs or can benefit from such access. All the surveyed institutions included the scientific community as a target user. Policy makers and the “general public” were included by 61% of the institutions followed closely by educators with 56%. Only five of the 18 institutions

(28%) included private companies as target users. Conservation NGOs were also separately mentioned. There was no predominant format for data exchange. In transfer methods, “interactive web search” was preferred (70%), followed by CD-ROM (50%).

The recommendation of the study was that all countries should be considered users and providers of data and information. Not only is it important to promote digitization of the largest holdings, but it is fundamental to promote digitization of smaller and perhaps more specialized collections, and promote capacity building in countries with rich biological diversity, also in the fields of curatorial practices and in information and communication technology. GBIF must acknowledge, respect and consider different levels of technological development. According to the study report, it was impossible to make an assessment as to how many institutions were making their information available on the Internet, and how many collections were involved. The report considered it important, once the GBIF data discovery system becomes available, that as many as possible of the collections be “discovered” and registered. (Canhos *et al*. 2004.)

A month after the publishing of the study, SciDev.Net printed an article about it. This article stated: “*Botanical organizations in developing countries tend to be unwilling to share information on their collection and prefer not to make it freely available to the public via the Internet, according to the new survey. Their reluctance is partly due to concern that private companies could use such information to develop commercial products from biological resources without returning any benefits to the countries where the specimens were found. Another concern is potential misuse by criminal organizations that buy and sell endangered species. The survey also shows that most developed country institutions, such as the NHM in London and Smithsonian Museum of*

Natural History in Washington DC, do not have formal policies on sharing data with countries of origin. Despite this, most are gradually transferring their data onto the Internet, though the process is slow and is not considered a priority." (Masood 2004.) This article published in SciDev.Net together with the study awakened wide conversation on repatriation issues, at least in the IABIN e-mail list, "Iabin-friends", in April-May 2004. Masood's article was said to have nothing to do with the original report of the study. Several developing world institutions were interviewed for the study, and almost all were positive about data sharing. Masood was said to have chosen to highlight the negative in the report, his article being just a selection of negative aspects of the report on the study, not corresponding with the general opinion. In May 2004, a letter to the editor was published in SciDev.Net. This letter was very critical about the GBIF, saying that it is not surprising that developing countries are reluctant to engage in initiatives such as the GBIF. Scientific considerations were said being sometimes used as a cover for economic motives, leading some to view GBIF as a form of neocolonialism. GBIF was accused of greatly favoring developed nations due to lack of access to the Internet in most developing countries and the GBIF being an online system. (Geerders 2004.)

4.2.4 GBIF Demonstration project

The fifth session of the GBIF Governing Board in October 2002 approved the elaboration of a GBIF demonstration project, which would in a clear and practical way show the relevance and usefulness of the GBIF concept and vision to the international community. The tender submitted by the consortium lead by Biota BD Oy, in collaboration with the University of Turku and the Research Institute of the Peruvian

Amazon (IIAP), was selected to undertake the demo task. The main objective of the demo project was to provide an end-user oriented innovative practical demonstration on the deliverables of the GBIF process, and show how the various users will benefit from the GBIF generated activities and can then further develop their own modes of work. (GBIF 2003e.)

The general object of the demonstration project was to produce functional demonstration web services of GBIF, based on existing regional biodiversity information systems in Asia, Europe and Latin America. The information systems were two Amazonian biodiversity web services (SIAMAZONIA and WAGIS) that are currently operational and cover the Amazon region of the Andean Community, the Asia-Europe Forest and Forest Conservation Platform (ASEMFOREST), and the Finnish regional biodiversity web service LOUNAISPAIKKA, linked with the European Network for Biodiversity Information (ENBI). These services and their specimen or collection data were developed as GBIF demonstration examples by using novel Internet-based data handling taking into account the databasing and data access standards considered by various current initiatives (ENBI, BioCASE etc.). The project focused on ways how the use potential of the specimen information (as defined in the DADI, ECAT and DIGIT programmes) could catalyze interest in the developed and developing countries by better use of biological resources, and could contribute to land-use planning and environmental policy formulation. (GBIF 2003d.)

The project consisted of five components. The main objective of work of component one was to develop map services that are utilizing the data accessible through GBIF. Component two concentrated on the techniques of linking professional literature

databases to geographical locations, so that the literature references can be searched and queried using a map interface. Component five concentrated on providing primary data bases that are accessible using GBIF technologies. (GBIF 2003e.) In addition to working in the core area of GBIF interest, GBIF demo project examined how added value can be gained by linking biodiversity data to other sources of information. In the examples provided by the demo project, biodiversity data was linked with various types of ecosystem level data ranging from satellite imagery to conservation plans and zoning proposals. (GBIF 2004d.)

The demonstration project proved the technical solutions adopted and developed by the GBIF to be operational for the purposes of the institutes represented. In their mid-term report it stated that after a wide range of specimen records available on-line, a variety of activities could benefit from the information. For example, species-level data can be utilized for land-use planning and zonification, in the identification of timber and non-timber forest resources, location of genetic resources and key areas for conservation. GBIF was considered to be an important mechanism providing orientation and resources for the biodiversity projects of World Bank, GEF and other financial mechanisms linked to Multilateral Environmental Agreements (MEAs). Furthermore, biodiversity information provided through GBIF could facilitate working linkages between biodiversity and global change scenarios. The key lessons learned by the demonstration project by the mid-term report had to do with the acknowledgement of IPR of the data owner, making the information understandable for a wide range of potential users, and emphasizing the georeferencing of the data. (OECD2003e.) The demonstration project showed the power of the GBIF tool in repatriation of data. The demonstration project's Amazon example showed how this data is easily presented in such a form that it can be

linked with existing land-use planning programs. Currently, several member countries of the Andean Community are carrying out zonification programs to better manage biological resources of the Amazon basin. The “Amazon tours” of the demonstration highlight how data derived from various sources can be joined by using satellite imagery, GIS and GBIF tools, and be directly used in research and application purposes. The project focuses on ways how the use potential of the specimen information and observational data could catalyze better use and management of the biological information resources. It utilizes the technologies provided and developed by the GBIF and integrates them into existing information systems. (GBIF 2004d.) A full description of the Demonstration project is found at http://gbifdemo.utu.fi/.

The seventh meeting of the GBIF governing board (October 2003) approved the development of a new demonstration project, with the view of showing in an exciting, clear and practical way the relevance and usefulness of GBIF’s data and applications to the wide international community. The 2004 GBIF demonstration project is focused on developing prototype or proof-of-concept products and tools to promote GBIF to a wide range of audiences. GBIF intends to use the demonstration project to promote GBIF, expand its membership and assist in catalyzing fund raising efforts. The new demo project needs to primarily address the potential new GBIF users (scientific and research institutions, governmental and non-governmental institutions, conservation organizations, policy and decision-makers) and existing participants who, among others, would benefit from getting useful and practical tools, applications and examples that could be easily replicated and implemented at different levels (national, regional and global). The project is planned to start the first of September and the conclusion of the project and presentation of the final results should be 31st of May 2005. (GBIF 2004c.)

5. Other organizations and repatriation

Besides the CHM and the GBIF, several other initiatives with related objectives have been established (Laihonen 2003). In this chapter I will review some of them, especially ENBI and IABIN, which are both important when considering repatriation of biodiversity information, IABIN especially to Latin America. The CBD web site lists 29 other global biodiversity information sharing initiatives, and just in North America for instance, a total of 120 biodiversity information projects have been identified (IABIN 2003, Laihonen 2003). Important projects and organizations include for example Australian Biodiversity Information Facility (ABIF), The ASEAN Regional Centre for Biodiversity Conservation (ARCBC), Biological Collection Information Service in Europe (BioCISE), A Biological Collection Access Service for Europe (BioCASE), BioNET-INTERNATIONAL, *Comisión Nacional para el Conocimiento y Uso de la Biodiversidad* (CONABIO), The Reference Center on Environmental Information (CRIA), DIVERSITAS, European Natural History Specimen Network, Southern African Botanical Diversity Network (SABONET), and many more (ENBI 2004a).

Integrated Taxonomic Information System (ITIS) is a partnership of United States, Canadian and Mexican agencies. It holds taxonomic information on plants, animals, fungi and microbes of North America and the world. More on ITIS can be found at http://www.itis.usda.gov/. Species 2000 is a "Federation" of database organizations working closely with users, taxonomists and sponsoring agencies. The Species 2000 is a global plan to create an array of participant global species databases covering each of the major groups of organisms. It aims to create a uniform and validated index to the world's known species for use as a practical tool in inventorying and monitoring

biodiversity worldwide (Bisby 2000). More on Species 2000 can be found at http://www.sp2000.org/. Species 2000 and the ITIS joined forces 2001 in the Catalogue of Life consortium and are now making progress with a catalogue of all known organisms. They have invited other organizations to join them in constructing a complete and freely available web-based synonymic index of species and associated data. The 2002 Catalogue of Life listed 260 000 species on CD-ROM and in the Internet. (Bisby *et al*. 2002.)

Launched in October 2002, the AndinoNET (Venezuela, Columbia, Ecuador, Peru, and Bolivia) is a regional initiative of BIONET in the Andean countries. BIONET is the information exchange tool of the GTI. The network is to promote the importance of the taxonomic research through a communication common platform between taxonomic researchers and diffusion of their work. BIOMAP (Venezuela, Columbia, Ecuador, Peru, and Bolivia) is a newly emerging sub-regional initiative, more developed in Columbia than in the other countries. Promoted in partnership between the National University of Columbia and Conservation International, this initiative is interested in compiling ornithological data (known locality, data, museum specimens, published papers, field notes of recognized ornithologists and birdwatchers) and publishing them through the Internet. Regarding natural history collections information, European and North American museum datasets are included with the interest of making viable data repatriation. Additional features of BIOMAP will include GIS analyses. (IABIN 2002.) BioNET-INTERNATIONAL, the Global Network for Taxonomy, is dedicated to supporting sustainable development by helping developing countries to overcome the taxonomic impediment by becoming self-reliant in taxonomy, i.e. self-reliant in the skills, infrastructure and technologies needed to discover, identify, name, classify and to

understand the relationships of all organisms. More can be found at http://www.bionet-intl.org/. The ALL species Foundation is a non-profit organization dedicated to the complete inventory of all species of life on Earth within the next 25 years. It is located at the California Academy of Sciences in San Francisco, U.S. Lately they have been unable to raise sufficient funds, but still have an office of one staff member. More can be found at http://www.all-species.org/. The World Intellectual Property Organization (WIPO) is an international organization dedicated to promoting the use and protection of intellectual property. WIPO has its headquarters in Geneva, Switzerland, and it is one of the 16 specialized agencies of the United Nations system of organizations. It administers 23 international treaties dealing with different aspects of intellectual property protection, and has 180 nations as member states. More on WIPO can be found at http://www.wipo.int/.

5.1. ENBI

Recently, the European Network for Biodiversity Information (ENBI) was launched. It is the European contribution to the GBIF. Although one of the rationales for ENBI is the scientific (bio-geographical) coherence of Europe, there is scope for ENBI activities that reach beyond this region, and the network will also provide important information to users outside Europe. Notably, because of many European countries' pasts as colonial powers, a disproportionately large share of global biodiversity information, especially from developing countries in the tropics, resides in European databases (including museum and botanic garden collections). Europe holds the world's richest and most important biodiversity collections, literature and other relevant data, and much of this information relates to parts of the world other than Europe. Thus, international sharing

of biodiversity data, or in other words repatriation of information, becomes a particular European responsibility. (ENBI 2002, ENBI 2004a.)

ENBI follows GBIF's priorities by concentrating on databases at the European scale and on activities that need cooperation at European level. The major objective of ENBI is to establish a strong network that will identify biodiversity information priorities to be managed at the European scale. Other objectives are the establishment of communication platforms to inquire the needs of end-users and to disseminate biodiversity expertise to professionals and policy-makers. ENBI coordinates its activities with those of the European Community CHM, as both give top priority to the access to biodiversity data. One of ENBI's objectives is the establishment of the best ways of institutional cooperation throughout Europe to provide species-level and collection-based biodiversity data to end-users, with special attention for sharing biodiversity data with end-users in the countries of origin. ENBI studies effective ways for the international sharing of biodiversity information in the framework of GBIF, with a focus on repatriation of collection information. (ENBI 2002.)

ENBI is organized as a thematic network, which implies that it will not undertake research projects. Its main objective is to bring together the existing European expertise in biodiversity information and biodiversity informatics. Members of the network are the coordinating institutes of past and current EU biodiversity projects, and the designated institutes that act as, or host, the national GBIF nodes. ENBI has 13 Work Programmes (WPs). WP 13 is "Making non-European biodiversity data in European repositories globally available". (ENBI 2002.) WP13 has the overall objective to improve electronic sharing of biodiversity data in European collections. The work within this WP has been

coordinated with GBIF, in particular the OCB. WP 13 has collaborated with OCB in all areas, especially data sharing. (ENBI 2004a.)

5.1.1 WP13 reports

WP 13 has produced a preliminary report that focuses on non-European user needs for biodiversity data in European holdings, with the aim to provide information on the needs for biodiversity information by various non-European user groups in order to guide priorities for electronic data sharing. The report focuses on what type of biodiversity data end-users would like electronically shared and what kind of data output they would prefer. The technical parts regarding electronic data sharing such as data standards, protocols, software etc. were not dealt with. Only limited existing information was available on user needs for biodiversity data in European repositories, so WP13 decided to carry out a small questionnaire survey on user needs. The report consists of results from the questionnaire survey to assess non-European user needs for biodiversity data in European repositories.

The survey size was relatively small (40 completed questionnaires: 28 form developing countries and 12 form developed countries). Eight replies came from Latin America, four organizations were NGOs, and most (16) were university or research institutions. The answers reveal a wide range of different uses of biodiversity data. The most frequently mentioned uses of biodiversity data were research and species identification, which can be explained by the fact that the majority of responses came from university or research institutions. However, biodiversity data are used in many other ways, e.g. conservation, education, bioprospecting, bioliteracy, impact assessment etc. In the

questionnaire, the recipients were asked to tick their organizations' preferences for particular types of biodiversity data. The types of biodiversity data were roughly divided in two categories: a) data related to the specimens at museum and botanic garden collection, and b) other biodiversity data. The vast majority of organizations preferred data from both categories. The dominating fields of interest for biodiversity data related to specimens were 1) taxonomy, 2) collecting details and 3) repository and storage. The dominating fields of interest for other biodiversity data were related to 1) identification, 2) monitoring, mapping and distribution, and 3) conservation and species protection. When asked for more specific interests, the answers revealed many different interests ranging from general to specific. The questionnaire asked organizations' interest in different database features in relation to biodiversity data project. The survey revealed high interest for all the suggested features, the most dominating ones being 1) generation of map, 2) viewing observation detail, and 3) retrieve species lists. The organizations were asked their preferences for access media (WEB, CD-ROM and/or other) to access biodiversity data. Access via Internet was the media most developing country organizations preferred, but almost as many preferred access via CD-ROM in addition to access via the Internet. The answers from the developed countries showed a different result, as only a few would prefer to have the data on CD-ROM in addition to access via Internet. Questionnaire asked to describe the capacity building resources and infrastructures necessary. In the responses from the developing countries, computer facilities and (good) Internet connections were the most needed. This was especially true in the responses from Africa. Developing countries also expressed the need for more data and staff. Very few institutions had carried out an assessment of their needs for biodiversity information. The report recommends that biodiversity data is made available on CD-ROM in addition to access via Internet. (ENBI 2004a.)

WP 13 has also produced another preliminary report that focuses on active use of biodiversity data. The objective of the report was to assess and analyze existing biodiversity databases in order to provide useful information for new data sharing projects, e.g. the feasibility studies that will be carried out in WP 13. The report provides many illustrated examples from different biodiversity databases. In addition, a small questionnaire survey was carried out on the active use of biodiversity databases. A number of biodiversity databases available online on the Internet were chosen for the survey in the report. Most of the databases provide an image. These can be type specimens or they can show live specimens. Some databases make it possible to generate a map showing the point localities of the specimen records. Many of the biodiversity databases provide other data regarding monitoring, mapping or distribution, and many also provide biodiversity data regarding identification, descriptions of biology, conservation and species protection. The BISS database provides link to satellite images. None of the biodiversity databases includes biodiversity data regarding genetics or biochemistry directly. However, some of the databases provide link to GenBank. The databases vary in their contents of biodiversity data. Several biodiversity databases form a part of a larger framework to support the overall objectives of an organization. None of the databases had carried out any evaluations or end-user surveys. (ENBI 2004b.)

5.2. IABIN

The Americas house five of the ten most biologically diverse countries in the world (Brazil, Colombia, Ecuador, Mexico and Peru), and eight of the world's top 25 biodiversity hotspots, one them being the Tropical Andes. Responding to the importance of the Americas in protection of biodiversity, the Inter-American Biodiversity

Information Network (IABIN) was officially mandated at the Summit of the Americas on Sustainable Development, convened by the Organization of American States (OAS) in Santa Cruz de la Sierra, Bolivia, in December 1996. OAS, in its coordinating role for Summit follow-up, invited each country to designate an official IABIN focal point. To date, all 34 member states of the OAS have done so. CHM's focal points are also IABIN's focal points. IABIN was considered officially launched when the OAS Inter-American Committee on Sustainable Development (CIDS) endorsed IABIN, in a resolution passed on October 15th 1999. Day-to-day activities of IABIN are managed by the IABIN hub that comprises of the Executive Secretary, Content Manager, and Technical Specialist. IABIN is mainly financed by GEF. (IABIN 2003.)

IABIN is an Internet-based forum for technical and scientific cooperation that seeks to promote greater coordination among Western Hemisphere countries in the collection, sharing, and use of biodiversity information relevant to decision-making and education. The objective of IABIN is to promote sustainable development, and the conservation and sustainable use of biological diversity in the Americas through better management of biological information and better decision-making. IABIN considers repatriation of information important. The IABIN Portal (www.iabin.net) is becoming a gateway to biodiversity information in the Americas as well as mechanism for facilitating interconnection of different institutions and agencies concerned with biodiversity conservation. IABIN is also developing a catalog of biodiversity data and information resources that allows users to identify and locate content available through the network. (IABIN 2003.) Activities that demonstrate the value of transnational exchange of biodiversity information include a survey of New World holdings in European collections. 1999 IABIN proposed a project of a directory of the biological collections of

the Americas, but it did not get funding. However, IABIN has completed an inventory of New World vertebrate holdings in European collections. (IABIN 2004a, IABIN 2004b.)

In 1999 a study on legal and institutional aspects was prepared for IABIN. The study was based on an analysis of responses obtained from a questionnaire sent to 76 organizations working on biodiversity issues in the Americas. Thirty organizations from fourteen countries replied to the survey. Most of the responses came from governmental and non-governmental organizations. The survey indicated that for exchange of information, the organizations generally prefer simple formal agreements based on legal authorities. Although ten countries represented in the survey have laws that control exchange of biodiversity information, only ten organizations reported the need of high level authorization in order to provide access to information. There is a considerable interest in data repatriation among the organizations that responded to the survey. Actual experience is minimal, but the high level of interest suggested that repatriation could well become an effort that could bring concrete results to IABIN in a short period of time. With respect of the repatriation of biodiversity information processes, 37% (10) of the analyzed institutions stated that they already had been involved with a repatriation of biodiversity information process. The rest, 63% (17) had not. 94% of these institutions were interested in participating in one in the future. Only 6% were not interested. (IABIN 1999.)

6. Cooperation between organizations

As so many different biodiversity information sharing innovations, projects and conventions exists, cooperation between them is necessary for many reasons, for instance to avoid duplication of efforts. Avoidance of competition with other organizations is cost-effective and time-efficient. Cooperation and partnerships enhance the goals of all concerned. (GBIF 2003a.) The need and will to cooperate with other information initiatives, and especially with each other, is genuinely expressed by both the CHM and the GBIF. Cooperation can be regarded as a vital necessity for both initiatives. The CHM is in need of contents, i.e. data and methodological support, whereas the GBIF has to produce convincing results to be able to continue. (Laihonen *et al.* 2002.) All major biodiversity information networks in Europe (EC/CHM, EIONET and ENBI) interact closely and directly with each other. They see that each technological solution communicates via shared information infrastructure addressing issues such as common tools, shared data definitions, agreed data interchange formats, public application protocols, directories of resources, group collaboration areas, electronic marketplaces and data repositories. ENBI also contributes to the objectives of the GBIF in various ways. (ENBI 2002.)

Given the complementary nature of the GBIF and CBD initiatives, a Memorandum of Cooperation (MOC) between their secretariats has been signed. The MOC established a framework of collaboration between the CBD secretariat and the GBIF secretariat to further common goals. These goals include facilitating the development and implementation of approaches, technologies and best practices that will be necessary to access, share and disseminate biodiversity data at the species, ecosystem and genetic

levels via the Internet. Specific collaborations have not yet been agreed upon, but projects may be undertaken in the areas of the CHM, the GTI and the 2010 initiative. (GBIF 2003b.) At its seventh meeting, the COP requested the executive secretary to further facilitate the synergistic collaboration between existing initiatives, including the CHM, GBIF, and regional and sub-regional taxonomic networks in order to develop more accessible information sources for countries on their biodiversity (UNEP 2004e).

IABIN works closely with other regional and global biodiversity information network initiatives, including the GBIF and the CHM. It is an associate member of the GBIF. GBIF focuses on specimen data whereas IABIN focuses on broader biodiversity information in the Americas, of which specimen data is a part. IABIN contributes to the development of the GBIF through helping to organize the specimen data of the Americas through an IABIN GBIF node. (IABIN 2004a.) The Chair of the IABIN council signed the GBIF MOU in May 2001. IABIN supports the GBIF's objectives of sharing, using and coordinating massive data sets, and of catalyzing new technologies applicable to biodiversity information. (IABIN 2004b.) IABIN also directly supports various goals of the CBD as defined in Articles 16 (Access to and Transfer of Technology), 17 (Exchange of Information), and 18 (Technical and Scientific Cooperation) (IABIN 2004a). IABIN and CBD have signed a Memorandum of Cooperation in 2002 to further common goals. These goals include facilitating the development and implementation of technologies and best practices necessary in order to share knowledge and information relevant to biodiversity conservation and sustainable management. The activities undertaken through the MOC promote the exchange of scientific and technical information capabilities of the parties of the MOC and their constituents. (UNEP-IABIN 2002.) The CBD Hub has been invited to participate in IABIN consultations since the

first experts' meeting in 1997, and IABIN Focal Points are commonly the CHM Focal Points for their respective countries. (IABIN 2003.)

GBIF has also formed partnerships with the Catalogue of Life consortium (Species 2000 and ITIS) aimed at increasing the rate of progress in producing a complete, concept-based listing of scientific names, and with the Taxonomic Databases Working Group (TDWG) to develop consensus on standards for data and metadata (GBIF 2003a). On the 15th of December 2003, GBIF and the Catalogue of Life partnership signed a Memorandum of Cooperation (GBIF 2004a). GBIF is developing a portal to provide specialized search engines for accessing digitized, georeferenced specimen data from the world's herbaria, museums and other natural history collections. In this it is working closely with the Catalogue of Life consortium, GTI and other taxonomic organizations. (Bisby et al. 2002.) GBIF will also further join forces with existing activities and programs. At the national level, these include Mexico's *Comision Nacional para el Conocimiento y Uso de la Biodiversidad* (CONABIO), Costa Rica's *Instituto Nacional Biodiversidad* (INBio), and the Australian's Biodiversity Information Facility (ABIF). Close connections are also being developed with DIVERSITAS, an international program of biodiversity science that is sponsored by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and several members of the International Council for Science (ICSU). In addition, new projects that are explicitly intended to be particular modules within GBIF are being developed. One of these is the Ocean Biogeographic Information System (OBIS). (Edwards *et al*. 2000.)

7. Peru and Bolivia

7.1 General

Peru and Bolivia are the countries studied in this Master's thesis. Both are developing nations, Bolivia being one of the poorest ones in South America. Many people in Peru still lack the basic needs like education and healthcare. In the year 2000 73% of the Peruvian population had electricity in their houses, 60% had running water, and only 43% had a waste pipe. The illiteracy rate was 11.7%, 54.1% of the population was considered poor and 14.8% extremely poor. In 2000 less than half of the Peruvian population were fully employed, 80% of the farmers had only primary education and the remaining 20% had no education at all. (UNDP 2002.) Still GNP per capita is higher in Peru than in Bolivia. Bolivia's national debt is very high, 63% of its population is considered poor and 37% extremely poor (World Bank 2000, World Bank 2004). In both countries there is great dependency on exports of raw or semi-processed minerals and non-refined agricultural products. Internal inequality is high and shows signs of increasing. (Mäki 2003a.) This causes political instability which has been a problem especially in Bolivia, where for example the president was overthrown last year.

Both Bolivia and Peru have a history of being Spanish colonies. The historical perspective has to be understood in order to realize the depth and importance of repatriation to these countries. I will review some parts of their history in the next chapter.

Biodiversity in Peru and Bolivia is vast, and the region is recognized as one of the richest biological regions of the planet (IABIN 2002). Peru is considered as one of the megadiversity countries (MSDP 1997). Bolivia so far has not been included into the "megadiversity group". Peru and Bolivia share the evolution of important crops such as potato, tomato and corn (IABIN 2002). I will take a closer look on their biodiversity in chapter 7.3.

Such a vast amount of biodiversity should have national interest. At the sub-regional level two important political actors are influential in Peru and Bolivia: the *Comunidad Andina de Naciones*, CAN (Andean Community of Nations), and the *Tratado de Cooperación Amazónica*, TCA (Amazon Cooperation Treaty). Both initiatives have intergovernmental representation. The CAN (Venezuela, Columbia, Ecuador, Peru and Bolivia) has released the Regional Biodiversity Strategy in 2002. The document aims to establish an integrated action platform to promote cooperation in sustainable use and conservation. They are also working with information exchange mechanisms and networks. During the Peruvian management of TCA, there was a project to establish an Information System of the Amazon. The initiative was led by *Instituto de Investigaciones de la Amazonía Peruana*, IIAP. Firstly, TCA settled a web system where the TCA publications were posted. However, the initiative was forgotten because of the new interest of the following secretary. The IIAP rescued the idea and took it to success with support of foreign financing. (IABIN 2002.) This is discussed more in chapter 7.4, and an analysis is made of Peru's and Bolivia's participation in CBD and GBIF.

7.2 History of colonialism and explorations in relation to biodiversity

Both Peru and Bolivia were violently conquered by the Spaniards in the 16th century. Before that most of the area was ruled by the Incas. When the Spaniards arrived to the harbor of Tumbes in Peru in 1532, the Inca state had been driven into inner conflicts. Their great empire was in turmoil. This was due to the death of an Inca ruler and the fights between his two sons. One of the sons, Atahuallpa, was in the city of Cajamarca when the Spaniards arrived. There they took him as a hostage, killed 6000-7000 Indians and wounded many more. The Spanish were led by Francisco Pizarro. After getting the ransom for Atahuallpa, Pizarro had him killed and started the march to the Inca capital of Cusco. The march proved difficult as they had to fight Indian armies in open battle, but in the end Pizarro and his men conquered Cusco. After that they headed on into modern Bolivia, Chile and Ecuador. (Seppänen 1992, Williamson 1992.) The age of colonialism in Peru lasted until the country was declared independent in July 1821 (actual independence starting from 1824). Bolivia, which was at the time referred to as Upper Peru, got its independence a bit later. The final battle of Bolivia was fought at Tumusla on April 1st 1825, and the resulting country took its name from the liberator Bolívar. (Burkholder & Johnson 1990.)

In the 16th century more people from Europe arrived and the explorations began. Explorations of South America, that resulted in the recognition of many new animals and plants, were soon noticed in Europe. They affected not only the biological literature but also peoples' daily lives. Nicolas Monardes (1493-1588) wrote a book describing the armadillo, tobacco and many other plants and animals. The Spaniard's book was also published in English under the name of *Joyfull Newes of the Newe Worlde.* (Singer

1951.) Many attempts were made to acclimatize useful plants found from South America. Potato, maize, sweet potato, beans, manioc, tomato, pumpkin, turnip, peanut, variety of peppers, avocado, cacao, cherimoyas and many other plants found their way into the European diet. (Singer 1951, Burkholder & Johnson 1990.) For example the potato was introduced to Europe by the Spaniards not long after the conquest of Peru (Burkholder & Johnson 1990). Probably the best known instance of introducing new plants was the one of tobacco (Singer 1951).

At first the explorations were made in hope to find gold, expensive merchandise, glory and fame, or to conquer new colonies. Their character started to change in the 17th century when, in addition to mariners, soldiers, traders and adventurers, also scientists began to be hired to explorations. The researchers were there to find out new information about the nature and the peoples in the exotic lands. Naturalists were especially interested in South America. (Grant & Morter 1992.)

Still some expeditions were made before the 17th century that did have scientific meaning. Although their main purpose was not scientific, they assisted in realizing the great biodiversity that existed especially in the Amazon. An example is the expedition of Francisco de Orellana with Gonzalo Pizarro into the Amazon. Orellana became the first European man ever to travel down the Amazon. He was born in Spain 1511 and left for the New World probably in the year 1527. He was looking for fame, fortune, glory and excitement, and he was related to the Pizarros. Orellana accompanied Francisco Pizarro notably during the attacks upon Lima, Trujillo and Cusco. Interested in finding wealth and adventure, Orellana left for the big expedition of the Amazon with Gonzalo Pizarro in 1541. They left from Quito (Ecuador) with many men and horses, and after ten

months of traveling and many unfortunate surprises, Orellana and Pizarro separated. Orellana continued downstream of the Amazon, sometimes getting food from the Indians and sometimes heavily fighting them. After Orellana's death other explorers entered the Amazon. Lope de Aquirre did an exploration with Pedro de Ursúa that was filled with loss of life. After them Pedro de Teixera declared a big part of the Amazon Portuguese. (Smith 1990.)

Then the really scientific explorations began. Charles Marie de la Condamine was an important explorer who started to record the scientific history of South America. Both, the scientific side and the problems of his expedition, were published in 1746. The founder of botanic geography, Alexander von Humboldt, was a German naturalist. Charles Darwin has said him to be the greatest explorer ever existed. He was interested in the nature in whole and was an excellent writer. In 1797, he met a French botanist, Aimé Bonpland, and after two years they did a five-year journey of exploration into the Amazon. There Humboldt made notes of more than 3000 species of plants then unknown to science. He also made important descriptions of China bark, from which one gets the medicine quinine that is used against malaria. Other important explorers of South America were for example Henry Walter Bates, Alfred Russel Wallace and Charles Darwin, who was only 23 years old when he made his voyage with the Beagle as the ship's hired naturalist. Some scientists sent their students on explorations, like Linné, who himself only traveled in Sweden, but sent Pehr Löfling to South America to collect specimens for him. (Leikola 1981, Smith 1990, Grant & Morter 1992.)

The explorations also enhanced the formations of natural history museums. Especially the European courts started to collect items from far-away lands including plants and

animals (Singer 1951, Leikola 1981). Dried collections of plants, herbaria, began to be formed in the sixteenth century. Since then also the practice of keeping botanical and zoological gardens has been continuous. The development of the biological museums entered in its modern stage in the 18th century. From this time museums have been among the main instruments of biological advance. They have become linked not only with teaching but with every form of scientific research. (Singer 1951.)

The early explorers of South America did not worry about intellectual property rights or collection permits. They considered it their right to come and go as they pleased and to take whatever they chose. They took specimens of every kind, collecting them in thousands. Such acts were considered to be neither irresponsible nor in any way detrimental to the countries concerned. Their way of thinking was that science needed these examples of the world's riches, and science existed back in Europe. Most items collected were of interest solely to the taxonomists. However, few involved different motives, such as profit. People did not understand why South America should be the sole possessor of certain plants merely because it was their place of origin. Europe wanted its share of South America's riches, for example of cinchona and rubber. (Smith 1990.)

Richard Spruce, whose predominant interest was in mosses, took cinchona (Smith 1990). He was a great botanical explorer, and spent approximately 15 years in South America. Spruce's interest in natural history dated back to his very early years. At the age of 16 he listed the plants of Ganthorpe, where he was born. He was an acknowledged expert with a sizeable herbarium of his own, and he published widely on bryophytes. In 1848 he was approached by William Hooker, the director of the Royal

Botanic Gardens at Kew, as a potential candidate to carry out a botanical exploration in the Amazon. Spruce financed the trip by selling sets of specimens to interested naturalists and institutions back in Europe. He sailed for South America in June 1849 at the age of 31. During the following 15 years his travels took him to Peru and also to Brazil, Venezuela and Ecuador. Spruce was a keen observer of the local people and their cultures. He learnt 21 different indigenous languages, and not only collected plants but also many locally produced items of ethnobotanical, economic and medical interest. His work in Ecuador was largely concerned with the procurement of seeds of the cinchona tree. As a request of the Royal Botanic Gardens at Kew, that needed cinchona for anti-malarial drug quinine, Spruce collected the cinchona seeds. Spruce was able to send samples of seeds to Kew thus helping to set up plantations. The plants and objects collected by Spruce in the Amazon and the Andes form an important botanical, historical and ethnological resource. The Natural History Museum, London and Royal Botanic Gardens at Kew have reconstructed Spruce's itinerary in Peru and Ecuador using Alfred Russel Wallace's edited compilation of the book about Spruce's travels, *Notes of a Botanist on the Amazon and Andes*, published in 1905. They are repatriating the information on the collection currently still hold in England. (The Natural History Museum and the Royal Botanic Gardens, Kew 2004.) More of the project will be discussed afterwards.

As for rubber, the name of Henry Wickham is for ever associated with the collection of the seedlings from the Amazon. Wickham was not a botanist, not even a collector, but he managed to gather one of the most lucrative species South America had to offer. (Smith 1990.) It was in Rio Tapajos in the Amazon 1876 where Wickham gathered the seed that gave rise to the Asian industry (Wade 1997). He smuggled 70.000 rubber seeds out of

Brazil and by 1919 the British colony of Singapore was the world's leading producer of rubber. South America could not do anything when one of its most prized natural resources was pirated without permission. (Hunter 1997.) The same form of thought and actions continued during the whole of the colonial period. Sample collection without permits did not stop even when colonialism ended, but has staid common until very resent. (Ilari Sääksjärvi 2004, personal communication.)

7.3 Biodiversity

7.3.1 Peru

Peru is one of the ten most biodiversity-rich countries in the Earth. It is a so called megadiversity country, due to the diversity of its ecosystems, species, genetic resources and the indigenous cultures. Peru is also one of the most important centers of genetic resources in the world because of its high number of endemic species. (CONAM 2001.)

Peru has a very high ecological diversity of climates, ecological layers, production zones and productive ecosystems. Of Latin American countries Peru has the second largest forest surface (fourth in the world level), and it holds 13% of the tropical Amazon forests. 11 ecoregions are known in Peru. These include the cold sea, the tropical sea, the coastal desert, equatorial dry forest, Pacific tropical forest, the mountain steppe, *la puna* (the high tableland in the Andes), *páramo* (the bush and grass desert above the tree line), high rainforests (high jungle), Amazonian tropical forests (low jungle), and the palm savanna. Of the world's 117 known life zones, 84 are found in Peru. There are ecosystems known all over the world for their high species diversity, for example the

cold sea of the Peruvian current, the dry forests of the north coast, *la puna*, the high jungle, and the low jungle. In the Amazonian rainforest the species diversity reaches its maximum. Also many different human tribes and cultures have developed in Peru. (CONAM 2001.)

Peru has very high species diversity, although most of the species are yet to be discovered. The microorganisms among others have not really been studied yet at all. Flora and fauna are a bit better known. 25.000 plant species have been calculated so far, which is 10% of the world total. Peru has the fifth highest number of species in the world. It has the largest amount of plant species which are known and used among the population (4.400 species). With fauna, Peru has the largest amount of fish species (2.000 species, 10% of the world total), second largest of bird species (1.730 species), third largest of amphibians (330 species) and mammals (462 species). (CONAM 2001.) Especially Amazonian lowland rain forests have been celebrated for their high alpha-diversity or species richness within habitats, whereas gamma- and beta diversity have been thought to be rather low. This has been proved wrong by Tuomisto *et al*. (1995, 2003) who have showed that also the Western Amazonian beta- and gamma diversity are high.

Peru has high genetic diversity. It has the highest diversity of potato, peppers and maize in the world. It also has many fruits, medicinal, ornamental and nutritional plants, and domesticated animals. It has 128 native domesticated plant species with hundreds or even up to thousands of varieties, including wild ones (almost 150 wild species of potato and 15 of tomato for example). Peru has five forms of domesticated animals: the alpaca, the lama, the guinea pig, the Creole duck, and a woodlouse (*Dactilopius costae).* Peru

also has a high diversity of potato and maize, which are globally very important nutritional plants. As for the cultures, Peru has 14 linguistic families and at least 44 different ethnic groups, of which 42 are found in the Amazon. These indigenous groups posses important knowledge on the genetic diversity (4.400 known used plants and thousands of varieties), the properties, and the managing techniques. For example, in one hectare of traditional potato cultivation in the Lake Titicaca, it is possible to find up to three species of potato and ten varieties. This is more than all the species and varieties together cultivated in North America. (CONAM 2001.)

7.3.2 Bolivia

Also Bolivia has a very high biodiversity, although it is not in the "megadiversity group". It has been suggested to be included though, since it is one of the least investigated countries in the Latin America. (MSDP 1997.) Bolivia does not have a coastline. It is a landlocked country, so it lacks all the marine diversity. Bolivia occupies 6% of the South America's surface. It has been considered one of the most spectacular countries on the continent (MSDP 2001). Personally I agree, and would be surprised if anyone who has seen the vast salt plains, lagoons filled with flamingos at 5.000 meters, volcanoes and the Amazon rainforest would not. Although the scientific investigation has advanced in the recent years, a major part of Bolivia is still virtually non-investigated. Most of the already done investigation has concentrated on vertebrate and vascular plant inventories (MSDP 2001).

Bolivia has 4 biomes, 14 ecoregions and 199 ecosystems. Some Bolivian ecosystems, for example the tropical humid and sub humid forests, *el paramo* and the ecosystems of *la puna,* have a high value as centers of biodiversity and endemism. (MSDP 2001.)

Keeping in mind that the inventory is not finished, at the moment Bolivia has 3.000 species of butterflies, which puts Bolivia within the four highest butterfly diversity countries. Bolivia has 325 species of mammals, including 5 new species added to the list just in the past few years, 106 species of bats, 186 species of amphibians, 260 species of reptiles, 550 species of fish, and 1.379 species of birds. (MSDP 2001.) Bolivia has around 18.000-20.000 species of vascular plants, which is close to the number of so called megadiversity countries. Actually Bolivia is second in the world with *Cactacea* of which it has more than 320 species (74% of the world total). (MDSP 1997.) Important endemism exists in cactuses (74%), orchids (20-25%) and vascular plants in general (20-25%). Of mammals approximately 4% are endemic, as also 17 species of birds, 6.2% of reptiles and 17.7% of amphibians. (MSDP 2001.) It has to be kept in mind that the numbers are growing year by year when more investigation is done and new species identified. For example in the year 1997 Bolivia reported to have 155 species of amphibians and 229 species of reptiles, and by the year 2001 the numbers had already increased to 186 species of amphibians and 260 species of reptiles (MSDP 1997 & 2001).

Bolivia is also center of origin of some domesticated species like peppers, potato, nuts, beans and yucca. Many of them are the same as in Peru. Also many wild species have nutritional value. In Bolivia around 2.849 species of medicinal plants are known, also 59 species of wild animals are traditionally used, and could have potential industrial

applications. In the latest years Bolivia has began to use microorganisms in agriculture. A lot of institutions, agriculturalist and communities that manage the genetic resources, do not have sufficient knowledge of them. The knowledge of different properties and industrial applications of domestic and wild biodiversity has advanced in Bolivia. The problem is that a big part of the information is found outside the country, and the existing information is not properly systematized. There is also capacity problems and lot of work with bureaucracy. (MDSP 2001.)

7.3.3 Some comparisons

Just to make some interesting comparisons, in Finland there exists 1300 species of vascular plants, 240 species of birds, 60 species of fish and 64 species of mammals (Lappalainen 1998).

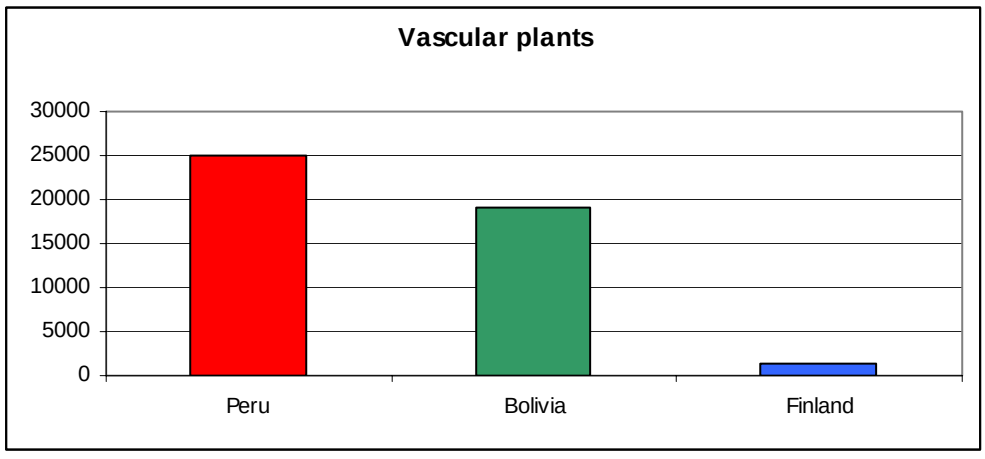

Figure II: The number of species of vascular plants in Peru, Bolivia and Finland.

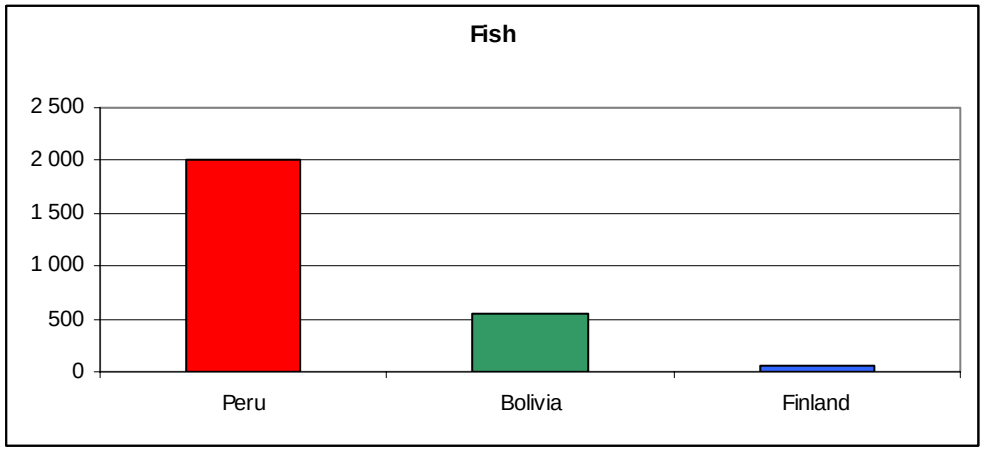

Figure III: The number of species of fish in Peru, Bolivia and Finland.

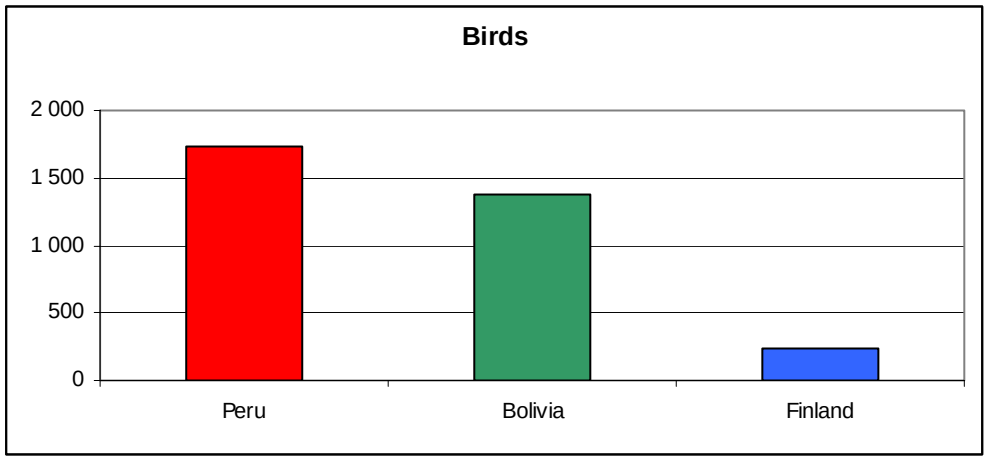

Figure IV: The number of species of birds in Peru, Bolivia and Finland.

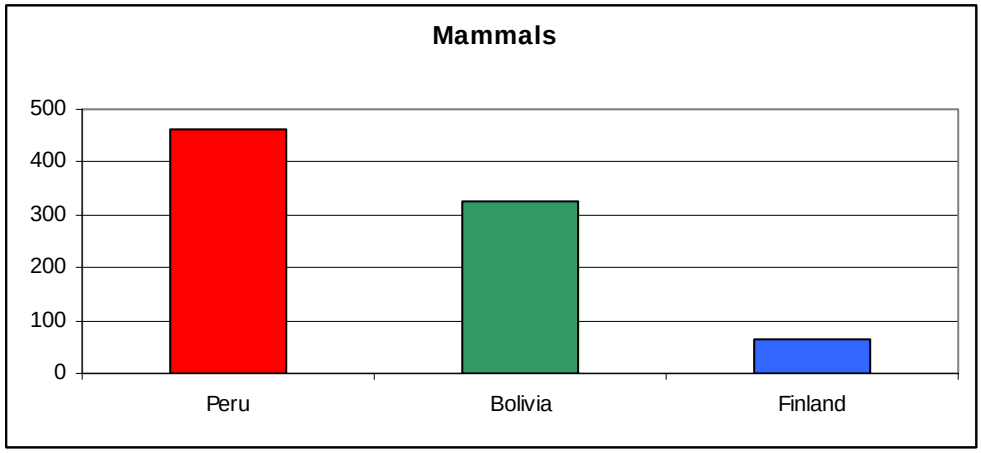

Figure V: The number of species of mammals in Peru, Bolivia and Finland.

It will be interesting to see if the differences between Peru and Bolivia will diminish, and how much, when more research is done. Both countries require more investigation. I would expect the number of species to grow in both countries, but more in Bolivia. Differences between these two countries and Finland will definitely grow even larger. Bolivia's "small" number of fish species is of course due to the fact that Bolivia is a landlocked country.

7.4 Participation in CBD and GBIF

7.4.1 Peru

Peru signed the CBD 12th of June 1992, and ratified it 7th of June 1993. Peru has published a National Biodiversity Strategy and an Action Plan under the CBD. It has published five national reports: First and Second National Report, and Thematic reports on Mountain Ecosystems, Protected areas, and Alien and invasive species. Peru has its own CBD and CHM websites (http://www.conam.gob.pe/chm/). (UNEP 2004h.)

In Peru, the National Environmental Council, *Consejo Nacional del Ambiente* (CONAM) is responsible for the CHM (BIODAMAZ 2001). CONAM is a public organization in charge of environmental decision-making in Peru. Biodiversity information initiatives are being developed under the leadership of CONAM. It is the designated institution for IABIN, CBD and CHM focal points. As agreed with the CHM, CONAM established the national CHM in 1998, and has since developed several activities to promote it. (IABIN 2002.)

The Peruvian Amazonian Research Institute, *Instituto de Investigaciones de la Amazonia Peruana,* (IIAP) within the framework of the agreement between the governments of Peru and Finland, Biological Diversity of Peruvian Amazonia Project, *Proyecto Diversidad Biológica de la Amazonia Peruana* (BIODAMAZ), contributes to the CHM by developing and initiating the *Sistema de Información de la Diversidad Biológica y Ambiental,* Siamazonia, and is responsible for initializing CHM in the regional scale. Siamazonia is an organization of possessors and generators of biodiversity information. It includes metadata and curatorial, taxonomic, ecologic, cartographic, bibliographic and other databases related to species and ecosystems. (BIODAMAZ 2001.) The development of Siamazonia began in 2000. The system started operating in November 2001. (BIODAMAZ 2004a.) Siamazonia is a decentralized system and is constructed of nodes representing the different institutions possessing valuable information of the Peruvian Amazonian biodiversity. IIAP has been designated as the facilitating node. The principal nodes are the universities, or their museums, research institutes, or other entities, with valuable information resources and interest in participation in the development of the system. Siamazonia strengthens the CHM significantly. They both contribute to the promotion and facilitation of technical and scientific cooperation in relation to biodiversity. Siamazonia has relations to national CHM (CONAM), Amazonian webs, other webs and GBIF. Siamazonia has been referred to in the Regional Biodiversity Strategy of Peruvian Amazonia (ERDBA) plan as a tool to facilitate the production and distribution of information on biological diversity. Specific objectives of Siamazonia include promoting the exchange of data, information and mechanisms of repatriation. The users of Siamazonia include universities, researchers, political decision makers, local governments, local indigenous communities and the public in general. (BIODAMAZ 2001a.)

IIAP within the framework of BIODAMAZ presented a proposition for Peru to participate in GBIF as an observing member. This decision was taken in April 2001 in a meeting of *Comición Nacional de la Diversidad Biológica* (CONADIB). CONAM has taken the responsibility for the national participation in GBIF. (BIODAMAZ 2001a.) Peru has been a voting participant of GBIF since September 2002 (http://www.gbif.org/GBIF_org/participation).

7.4.2 Bolivia

Peru has demonstrated a special interest in building a participatory system while Bolivia is just starting the awareness and capacity building process of biodiversity information systems (IABIN 2002). So, the tale to tell about Bolivia's participation to CBD, GBIF and other innovations is short. Bolivia signed the CBD 13th of June 1992, and ratified it 3rd of October 1994. Bolivia has published National Biodiversity Strategy and Action Plan under the CBD and two national reports: Thematic Report on Protected Areas, and a First National Report. Bolivia's National Focal Points of CHM, CBD and SBSTTA are all in the Ministry of Sustainable Development and Environment. (UNEP 2004g.) *Dirección General de Biodiversidad,* The General Direction of Biodiversity, is the official IABIN focal point (IABIN 2002). Bolivia has a national CHM website (http://www.chmbolivia.org.bo/), but at least in May and June 2004, despite of my many efforts, I could not access the site. In few months the wider development of Bolivian CHM should start with greater intensity (Mariaca 2004, personal communication). Bolivia is neither a voting nor an associate participant of GBIF (http://www.gbif.org/GBIF_org/participation).

7.5 Data bodies that could be repatriated

In this chapter I will take a look at where exactly the data originating from Peru and Bolivia is held. We know that a big part of it exist in Europe and United States (BIODAMAZ 2001a). To know exactly where the data is, all institutions should be identified and contacted. This is very difficult and time-consuming, so instead I took a look at some already done searches. This will give us some institutions and countries holding the data, but not by any means all of them.

I will first take a look at the information in the Siamazonia web page for European and North American museums and herbaria that possess biological collections that include samples from the Peruvian Amazon. Siamazonia lists 13 institutions from the United States. These are the American Museum of Natural History, Cornell University, Florida State University, Harvard University Herbaria, Louisiana State University, Missouri Botanical Garden, New York Botanical Garden, Smithsonian Institute, The Field Museum of Chicago, University of California, University of California Herbarium, University of Washington, Yale University and Peabody Natural History Museum. From United Kingdom two institutions are listed. These are The Natural History Museum and World Conservation Monitoring Center. Others include Botanisches Museum Berlin-Dahlem from Germany; Herbario Nacional Colombiano, Universidad Nacional de Colombia from Columbia; Herbario Secao de Botánica Sistematica, Jardin Botánico do Rio de Janeiro from Brazil; Herbarium Conservatoire et Jardin Botaniques de la Ville de Geneve from Switzerland; Herbarium Institute of Systematic Botany, State University of Utrecht from Holland; Swedish Museum of Natural History from Sweden; Universidad

de Sevilla from Spain; and University of Turku from Finland. In addition also Conservation International and CBD are listed. (BIODAMAZ 2004b.)

The Natural History Museum and Royal Botanic Gardens Kew have several repatriation projects (Tania Durt 2004, personal communication). Some of them include data from Peru and Bolivia. One example is the Richard Spruce Project. A part of the project's history and Richard Spruce were discussed earlier. The project is collaboration between the Natural History Museum and Royal Botanic Gardens Kew. They are working to locate and database the Spruce holdings in their respective herbaria in order to make information about them available to a wider audience of botanists, historians and others interested in the exploration of the Amazon and Andes. The present phase of the project (2002-2004), is focusing on Spruce's collections from Peru and Ecuador, and involves the work of five researchers from the Natural History Museum, RBG Kew and Universidad Nacional de San Marcos, Lima, Peru. Spruce kept detailed notes about the plants he collected. The notebooks are held in archives at RBG and have been transcribed and imaged. The information from the transcriptions is being stored using the same database as the specimen information. In total there are 2.874 individual collecting numbers in the two notebooks which cover Peru and Ecuador. All of these have now been transcribed. The Spruce project is the first in series of joint digitization efforts being undertaken by the herbarium of the RBG Kew and the herbarium of the Botany Department of the NHM, London. Together their collections represent a world resource, with approximately 12 million specimens from all over the world. 3442 specimens from selected families have been databased so far. Of these, 1367 have been imaged. Recorded in the notebooks are 2874 Spruce collection numbers, but the total

number of specimens is estimated to be over 8500. (The Natural History Museum and the Royal Botanic Gardens, Kew 2004.)

The large collections in The Natural History Museum, London and for example Missouri Botanical Garden, to which Bolivia and Peru have provided data (Canhos *et al*. 2004), are well known. But how to get information on the smaller holdings often located in less well known local museums? European inventory of vertebrate animal holdings from the New World was one of the pilot projects of IABIN 1999-2001, funded by the Dutch trust funds at the World Bank. The inventory was done using the Internet and questionnaires. The concrete output is a directory of European holdings of New World vertebrates, with emphasis on the relatively unknown smaller holdings throughout Europe. The database contains information on 114 collections from 50 institutes in 23 European countries, with a total of 1311 entries in taxon level. Of the collections, 69 are partially or completely available in a local database, 3 collections are accessible via Internet (unrestricted), 33 have nothing in digital format yet, while for 6 collections no information was provided. Some of the larger museums were rather blunt in their refusal to cooperate with the initiative, stating that the people that were searching for information on their collections, would always find their way to them, so some of the very well known museums are not included in the database. The inventory includes significant number of relatively unknown holdings throughout Europe, and is a fairly extended list of collections. The big collections are definitely underrepresented. (IABIN 2001.)

I went through the IABIN inventory's database using the geographical origin, and searched all the institutions that held samples from Bolivia or Peru or both. The

institution that holds samples from Bolivia is the Biological Station of the Doñana, Seville, Spain. Institutions that hold samples from Peru are the Museum of Natural History, Geneve, Switzerland; Museum of Natural Sciences “La Salle Hermano Leon”, Valencia, Spain; National History Museum, Entomology Laboratory, Paris, France; Natural History Museum Basel, Basel, Switzerland; and the Natural History Museum, Neuchatel, Switzerland. Institutions that hold samples form both countries are the Museum of Natural History, Facultada de Sciencias, Porto, Portugal; Royal Belgian Institute of Natural Sciences, Brussels, Belgium; Natural History Museum, Vienna, Austria; Senckenberg Research Institute, Frankfurt am Main, Germany; Museum of Natural History of Lugano, Lugano, Switzerland; Uebersee-Museum, Natural History Department, Bremen, Germany (4 collections); Natural History Museum, Perpignan, France; Zoological Museum of the University of Copenhagen, Copenhagen, Denmark; and the State Darwin Museum, Moscow, Russia (3 collections).

8. Survey of Peruvian and Bolivian NGOs

8.1 Objectives and assumptions

The objective of this survey study was to find out Bolivian and Peruvian NGOs' experiences and opinions on repatriation, CHM and GBIF. The idea was to make comparisons and to see if the CHM was more familiar to the NGOs than the GBIF, and if the level of knowledge was greater in Peru than in Bolivia. I wanted to find out if the organizations had already benefited from repatriation, and if so, how. Also the question was if the organizations believe to benefit from repatriation in the future, and if so, how.

Since Peru clearly has put more effort in developing their national CHM than Bolivia, and Peru is a GBIF member while Bolivia is not (see chapter 7.6), I expected the level of knowledge to be a bit greater in Peru. I also expected that in both Bolivia and Peru there would be more knowledge on CHM than on GBIF because GBIF is still a very new organization. In fact, I expected very little knowledge on GBIF. The general issue of repatriation I assumed to be considered important due to many historical and practical matters discussed in the previous chapters.

8.2. Methods

8.2.1 Questionnaire

NGOs express the thought of the civil society. They develop activities in relation to biodiversity and conservation and in many cases fill the "holes" left by the government

institutions. In Bolivia this started to happen on the 1970s'. At the moment over 1.000 NGOs exist in Bolivia, of which 9% deal with some sort of environmental issues. Some organizations specifically concentrate on the biodiversity and conservation issues, and they can play an important role in investigation. (MDSP 1997 & 2001.)

To do the survey, I used a questionnaire (Annex 1) which I sent with an introduction letter (Annex 2) to ten organizations and two museums. I had contacted all the organizations before sending them the questionnaire. The questionnaire was written in Spanish. I used instructions gotten from the Survey Kit published by SAGE publications, making the questions as short and clear as possible. I chose to use only the abbreviations "CHM" and "GBIF" in the questionnaire and write them open in the covering letter.

In the questionnaire, I first asked the recipient's name, their e-mail, the name of their organization and their position in the organization. Then I asked how much they knew of CHM's work. I gave four answer alternatives: nothing *(nada)*, some *(poco)*, moderate *(regular)* and a lot *(mucho)*. The same question was asked about GBIF. Then I asked for their opinion (if they had one) on how much importance CHM has (considering repatriation). The answer alternatives were again: no importance at all *(nada)*, some importance *(poco)*, moderate importance *(regular)*, and a lot of importance *(mucho)*. The same question was asked about GBIF. Then I asked whether or not their organization had benefited from repatriation, and if so, how. This was an open question. The next question was if they believed that their organization will benefit from repatriation in the future, and if so, how. This one was also an open question as well as the last one asking

if they had anything to add or comment about repatriation, CHM, GBIF or the questionnaire.

8.2.2 Receiving organizations

The organizations were selected searching from the Internet. I wanted the organizations included in the survey to have interest in biodiversity issues, access to Internet, a web page and credibility, for example a mention of them in official governmental documents. There were very few that I found, ten in total of which eight filled in and returned the questionnaire. A brief introduction to each of the eight organizations is given in Annex 3. The ones who did not return the questionnaire were *Fundacion Amigos de la Naturaleza* (FAN) from Bolivia and *Fundacion Peruana para la Conservación de la Naturaleza* (PRO NATURALEZA) from Peru.

I first wrote to all the ten NGOs asking whether I could send them the questionnaire and to whom I should send it to. I then sent them the questionnaire with a covering letter which stated who I was, what the study was about and briefly what are CHM, GBIF and repatriation of biodiversity information (see Annex 2).

I also decided to extend the study a little bit and included two Natural History Museums: Museo de Historia Natural Noel Kempff Mercado in Santa Cruz de la Sierra, Bolivia, and Museo de Historia Natural, Universidad Nacional Mayor de San Marcos in Lima, Peru. They are both probably the most important museums in their respective countries, having a long list of databases in digital format, spreadsheets and Access (IABIN 2002;

Ilari Sääksjärvi 2004, personal communication). Both museums filled in and returned the questionnaire.

8.2.3 Analysis of the results

Since the number of institutions included in the survey is very small (only 10 received questionnaires, including the NHMs), statistical analysis is out of the question. The focus is more on the qualitative than quantitative analysis of the results. From the yes/no questions I counted the numbers of yes and no answers, but when making generalizations the small number of answers has to be kept in mind. The same goes for the questions where the respondents were asked to estimate their level of knowledge on and the importance of CHM and GBIF. I decided to convert the answers into numbers (not at all knowledge/importance = 0, some = 1, moderate = 2, and a lot = 3) so that I could calculate some averages and make comparisons. I made some comparisons between CHM and GBIF, as well as Bolivia and Peru. The open questions are the most important and have the most value in this survey since their interpretation is not affected by the sample size, and the recipients are freely expressing their views and experiences on repatriation of biodiversity information. I decided that some of the answers are best represented as they are, except of course translated from Spanish to English.

8.3 Results

The results discussed here are the results obtained from the organizations, not from the museums, unless stated otherwise.

The results of the level of knowledge on CHM and GBIF are presented in the following table:

Table 1. Levels of knowledge on CHM and GBIF

COUNTRY	KNOWLEDGE ON CHM	KNOWLEDGE ON GBIF
Peru	Nothing	Some
Peru	Nothing	Nothing
Peru	Moderate	A lot
Peru	Moderate	Some
Bolivia	Some	Nothing
Bolivia	Moderate	Moderate
Bolivia	Some	Some
Bolivia	Some	Nothing

Now, when the answers are converted to numbers, the lowest being 0 and the highest being 3, some averages can be calculated:

Table 2. Levels of knowledge on CHM and GBIF in numbers

COUNTRY	KNOWLEDGE ON CHM	KNOWLEDGE ON GBIF
Peru	0	1
Peru	0	0
Peru	2	3
Peru	2	1
Bolivia	1	0
Bolivia	2	2
Bolivia	1	1
Bolivia	1	0
AVERAGE	**1.125**	**1.000**

Also comparisons between CHM, GBIF, Peru and Bolivia can be made:

Table 3. Comparisons between CHM, GBIF, Peru and Bolivia

KNOWLEDGE	PERU	BOLIVIA
CHM	0	1
CHM	0	2
CHM	2	1
CHM	2	1
AVERAGE	**1.00**	**1.25**
GBIF	1	0
GBIF	0	2
GBIF	3	1
GBIF	1	0
AVERAGE	**1.25**	**0.75**

The next tables describe the opinions on how much importance CHM and GBIF have for repatriation of biodiversity information. One NGO from Bolivia did not have an opinion.

Table 4. Importance of CHM and GBIF

COUNTRY	IMPORTANCE OF CHM	IMPORTANCE OF GBIF
Peru	A lot	A lot
Peru	A lot	A lot
Peru	Some	Moderate
Peru	A lot	Some
Bolivia	-	-
Bolivia	A lot	A lot
Bolivia	A lot	A lot
Bolivia	Some	Some

And then the same put in numbers, again highest being 3 and the lowest 0:

Table 5. Importance of CHM and GBIF in numbers

COUNTRY	IMPORTANCE OF CHM	IMPORTANCE OF GBIF
Peru	3	3
Peru	3	3
Peru	1	2
Peru	3	1
Bolivia		
Bolivia	3	3
Bolivia	3	3
Bolivia	1	1
AVERAGE	**2.4**	**2.3**

And then again the same comparison can be made:

Table 6. Comparisons between CHM, GBIF, Peru and Bolivia

IMPORTANCE	PERU	BOLIVIA
CHM	3	
CHM	3	3
CHM	1	3
CHM	3	1
AVERAGE	**2.5**	**2.3**
GBIF	3	
GBIF	3	3
GBIF	2	3
GBIF	1	1
AVERAGE	**2.3**	**2.3**

When asked if the organization had yet benefited from repatriation, only two answered yes. The rest had not benefited. When asked if they thought their organization will benefit in the future, the result was the exact opposite. Only two answered no, and the

majority thought their organization will benefit from repatriation of biodiversity information in the future.

The two organizations who mentioned having benefited from repatriation were both Peruvian. The SPDA had had a fellowship in England in 1998, where they worked in the Botanical Gardens, Kew on the legal and political perspectives of repatriation strategy and on a repatriation manual. The Amazon Conservation Association (ACCA) seemed to have had the greatest experience on repatriation:

"The biological stations in Peru, those being Peruvian or foreign, constantly manage information collected by non-Peruvian investigators or institutions. For example, many of the layers of our geographical information system (satellite images, aerial photos, vegetation maps, data of permanent parcels) have been elaborated in the United States or Europe and then sent to ACCA in Peru. It has also been the case with the lists of flora and fauna in the ACCA stations, many of which having been elaborated or worked by foreign investigators: they are now freely available for the public and will be available in a short while at our web-site (www.amazonconservation.org). The investigators in the stations also use the electronic databases quite a lot, like TROPICOS or SALVIAS, through our satellite Internet connection…"

Also The Natural History Museum, Universidad Nacional Mayor de San Marcos in Lima, Peru stated that they had benefited from repatriation, and that it has been a vital importance for their investigators, although this repatriation had not happened through a particular institution, but through a wide network of international contacts.

The question about the expected benefits of repatriation to the organizations produced more answers. Here are some different expected benefits:

- *"Our organization benefits because with more information available in Peru, everybody advances more in their investigation and there is better scientific communication and more opportunities to collaborate between the Peruvian and foreign scientists or students."*

- *"The repatriated information permits us to complete our databases… to implement different projects of conservation and planning."*

- *"Bolivia is a country in which the major part of the investigation has been done by the universities from highly industrialized countries and generally this information has not been returned to the country. This information is very necessary for future investigations as well as for decision-making. For this reason we consider enormous importance to count on this information for the tasks intended to be achieved in the future."*

- *"In the framework of repatriation, there is a void of information considering species of animals (mainly insets) and plants, which we would be interested in knowing and promoting in our Natural Areas (parks, reserves, etc). This knowledge includes a series of curiosities like the natural history of many species, behaviour and the relations with other species. Data that without a doubt is a good stimulus for "real" plans of environmental education directed to target populations (communities, institutions, decision-makers, etc.)"*

Also some interesting points and experiences were told in the final open question where the recipients were free to comment on repatriation.

- *"My best experience with the repatriation of the scientific data has been in Ecuador. As a part of a project of analysing the state of conservation of the 4.000 endemic plant species in the country, repatriation of many scientific articles (taxonomic descriptions), some photos (of botanic species in the United States and European museums) and high resolution scanner printed copies of botanic species in the United States and European museums, that now are found in Ecuadorian museums, was achieved. Also we were able to document the scale of the problem, finding out quantitative data, for example the percentage of the Ecuadorian endemic plants for which does not exist any specimen in Ecuadorian museums."*

- *"The repatriation has to bee looked at case by case…"*

- *"…in my country (like in other developing countries), there has constantly been exportation of information: through collections (insects, seeds, verbal data of indigenous communities etc.), data that has not arrived (until now to us), and if it has arrived, it has been poor or not very understandable. In my little experience I have observed how this information does not arrive to the destination, for example: in the year 1998 we worked with a foreign museum with the collection of Lepidoptera, a group that did the collection had to as a counterpart (because we do not have the bibliography to do profound identification of the collected species) pay us with the articles and information of the specimens, this information did not arrive to our scientific institution..*

and the times when I tried to communicate with the persons responsible they did not reply.. and like this there is a series of examples that are not very clear…"

8.4 Conclusions

Although the sample size was small, the generalizations and comparisons made from the answers give some signs of the level of CHM/GBIF/repatriation knowledge in Bolivian and Peruvian NGOs. A surprise was that the knowledge on CHM was approximately the same as on GBIF (table 2.). So, my assumption that people would know more of CHM was not correct. Also the differences between Peru and Bolivia were minimal (table 3.). The knowledge of GBIF in Bolivia was the lowest (0.75) and the highest were the knowledge of CHM in Bolivia, and surprisingly of GBIF in Peru (both 1.25) (table 3.). But when rounded up, all the averages of the level of knowledge become 1, which, when converted back to text, means "some knowledge". So, a generalization can be made that knowledge on CHM is equal to the knowledge on GBIF, but that the knowledge of both is still fairly poor. But again I must emphasize the small sample size, and the possibility that the figures would change, and some differences emerge if the sample size would be larger. Three recipients knew nothing of GBIF, and two knew nothing of CHM (table 1.). Also the possibility has to be kept in mind that people are not always completely honest when they are asked to evaluate their own knowledge, or they might have different ideas on what is meant by having *some* or *a lot* of knowledge. In my opinion the most important conclusion that can be made from this particular question, is that at least some knowledge on GBIF exists. Although GBIF is a very recent innovation, some NGOs in Peru and Bolivia (which is not even a GBIF member) have some knowledge of it. This means that the OCB of GBIF has reached some of its

goals making GBIF known to the world. CHM should have been more promoted and familiar to the NGOs by now.

The next question was the same type, but dealt with the importance of CHM and GBIF. The organization representatives gave their opinion on how important they thought CHM and GBIF are in relation to repatriation (table 4.). Again, very little difference existed between Bolivia and Peru, and CHM and GBIF (table 6.). Keeping in mind the same reservations about the sample size and differences in people's ideas on "how much is much", I conclude that in both countries both CHM and GBIF were considered to be fairly important, averages being between "moderate" and "a lot". Nobody said that GBIF or CHM have no importance at all. An interesting point to mention is that although an option of not answering the question (if not having an opinion) was given in the questionnaire, only one person chose not to answer. In a few cases, CHM/GBIF was considered to have a lot of importance, even though the person answering had not had any previous knowledge on CHM/GBIF. In one case this was explained by saying that any kind of international institution that contributes to repatriation is important.

Most respondents had not yet experienced any benefits from repatriation to their organizations, but expected to do so in the future. This result supports the conclusion that a lot of interest exists towards repatriation, even though the benefits have not yet been personally experienced. There is a clear need for innovations like the CHM and the GBIF that have the capacity to facilitate repatriation of biodiversity information. From the open questions, it is obvious, that to benefit from repatriation today, it is necessary to have a good, firm, established network of contacts including universities and other institutions in industrialized countries. Some experiences have been bad and

discouraging to the developing country institutions due to sometimes very bad behavior of the industrialized country counterpart. From the answers and also for example from discussions in “Iabin-friends” e-mail list, I have noted that some developed country investigators still possess old colonial attitudes of collecting whatever they please without respecting the laws of the developing country concerned. Still, repatriation of biodiversity information has a lot of potential and can be used in many practical cases helping to conserve the biodiversity. It seems that at least Bolivian and Peruvian NGOs count on this, feel positively about repatriation and believe to benefit from it in the future.

9. Discussion

9.1 Dealing with the problems

Repatriation of biodiversity information has many benefits but also faces problems. In the GBIF OCB Study on Data-sharing with Countries of Origin, the most frequently mentioned problems and hurdles were the financial constraints, technological problems and problems with human resources. Human resource problems are common all around the globe, also the European museums suffer from staff shortages. More staff is needed especially for the digitisation process. Lack of good Internet connections and other technology shortages are a problem in many developing countries, and capacity building should be included in repatriation efforts. The developing countries have expressed their desire to get the access to information via CD-ROM in addition to the Internet (ENBI 2004a). Of course at the moment this is important for institutions that lack good Internet connections. Still, I would see the improving of the Internet connections and facilities in developing countries more important than using of resources for information channels additional to the Internet. Internet will continue to be significant in the future, at least until something even faster and more efficient is developed, and it is important for developing countries to fully benefit from it. Internet will provide access to different types of information, not just to repatriated data, and will benefit the institutions in general.

I do not agree with the accusations that GBIF favours the developed nations or represents a form of neo-colonialism because of its Internet dependency. Organizations and innovations like the GBIF are needed so that the existing problems can be

conquered. GBIF's OCB is concentrated on helping developing countries with their capacity building problems and educating staff to use repatriated data for decision-making and other purposes. GBIF is helping to solve the problem, not causing it. The fact that the membership of GBIF costs too much for many developing countries is unfortunate, but since a chance exists to become an associate participant, it seems only fair that those making the financial contribution are the ones allowed to vote. Still, the participation of the megadiversity countries should be encouraged more and perhaps even facilitated when appropriate.

9.2 Benefits and need for repatriation in the future

Repatriation of biodiversity information brings many benefits. Not only for the country of origin, but also for the *ex situ* institution and the scientific community in general. The scientific community benefits when the relationships between developed and developing countries improve. Also making data digitally available will benefit all. The *ex situ* institutions will get more contacts and better access to *in situ* resources when they are known to share the data with the country of origin and have so gained respect and trust. Repatriated biodiversity information has already been used in several occasions in the countries of origin. Some examples have been mentioned in this Master's thesis, for instance the case of repatriating data of endemic plant species to Ecuador (see chapter 8.3). Still, not many organizations or institutions have had any concrete experience in repatriation, and the developing countries have expressed their need for more data and information (ENBI 2004a). My study supports the previous studies made by IABIN that a lot of interest exists towards repatriation of information, but the actual experience is still very minimal. IABIN expects the repatriation of information to be able to bring

concrete results in a short period of time due to the high level of interest suggested by their study (IABIN 1999). In the IABIN study (see chapter 5.2) 94% of the organisations were interested in participating in repatriation of biodiversity information process, but only 37% had already been involved in one. The results of my study are similar, only two organizations having benefited from repatriation of biodiversity information, but only two expecting not to benefit in the future (see chapter 8.3). Organizations in the countries of origin, those being mainly developing countries, definitely expect concrete benefits from repatriation even though some have had bad experiences in the past. This shows real need for innovations like the GBIF, CHM, ENBI and IABIN, as well as for individual repatriation projects.

In Peru and Bolivia most of the species are still unknown to science, and more basic research is desperately needed. Equally important are the ways to make information usable for the decision makers. Repatriation of information can be a powerful tool in increasing the knowledge on Peruvian and Bolivian biodiversity, and so enhance conservation efforts and sustainable development. Especially Bolivia, but also Peru, require better infrastructure and more resources to develop their national CHMs, systematize and organize information, increase the level of basic research and train scientists.

9.3 GBIF's future role

The survey study of this Master's thesis was mainly about CHM and GBIF, but it would have been interesting to include at least IABIN to see if the Bolivian and Peruvian NGOs feel the American IABIN is closer to them than the world wide organizations.

GBIF seems to have real potential to become an important and respected organization world wide. Despite of its young age it is partly known in Bolivian and Peruvian NGOs. The OCB of the GBIF has a major task ahead to promote and implement GBIF in all countries as well as to deal with capacity building, but it seems to have all the possibilities to succeed. In the future, initiatives like the GBIF will hopefully make easier searching for collections in *ex situ* institutions. The mid-term report of the GBIF Demonstration project states that the GBIF structures will help to identify where the country-specific biodiversity data is located. Furthermore, GBIF could provide assistance for countries to get in touch with primary producers of data outside the country and to identify research groups and organizations that have metadata and biodiversity data already linked with environmental parameters. (GBIF 2003e.) GBIF is developing central web services. These services will include a DiGIR service to query specimen and observational data from the network. This will support queries to find specimens or observations by scientific name, country, latitude/longitude bounding box and collection date. (GBIF 2004c.) When developing a new portal to search for data (GBIF or any other) it might be a good idea to add the geographical origin. Then the search could be done by the origin, not just by the taxon or the institution holding the sample. In the future, I see the GBIF having enormous potential with its technical capacities to facilitate repatriation. GBIF will become widely respected and known around the world. It will enhance the technical capacities of the developing countries, as well as developed countries, and will help to diminish the technology gap. GBIF becomes a powerful tool that can actually make repatriation happen in practice. Of course GBIF alone will not be able to eliminate poverty and inequality in this world, but it has the potential to make a considerable contribution to the process.

9.4 Benefit sharing and future role of the CBD

The open sharing of biodiversity information is seen as a necessity to preserve biodiversity, and has been promoted by several initiatives. Another necessity to preserve biodiversity is the income it generates to its holders, developing countries especially. Biodiversity can not be expected to be conserved by the developing countries unless they economically benefit from it. The failure to pay for the services that biodiversity provides leads inevitably to its decline, that is, to the loss of biodiversity. It has proven a difficult task to put a price and an economical market value to biodiversity. The CBD recognized the national sovereignty of all states over their genetic resources and promotes the fair and equitable sharing of benefits arising out of those resources (UNEP 2000c). During the signing of the CBD, a lot of hope was put to the pharmaceutical industry to pay for the right to exploit the genetic resources. Unfortunately, as predicted by for example Aylward (1995) and Albers-Schönberg (1995), this hope was premature as pharmaceutical industry has turned also to other methods of developing new drugs, and so the royalties derived from this industry to biodiversity protection are not enough. In the same time, the CBD has recently been accused of making the work of research scientists very difficult (Agres 2003, Dalton 2004, Pethiyagoda 2004). Developing countries have been keen to protect their interest and accordingly have set laws to limit access to their genetic resources. But isn't this perfectly understandable? And is the CBD really the one to blame when the countries choose to protect their biodiversity even if the measures are in excess? As the CBD recognizes the national sovereignty of all countries over their genetic resources, every country has the right to set the measures of protection as it chooses. The CBD provides general guidelines, but can not control the countries further. The fact remains that developing countries are very unlikely to protect

their biodiversity if they do not receive any benefits from it, and now some countries are trying to receive those benefits by limiting access. On the other hand, if the basic scientific research is prohibited in fear of loosing possible benefits, we do not get the valuable information on how to conserve and benefit from biodiversity. A clear trade-off exists.

CBD and its CHM are very important for setting up frames for actions and disseminating information, and they could play an important role in making the repatriated information useful in decision-making. The CBD has to deal with the very complicated issues of IPR, of which repatriation of information is a part. IPR affect international, national and regional development; they relate to conservation, sustainable development, trade and economical issues. They combine the modern globalized world and the traditional lifestyles of the indigenous peoples. For non-experts the rules seem confusing, and the current system does not value the information derived from biodiversity. At the moment IPR have been developed by the industrialized countries for the industrialized countries. A *sui generis* system has been suggested in order to value the knowledge of the indigenous peoples. Many negotiations, new standards, certificates and agreements are required. The CBD is currently planning for a new certificate of legal provenance/origin/source (UNEP 2004f).

Despite of the recent criticism, the CBD is the most comprehensive biodiversity convention bringing together many nations. It is also legally binding. It obviously needs to strengthen its position in the scientific community at the moment, and also invest more effort to the CHM. For dealing with the complicated IPR issues a strong organization is needed. One able to set and implement guidelines, to speak for the

conservation of biodiversity and sustainable use of its components in the international negotiations. The organization has to be strong enough to lead and to combine different aspects relating to environment and for example trade. It has to be big and respectable enough to set widely accepted standards in many biodiversity related issues, and to be able to negotiate and cooperate with other very powerful organizations, such as the WTO. I see no other biodiversity related organization or convention being able to do this better at the moment than the CBD. The future IPR rules and regulations will be made by the market forces, economical institutions and the large developed country companies if the “environmental front” stays quiet, undecided and soft. To really secure the right of the indigenous peoples and countries of origin to gain fair benefits arising out of use of genetic resources and so protect the biodiversity, strong measures are needed from the CBD. And in the mean while, all the institutions, whether in developed or developing countries, should remind themselves that they are all receivers and providers of information, and sharing of that information, especially with the countries of origin, will benefit us all.

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References

Agres, T. 2003: The Scientist. Daily News 10.9.03. http://www.biomedcentral.com/news/20030910/03/

Albers-Schönberg, G.: Pharmaceutical discovery process. In Swanson, T. (ed.): Intellectual property rights and biodiversity conservation. An interdisciplinary analysis of the values of medicinal plants. Cambridge University Press, Cambridge. 92 p.

Aylward, B.: Role of plant screening. In Swanson, T. (ed.): Intellectual property rights and biodiversity conservation. An interdisciplinary analysis of the values of medicinal plants. Cambridge University Press, Cambridge. 115 p.

Bhat, M. 1999: On biodiversity access, intellectual property rights, and conservation. Ecol. Econ. 29: 391–403.

BIODAMAZ 2001a: Sistema de Información de la Diversidad Biológica y Ambiental de la Amazonía Peruana – SIAMAZONIA. Documento Técnico N° 02 – Serie BIODAMAZ – IIAP, Iquitos, Perú.

BIODAMAZ 2001b: Estrategia Regional de la Diversidad Biológica Amazónica. Documento Técnico N° 01 – Serie BIODAMAZ – IIAP, Iquitos, Perú.

BIODAMAZ 2004a: http://www.siamazonia.org.pe/Sobre_SIDBAP/historia_SIAMAZONIA.htm. Downloaded 4.5.2004. BIODAMAZ – IIAP, Iquitos, Perú.

BIODAMAZ 2004b: http://www.siamazonia.org.pe/DBF-HerbarioA/Instituciones.asp. Downloaded 4.5.2004. BIODAMAZ – IIAP, Iquitos, Perú.

Bisby, F. 2000: The quiet revolution: Biodiversity informatics and the Internet. Science 289: 2309–2313.

Bisby, F., Shimura, J., Ruggiero, M., Edwards, J. & Haeuser, C. 2002: Taxonomy, at the click of a mouse. Nature 418: 367.

Blackmore, S. 2002: Biodiversity update-progress in taxonomy. Science 298: 365.

Burkholder, M.A. & Johnson L.L. 1990: Colonial Latin America. Oxford University Press, New York. 334 p.

Canhos, D., Chapman, A. & Canhos, V. 2004: Study on Data-sharing with Countries of Origin. GBIF/OCB. (http://www.gbif.org/prog/ocb/sdco)

CONAM 2001: Perú: Estrategia Nacional Sobre Diversidad Biológica. Consejo Nacional del Ambiente –CONAM, Lima, Peru.

Dalton, R. 2004: Bioprospectors hunt for fair share of profits. Nature 427: 576.

Edwards, J., Lane, M. & Nielsen, E. 2000: Interoperability of biodiversity databases: Biodiversity information on every desktop. Science 289: 2312–2315.

ENBI 2002: Description of Work. European Network for Biodiversity Information.

ENBI 2004a: Preliminary report on non-European needs for biodiversity data. Sub-report 1: Report on non-European user needs for biodiversity data. European Network for Biodiversity Information, WP 13, Zoological Museum, University of Copenhagen, Denmark.

ENBI 2004b: Preliminary report on non-European needs for biodiversity data. Sub-report 2: Report on data use of biodiversity databases. European Network for Biodiversity Information, WP 13, Zoological Museum, University of Copenhagen, Denmark.

Gaston, K.J. & May, R.M. 1992: Taxonomy of taxonomists. Nature 356: 281–283.

GBIF 2000: Memorandum of Understanding for the Global Biodiversity Information Facility.

GBIF 2002a: GBIF Work Programme 2003.

GBIF 2002b: Scientific and Technical Advisory Group meeting on GBIF's Outreach and Capacity Building. 14-15 July, 2002, Pretoria, South Africa. GBIF Secretariat.

GBIF 2003a: Global Biodiversity Information Facility Strategic Plan.

GBIF 2003b: GBIF and CBD sign a Memorandum of Cooperation. http://www.gbif.org/Stories/STORY1059394566.

GBIF 2003c: GBIF Work Programme 2004.

GBIF 2003d: Promotion of GBIF, expansion of GBIF membership and catalyzation of fundraising efforts. Executive summary of the tender. GBIF/OCB/GBIF Demonstration Project. http://gbifdemo.utu.fi/

GBIF 2003e: Promotion of GBIF, expansion of GBIF membership and catalyzation of fundraising efforts. Mid-Term Report. GBIF/OCB/GBIF Demonstration Project. http://gbifdemo.utu.fi/

GBIF 2004a: GBIF and Catalogue of Life partnership sign a Memorandum of Cooperation. http://www.gbif.org/Stories/STORY1073492201.

GBIF 2004b: GBIF Experts' Meeting on biodiversity data, databases and property rights issues. Royal Botanical Garden, Madrid, Spain, 1-2 March 2004. Meeting Report.

GBIF 2004c: Call for tenders. 2004 GBIF Demonstration project. http://www.gbif.org/prog/ocb/2004demo

GBIF 2004d: Final report. GBIF Demonstration Project. http://gbifdemo.utu.fi/.

Geerders, P. 2004: Developing a context of trust in biodiversity data sharing. SciDev.Net. Letters to the editor. 11 May 2004.

Grant, N. & Morter, P. 1992: Löytöretkiatlas. Werner Söderström Osakeyhtiö, Porvoo-Helsinki-Juva. pp. 48–51.

Hunter, C. 1997: Sustainable bioprospecting: Using private contracts and international legal principles and policies to conserve raw medicinal materials. Boston College Environ. Affairs Law Rev. 25: 129–175.

IABIN 1999: Red Interamericana de Intercambio de Información sobre Biodiversidad: Aspectos legales e institutionales. http://www.iabin-us.org/meetings/legal_issues/legalfnl.html.

IABIN 2001: European Inventory pilot project. An inventory of New World vertebrate holdings in European collections. Final Report. Inter-American Biodiversity Information Network.

IABIN 2002: Phase I IABIN Report for Sub-region 1. “Building the Inter-American Biodiversity Information Network (IABIN)”. GEF PDF Preparatory Block B Grant.

IABIN 2003: Building the Inter-American Biodiversity Information Network. Project Implementation Plan. Draft #4.0.

IABIN 2004a: Building the Inter-American Biodiversity Information Network. Project Implementation Plan. Draft #8.2.

IABIN 2004b: The United Stated Node of the Inter-American Biodiversity Information Network. http://www.iabin-us.org. (downloaded 10.3.2004)

Laihonen, P., Salo, J. & Kalliola, R. 2002: The Clearing-house mechanism and the Global Biodiversity Information Facility; is there a common future? In Pillman, W. & Tochtermann, K. (Eds.): Environmental Communication in the Information Society. – Proceedings of the 16th Conference "Environmental Infomatics 2002" of the Expert Committee 4.6 "Informatics for Environmental Protection", GI Gesellschaft für Informatik, Bonn, September 25-27, 2002, Vienna University of Technology.

Laihonen, P. 2003: Global biodiversity information exchange: Processes and methodological challenges. Turun yliopisto, Turku.

Laihonen, P., Rönkä M., Tolvanen H. & Kalliola, R. 2003: Geospatially structured biodiversity information as a component of a regional clearing house. Biodiversity and conserv. 12: 103-120.

Laihonen, P., Kalliola, R. & Salo, J. 2004: The biodiversity information clearing-house mechanism (CHM) as a global effort. Environ. Sci. & Policy 7: 99–108.

Lappalainen, I. (ed.) 1998: Suomen luonnon monimuotoisuus. Oy EDITA Ab, Helsinki.

Leikola, A. 1981: Biologian historian pääpiirteet. Helsingin yliopiston monistuspalvelu, Helsinki. 63 p.

Leslie, M. (ed.) 2004: One-Stop Taxonomy. Science 303: 1267.

Masood, E. 2004: Developing world slow to share biodiversity data. SciDev.Net. News.15 April 2004.

Merck 2004: http://www.merck.com/about/cr/policies_performance/environmental/. (downloaded 3.9.2004)

MDSP 1997: Implementación del Convenio sobre Diversidad Biológica. Ministerio de Desarollo Sostenible y Planificación (MDSP), Viceministerio de Desarollo Sostenible y Medio Ambiente, Direccion General de Biodiversidad, La Paz, Bolivia.

MDSP 2001: Estrategia Nacional de Conservación y Use Sostenible de la Biodiversidad. Ministerio de Desarollo Sostenible y Planificación, La Paz, Bolivia.

Mittermeier, R. A., Gill, P.R, & Mittermeier C.G. 1997: Megadiversity: earth's biologically wealthiest nations. CEMEX, Mexico City, Mexico.

Mäki, S. 2003a: The Western Amazon Region in a wider context: An international and inter-regional study of Colombia, Ecuador, Peru and Bolivia. In: Geographical variation and interactions in the Western Amazon region: Providing tools for environmental planning. Turun yliopisto, Turku.

Mäki, S. 2003b: Geographical variation and interactions in the Western Amazon region: Providing tools for environmental planning. Turun yliopisto, Turku.

Pethiyagoda, R. 2004: Biodiversity law has had some unintended effects. Nature 427: 576.

Redfearn, J. 1999: OECD to set up global facility on biodiversity. Science 285: 22–24.

Ruiz, M. & Pooma, R. with Jenkins, M. & ten Kate, K. 2000: Going Home. A manual on the Repatriation of Information form ex-situ Conservation and research Institutions to countries of origin. The Board of Trustees, Royal Botanic Garden, Kew.

Ruiz Muller, M. 2004: An analysis of the implications of intellectual property rights (IPR) on the Global Biodiversity Information Facility (GBIF). (www.gbif.org/prog/ocb/iprmtg)

Schnase, J., Cushing, J., Frame, M., Frondorf, A., Landis, E., Maier, D. & Silberschatz, A. 2003: Information technology challenges of biodiversity and ecosystem informatics. Inform. Systems 28: 339–345.

Seppänen. M. & Zegarra, J. 1992: Kohti loistavaa menneisyyttä. Kenen Amerikka? 500 vuotta Latinalaisen Amerikan valloituksesta pp. 62-84. Toim. Pakkasvirta, J. ja Teivainen, T. Gaudeamus. Gummerus Kirjapaino. Jyväskylä.

Singer, C. 1951: A History of Biology. A General Introduction to the Study of Living Things. Henry Schuman, New York. pp.130–145

Smith, A. 1990: Explorers of the Amazon. The University Chicago Press, Chicago and London. 344p.

Stork, N.E. 1988: Insect diversity: facts, fiction and speculation. Biological Journal of the Linnean Society 35: 321–337.

Sääksjärvi, I.E. 2001: Eliönäytteiden keräilystä ulkomailla: lupa-asiat kuntoon ennen maastoon menoa. Babtria 26: 125–126.

The Natural History Museum and the Royal Botanic Gardens, Kew 2004: Richard Spruce on the Amazon. http://internt.ac.uk/jdsml/botany/spruce/index.dsml

Thwaites, T. 1998: Bioinformatics. Ecos. 97: 30–34.

Tuomisto, H., Ruokolainen, K. & Yli-Halla, M. 2003: Dispersal, Environment, and Floristic Variation of Western Amazonian Forests. Science 299: 241–244.

Tuomisto, H., Ruokolainen, K., Kalliola, R., Linna, A., Danjoy, W. & Rodriquez, Z.1995: Dissecting Amazonian biodiversity. Science 269: 63–66.

UNDP 2002: Informe sobre Desarollo Humano. Perú 2002. Aprovechando las potencialidades. Programa de las Naciones Unidas para el Desarollo (PNUD). Oficina del Perú. Lima, Perú.

UNEP 1992a: Article 16. Access to and transfer of technology. Convention on biological diversity.

UNEP 1992b: Article 2. Use of terms. Convention on biological diversity.

UNEP 1992c: Article 17. Exchange of information. Convention on biological diversity.

UNEP 1992d: Article 1. Objectives. Convention on biological diversity.

UNEP 1992e: Article 18. Technical and scientific cooperation. Convention on biological diversity.

UNEP 1992f: Article 19. Handling of biotechnology and distribution of its benefits. Convention on biological diversity.

UNEP 1992g: Article 20. Financial resources. Convention on biological diversity.

UNEP 1992h: Preamble. Convention on biological diversity.

UNEP 1996: Identification, monitoring and assessment. UNEP/CBD/COP/3/10.

UNEP 1998: Report and recommendations of the third meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, and instructions by the Conference of the Parties to the Subsidiary Body on Scientific, Technical and Technological Advice. UNEP/CBD/COP/4/1

UNEP 2000a: Access to genetic resources. UNEP/CBD/COP/5/26

UNEP 2000b: Article 8(j) and related provisions. UNEP/CBD/COP/5/16.

UNEP 2000c: Sustaining life on Earth. How the Convention on Biological Diversity promotes nature and human well-being. Secretariat of the Convention on Biological Diversity.

UNEP 2000d: Scientific and technical cooperation and the clearing-house mechanism. UNEP/CBD/COP/5/14.

UNEP 2002a: Access and benefit-sharing as related to genetic resources. UNEP/CBD/COP/6/24.

UNEP 2002b: Global Taxonomy Initiative. http://www.biodiv.org/programmes/cross-cutting/taxonomy/

UNEP 2003: Consideration of Article 17 by the COP. http://www.biodiv.org/convention/articles.asp?a=cbd-17&inf=1#inf (downloaded 12th of May 2004)

UNEP 2004a: Parties to the Convention on Biological Convention. http://www.biodiv.org/world/parties.asp?tab=0 (downloaded 15th of May 2004)

UNEP 2004b: Scientific and technical cooperation and the clearing-house mechanism. UNEP/CBD/COP/7/23.

UNEP 2004c: Clearing-House Mechanism. CBD. http://www.biodiv.org/chm/default.aspx (downloaded 17th of May 2004)

UNEP 2004d: Transfer of technology and technology cooperation. UNEP/CBD/COP/7/29.

UNEP 2004e: Global Taxonomy Initiative. UNEP/CBD/COP/7/9.

UNEP 2004f: Access and benefit-sharing as related to genetic resources. UNEP/CBD/COP/7/19.

UNEP 2004g: The Convention on Biological Diversity in Bolivia. http://www.biodiv.org/world/map.asp?lg=0&ctr=bo (downloaded 17th of May 2004)

UNEP 2004h: The Convention on Biological Diversity in Peru. http://www.biodiv.org/world/map.asp?lg=0&ctr=pe (downloaded 17th of May 2004)

UNEP 2004i: Clearing-House Mechanism. Status of CHM National Focal Points. http://www.biodiv.org/chm/stats.asp (downloaded 18th of May 2004)

UNEP-IABIN 2002: Memorandum of cooperation between The Secretariat of the Convention on Biological Diversity and The Council of the Inter-American Biodiversity Information Network.

Wade, D. 1997: The rubber industry's biological nightmare. Fortune 136: 86–94.

Williamsom, E. 1992: The Penguin History of Latin America. Penguin Books, London.

Wilson, E. 2000: A global biodiversity map. Science 289: 2279.

World Bank 2000: Banco Mundial con contribución de: INE: Instituto Nacional de Estadística y UDAPE: Unidad de Análisis de Políticas Económicas: "Bolivia: Diagnóstico de Pobreza 2000" Versión borrador, 30 de junio del 2000.

World Bank 2004: The World Bank Group. Bolivia Data Profile. http://devdata.worldbank.org/external/CPProfile.asp?SelectedCountry=BOL&CCODE=BOL&CNAME=Bolivia&PTYPE=CP.

Master's thesis

Pohja, M. 2002: *Complexity of inventorying the global biological diversity: meeting demands of the Convention on Biological Diversity; Collecting and export permits, loans of specimens and dissemination of data.* Biodiversity Science. Turku. The University of Turku. p.19.

Annex 1.

La encuesta sobre la repatriación de información de biodiversidad

Abril 2004

1. Nombre y correo electrónico:_____

_____

2. Nombre de la institución en que trabaja:_____

_____

3. La posición que ocupa en la institución:_____

_____

4. a. ¿Cuánto conoce usted sobre el trabajo de CHM? (MARCAR CON X)

__ nada

__ poco

__ regular

__ mucho

4. b. ¿Cuánto conoce usted sobre el trabajo de GBIF? (MARCAR CON X)

__ nada

__ poco

__ regular

__ mucho

5. a. En su opinión, desde el punto de vista de repatriación, ¿cuánta importancia tiene CHM? (MARCAR CON X; SI NO TIENE OPINIÓN, NO MARCA)

__ nada

__ poco

__ regular

__ mucho

5. b. En su opinión, desde el punto de vista de repatriación, ¿cuánta importancia tiene GBIF? (MARCAR CON X; SI NO TIENE OPINIÓN, NO MARCA)

__ nada

__ poco

__ regular

__ mucho

6. ¿ La repatriación de información ya ha sido útil a su institución? (SÍ / NO)_____

SI RESPODIÓ SÍ: ¿Cómo ha sido útil y de dónde se obtuve la información?

_____

_____

_____

_____

_____

7. ¿Cree usted que en el futuro la repatriación de información de biodiversidad va a ser útil a su institución? (SÍ / NO) _____

SI RESPODIÓ SÍ: ¿Cómo cree usted que su institución va a beneficiar?

_____

_____

_____

_____

8. Datos adicionales, o si quiere comentar algo sobre este encuesta, CHM / GBIF o repatriación.

_____

_____

_____

MUCHISIMAS GRACIAS POR SU PARTICIPACIÓN!!!!

POR FAVOR, DEVUELVE ESTE FORMULARIO A ulla.helimo@utu.fi.

Annex 2. Turku, Finlandia 14.4. 2004

LA REPATRIACIÓN DE INFORMACIÓN DE BIODIVERSIDAD

Estimado destinatario,

Estoy haciendo mi licenciatura en la Universidad de Turku, Finlandia. Mi tesis es sobre la repatriación de información de biodiversidad. Me centro en los roles de Infraestructura Mundial de Información en Biodiversidad (GBIF, Global Biodiversity Information Facility), en el Mecanismo de Facilitación (CHM, Clearing House Mechanism), y en los puntos de vista de las organizaciones no gubernamentales (ONG´s) en Peru y Bolivia. He elegido algunas organizaciónes de medio ambiente que tienen importancia en su país, y estoy muy interesada en conocer las opiniones de su organización, por lo que le envió este cuestionario.

La repatriación significa devolver los datos y informacíon a los países de origen. Hay grandes colecciones en Museos de Historia Natural en Europa y Estados Unidos donde los especímenes son de países en vías de desarollo. Ahora se ha empezado la digitalización y difusión global de los datos de biodiversidad del mundo. CHM (Mecanismo de Facilitación), es un mecanismo establecido en el marco de Convenio sobre Diversidad Biológica (CDB) para promover y facilitar la cooperación cientifica y técnica. GBIF (La Infraestructura Mundial de Información en Biodiversidad), es un esfuerzo científico internacional que tuvo su génesis en un grupo de trabajo del Foro Mega Científico de la Organización para la Cooperación Económica y de Desarollo (OCDE) y fue establecida formalmente el 1 de marzo del 2001. Una parte de su visión de GBIF es permitir a usuarios de todo el mundo descubrir y usar inmensas cantidades de datos globales de biodiversidad.

Por favor familiarizarse con el cuestionario, llenalo y envialo a mi e-mail a: ulla.helimo@utu.fi. Si necesita datos adicionales, puede preguntar via e-mail: ulla.helimo@utu.fi o teléfono: +358445270777.

Muchas gracias por su cooperación!

Atentamente,

Ulla Helimo, BSc

Annex 3. ORGANIZATIONS INCLUDED IN THE SURVEY STUDY

BOLIVIA

HERENCIA (http://www.herencia.org.bo)

Herencia is an NGO that promotes the sustainable development of the Bolivian Amazon together with the local communities and organizations. The central office is located in the city of Copija, department of Pando in Bolivia. The general objective of Herencia is to generate, promote, implement and support planning, education and investigation processes done for sustainable development. Herencia has three priorities: 1) conservation of the natural resources and environment, including investigation of biodiversity and monitoring of plant and animal species; 2) local development, including the formulation of projects on sustainable use of natural resources based on the local biodiversity; and 3) citizen participation. Herencia's activities also include information on and databases of the Amazon; strengthening the geographical information systems (GIS); systematization of the indigenous knowledge; and elaboration of socioeconomic studies. Herencia works with the communities, municipal governments, and with local, regional, national and international institutions involved with development and procedures of the natural resources and environment.

Liga de Defensa del Medio Ambiente - LIDEMA (http://www.lidema.org.bo)

LIDEMA is a non-profit organization founded in 1985 in La Paz, a network of 23 institutions dedicated to promoting sustainable development in Bolivia It was founded by the first environmental organizations in Bolivia.. LIDEMA aims to affect environmental politics and law. It implements educational programs on development, formation of human resources and investigation. Its activities include environmental planning and education, basic and applied investigation, managing protected areas, and ecotourism. It has national and international projects. The mission of LIDEMA is to contribute to the defence of the environment and the conservation of the biosphere. Its role is to represent and promote the national environmental movements through coordination of forces and actions of its member institutions.

Protección del Medio Ambiente Tarija – PROMETA

(http://elgranchaco.com/prometa/)

PROMETA is a private non-profit organization dedicated to the conservation of the natural environment. PROMETA has its base of operations in the city of Tarija in southern Bolivia. Founded in 1990 by three volunteer members, PROMETA currently consists of a board of directors, an executive director and technical staff of more than 70 professionals who execute numerous programs that focus on conservation, sustainable development, environmental education and communication, valuation of environmental services, and implantation of ecological corridors in the protected areas of the department of Tarija. PROMETA has a public and private protected area administration which embraces the biodiversity conservation strategy. It works for the conservation of the environment by administering public, private, departmental and municipal protected areas. These areas constitute an important instrument in Bolivia's National Biodiversity Strategy. PROMETA believes that in order to build an effective model of fair and inclusive sustainable development, the different groups and sectors that make up society must be included, and so PROMETA maintains contact and relation with Civic Committees, universities, state agencies and municipal governments.

Asociación Boliviana para la Conservación – TRÓPICO (http://www.tropico.org)

TRÓPICO is a non-profit NGO focusing on the biodiversity conservation and the sustainable development in Bolivia. TRÓPICO was founded in 1986 when it was called Centro de Datos para la Conservación (CDC-Bolivia). The objectives of TROPICO are to support and to promote the administration and conservation of the protected areas for the benefit of the local population and the country in general; to support and to promote the conservation and management of wildlife and natural resources; and to provide consultation to the public and private entities on different environmental issues. TROPICO's mission is to contribute to the conservation of the biological diversity in Bolivia in the framework of sustainable development. TRÓPICO has executed over 50 projects and programs in various zones in Bolivia. It works with the government institutions, and national and international NGOs. TRÓPICO has many on-going projects and programs, for example it has a project on biodiversity and protected areas and a Tropical Forests Program that contributes to the protection of the biodiversity in the tropical forests.

PERU

Amazon Conservation Association (http://www.amazonconservation.org/)

The ultimate goal of the non-profit Amazon Conservation Association is to conserve the maximum amount of Amazonian biodiversity. It envisions a network of state, community, and private lands managed for conservation and sustainable resource use so that the biological diversity of the southwest Amazon basin is conserved. It strives to establish partnerships with governments, local communities and other conservation organizations to develop innovative conservation tools that will expand the amount of protected land in the region. Its actions are informed by scientific research and designed to achieve concrete and measurable outcomes. Resources are concentrated in the field, where they have the largest conservation impact. Amazon Conservation Association has two administrative offices in Peru, one in Cusco and one in Puerto Maldonado. It also has an administrative office in Washington, DC, USA, although virtually all of their employees are in Peru. They have many projects, one of which is called Biodiversity Assessment and Monitoring.

Asociación Peruana para la Conservación de la Naturaleza – APECO (http://barrioperu.terra.com.pe/apeco/presentacion.htm)

APECO is a non-profit NGO with 20 years of experience in the conservation of biological diversity and promotion of sustainable development. Its mission is to support the nature conservation in Peru, preserve the biological diversity and to promote the right use of natural resources. Principal interests include environmental education and capacity building; investigation and monitoring of biological diversity for conservation purposes; sustainable management of natural resources; and promotion of environmental politics. APECO was funded in 1982, and works together with NGOs, and the governmental sector. It supports environmental contracts and laws, helps to develop strategies and to complete inventories of flora and fauna of the protected nature areas. APECO has provided the major part of the scientific information of biological diversity in the Río Abiseo National Park. It keeps generating information and has on-going projects. APECO has for example provided for the introduction of the environmental dimension to the national education, and works for educating the public on the environmental issues, including the international conventions on biological diversity.

PROTERRA (http://www.proterra.org.pe)

PROTERRA is a non-profit NGO founded in 1983. It promotes the environmental laws and the sustainable development in Peru. PROTERRA concentrates on political will and the public opinion in environmental issues. It directs the formation of environmental law and administration in local, regional, national and international levels. PROTERRA works with communal organizations, political actors, opinion formers, academics, NGOs, and public and private institutions. PROTERRA's objectives include to create bonds between communal organizations, NGOs and institutions, and in the end have influence in the level of political decision-making in respect of a systematic conception on sustainable development and the protection of the environment.

Sociedad Peruana de Derecho Ambiental – SPDA (http://www.spda.org.pe)

SPDA is a non-profit organization directed to law professionals who believe in the possibility of sustainable development and the necessity to conserve the environment. SPDA's priorities include to act as a facilitator in the decision-making process, in the generation of law applications that combine social, economic and environmental issues; to defend every citizen's rights for a clean environment; and to contribute to the production processes of clean environment. SPDA serves the Peruvian community and works in the national and international level. SPDA has a program on conservation aimed to implement the legislation and politics for the protection of biodiversity, especially through conservation of the protected natural areas, protection of wildlife and ecosystems that possess a high biological diversity. SPDA also has a program on international matters and biodiversity that aims to have influence on national, regional and international level. The program is especially for conservation of biological diversity and the proper use of biological resources, for example the equal distribution of the benefits derived from genetic resources within the framework of CBD.

Annex 4. LIST OF ACRONYMS

ABIF	Australian Biodiversity Information Facility
ACCA	Amazon Conservation Association
ARCBC	Asean Regional Center for Biodiversity Conservation
BioCASE	Biological Collection Access Service for Europe
BioCISE	Resource Identification for a Biological Collection Information Service in Europe
BIODAMAZ	Proyecto Diversidad Biológica de la Amazonia Peruana
CAN	Comunidad Andina de Naciones
CBD	Convention on Biological Diversity
CDC	Center for Data Conservation
CHM	Clearing House Mechanism
CIDS	Inter-American Committee on Sustainable Development
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CONABIO	Comisión Nacional para el Conocimiento y Uso de la Biodiversidad
CONADIB	Comisión Nacional de la Diversidad Biológica
CONAM	Consejo Nacional del Ambiente
COP	Conference of the Parties
CRIA	Reference Center on Environmental Information
DADI	Data Access and Database Interoperability
DIGIT	Digitization of Natural History Collections
DSCO	Data Sharing with Countries of Origin
ECAT	Electronic Catalogue of the Names of Known Organisms
ENBI	European Network for Biodiversity Information
ERDBA	Regional Biodiversity Strategy of Peruvian Amazonia
EU	European Union
GBIF	Global Biodiversity Information Facility
GEF	Global Environmental Fund
GIS	Geographical Information System
GNP	Gross National Product

GTI	Global Taxonomy Initiative
ICSU	International Council for Science
IAC	Informal Advisory Committee
IIAP	Instituto de Investigaciones de la Amazonia Peruana
INBio	Instituto Nacional Biodiversidad
IPR	Intellectual Property Rights
IT	Information Technology
ITIS	Integrated Taxonomic Information System
LDC	Least Developed Country
LOOP	Locally Owned and Operated Partnership
MDSP	Ministerio de Desarollo Sostenible y Planificación
MEA	Multilateral Environmental Agreement
MoC	Memorandum of Cooperation
MoU	Memorandum of Understanding
NFP	National Focal Point
NGO	Non-governmental Organization
NHM	Natural History Museum
NYBG	New York Botanical Garden
OAS	Organization of American States
OBIS	Ocean Biogeographic System
OCB	Outreach and Capacity Building
OECD	Organization of Economic Co-operation and Development
RBG	Royal Botanical Garden
SABONET	Southern African Botanical Diversity Network
Siamazonia	Sistema de Información de la Diversidad Biológica y Ambiental
TCA	Tratado de Cooperación Amazónica
UNEP	United Nations Environmental Programme
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
WIPO	World Intellectual Property Organization

Annex 5 WWW PAGES

The Convention on Biological Diversity (CBD)
http://www.biodiv.org

The Clearing House Mechanism of the CBD (CHM)
http://www.biodiv.org/chm/default.aspx

The Global Biodiversity Information Facility (GBIF)
http://www.gbif.org

The European Network for Biodiversity Information (ENBI)
http://www.enbi.info/forums/enbi/index.php

The Inter-American Biodiversity Information Network (IABIN)
http://www.iabin.net/

The GBIF demonstration project
http://www.gbifdemo.utu.fi

The Integrated Taxonomic Information System (ITIS)
http://www.itis.usda.gov

Species 2000
http://www.sp2000.org

BIONET International
http://www.bionet-intl.org

ALL Species Foundation
http://www.all-species.org

The World Intellectual Property Organization (WIPO)
http://www.wipo.int