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## German Research Programs, related to the understanding and conservation of biodiversity as an example of the impact of the Convention of Rio on an industrial nation

Programas Alemanes de Investigación, relacionados con la comprensión y la conservación de la biodiversidad como ejemplo del impacto del Convenio de Rio sobre una nación industrializada

Erwin H. Beck

Department  
of Plant Physiology, University of Bayreuth, Universitaetsstr. 30,  
95440 Bayreuth, Germany, e-mail: erwin.beck@uni-bayreuth.de

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## **German Research Programs, related to the understanding and conservation of biodiversity as an example of the impact of the Convention of Rio on an industrial nation**

### **Abstract**

An overview of the various German programs on biodiversity research, which are linked to, or result from the commitments of the Convention on Biological Diversity, and their source of funding, is presented. Referring briefly the aims of the individual programs the major topics of German biodiversity research, in particular inventories, functionality, dynamics and regeneration, protection, management, valuation, legal aspects, and benefit sharing with counterparts is addressed and commented. Connections of biodiversity research and global change research are worked out. Key words: Research German program, Biological diversity, global change

### **Resumen**

Se presenta una descripción de varios programas alemanes sobre la investigación de biodiversidad que son unidos a, o que son resultado de los acuerdos de la Convención sobre la Diversidad Biológica, y su fuente de financiamiento. Se describe y se comenta brevemente los objetivos de los programas individuales, los temas de la principales investigaciones alemanas de la biodiversidad, particularmente los inventarios, la funcionalidad, la dinámica y regeneración, la protección, el manejo, evaluación, los aspectos legales, y la ventaja compartida con los homólogos. Están demostradas las relaciones entre la investigación de biodiversidad y la investigación de cambio global. Palabras clave: Programa de Investigación Alemán, Diversidad biológica, Cambio global

### **Introduction**

Germany's biodiversity is estimated as 28000 plant species, of which 6450 species are vascular plants, about 45000 species of animals and an uncounted number of fungi and microorganisms. Ecuador's biodiversity is less well known, but estimating it five-fold higher at least with respect to plants, may be fair. In a plain sense, the term "biodiversity" refers to the number of species, genomes or genes of a selected area say Ecuador or Germany. However, in a figurative sense, biodiversity also implies the idea of communities and of interactions. Therefore biodiversity research connotes more than only inventory research. The dramatic loss of species caused by global change, and the increasing public interest in sustainable utilization of ecosystems, resulted in governmental and non-governmental activities for the worldwide conservation of activities for the worldwide conservation of biodiversity and finally in 1992 in the Convention of Rio, the "CBD".

Germany's participation in international programs and activities

Germany has signed the CBD and is a member of Conference of the Parties (COP) since 1993. Biodiversity protection and research are therefore genuine tasks and obligations shared by a great number of governmental and non-governmental authorities. In addition to their own terms of reference, the Federal Ministries and Authorities fulfill the national tasks and international commitments of the Biodiversity agreements.

A "National Committee on Global Change Research" and a "Scientific Council for Global Change of the Federal Government" (<http://www.wbgu.de>) were established in Germany which strongly emphasized the importance of biodiversity conservation and the necessity of biodiversity research. Several secretariats have been set up, e.g. a CBD-secretariat (<http://www.biodiv.org>), a secretariat for the Clearinghouse-Mechanisms (<http://www.biodiv-chm.de/english/index>), a secretariat of Diversitas, and several Central Offices for documentation of biodiversity, e.g. for agriculture, forestry and fishery.

As a member of the European Union, Germany participates in the 5th and the 6th framework programs. In the scope of the 5th framework biodiversity-research was and is performed under the aspects of "Quality of life and management of living resources" and "Global Change, Climate and

Species Diversity". In these days the 6th framework programs have just started. There is a research priority "Sustainable Development and Global Change" which addresses research into "Biological diversity, Conservation of genetic resources, Functionality in terrestrial and aquatic ecosystems and Interaction of man and ecosystems".

Exact figures about financing of biodiversity-research by the German government are not available. However, extrapolations on the basis of the major programs may come up to a magnitude of 100 million \$ per year.

#### Nature Conservation in Germany

Nature Conservation has a long history in Germany. Originally only endangered species were protected, but after World War II, habitat protection came into practice. Nature Conservation has been taken into the Federal as well as most of the Federal States Constitutions and is a matter of the German basic law. It is taught as a subject in primary and secondary schools. Two Universities offer Diploma Studies in Nature conservation. Establishment and gazetting of the more than 5000 protected areas range as affairs of the individual states but have to be agreed upon by the Federal authorities. This holds also for the 14 National Parks which have been established in Germany since 1978.

Botanical Gardens. An important contribution to the commitments of the CBD, is accomplished by the 101 German Botanical Gardens, which are either affiliated with Universities or directly financed by the public. About one fifth of the worldwide known vascular plants are *ex-situ* cultivated in these Gardens. Several species which have been eradicated in their natural habitat have survived in Botanical Gardens and in a few cases from there have been reintroduced to their home-country, e.g. *Sophora toromino*, the only tree of the Easter Island, which was exterminated according to the records of IUCN. In 1988 one individual was detected in the Botanical Garden of Bonn and an international propagation program was started. In 1996 the first juveniles could be reintroduced to the Easter Islands.

Non-governmental organizations: In a similar way numerous NGOs and scientific societies work in the fields of biodiversity-research and -conservation. Such NGOs, e.g. the German Botanical Society (<http://www.deutsche-botanische-gesellschaft.de>), Ecological (<http://www.uni-giessen.de/gfoe>) and Zoological Societies (<http://www.dzg-ev.de/index.html>) not only pursue the protection of endangered species, but also monitor and map the occurrence of the individual species and often investigate their biology. The most important NGO for nature protection in Germany is the BUND (<http://www.bund.net/>).

#### Grant-funded Biodiversity Research in Germany

Biodiversity research on a higher instrumental level, such as genetic population demarcation, analysis of ecological fitness and survival strategies, and of a potential economic use is the task of institutions which have the necessary equipment at their disposal, such as Universities, major research associations, e.g. the institutes of the Max Planck Society (<http://www.mpg.de/instituteProjekteEinrichtungen/index.html>), several Academies, Federal and Non-Federal research departments.

#### Main areas of biodiversity-research

According to the programs, biodiversity-research in Germany takes place at 3 levels: Molecular biodiversity-research, organismic biodiversity-research and ecosystem-related biodiversity-research (Figure 1).

**Fig.1 Major Topics of Biodiversity Research in Germany**

| <b>Molecular BD-Research</b>   | <b>Organismic BD-Research</b>  | <b>Ecosystem-targeted BD-Research</b>  |
|--|--|--|
| <p><b>1. Microorganisms (MO)</b></p> <ul style="list-style-type: none"> <li>• alpha-Diversity of terrestrial and marine MO</li> <li>• MO for soil &amp; water detoxification</li> <li>• MO and sustainable agricultural fertility</li> <li>• Foodstuff relevant MO</li> <li>• MO genetic diversity and variability: Medicinal aspects</li> <li>• alpha-Diversity of phyto- and zooplankton</li> </ul> <p><b>GenoMik</b><br/>Center of Biol. Resources</p> <p><b>2. Plants</b></p> <p>GABI (Genome analysis...)<br/>Genetic variability of forest trees</p> <p><b>Gene bank: IPK Gatersleben</b><br/>Information Centre on BD</p> <p><b>3. Animals</b></p> <p>Population analysis &amp; conservation (<i>gene bank</i>)</p> | <p><b>Databases:</b></p> <ul style="list-style-type: none"> <li>•Vascular Plants</li> <li>•Global Register on Migratory Species</li> <li>•GBIF</li> </ul> <p><b>Subjects:</b></p> <ul style="list-style-type: none"> <li>• <math>\alpha</math>-Diversity</li> <li>•Population ecology</li> <li>•Biology of species</li> </ul> <p><b>Programs:</b></p> <p><b>Terrestrial Biodiversity</b></p> <ul style="list-style-type: none"> <li>•Biodiversity and Agriculture</li> <li>•Biodiversity and Forestry</li> <li>•Animal wildlife and wildlife diseases</li> </ul> <p><b>Marine Biodiversity</b></p> <ul style="list-style-type: none"> <li>•Inventories</li> <li>•Deep Sea Research</li> <li>•Marine Natural Compounds</li> </ul> <p><b>German Science Foundation:</b><br/>Adaptive Radiation: Origin of biological diversity</p> | <p><b>Subjects:</b></p> <ul style="list-style-type: none"> <li>• <math>\beta</math>- and <math>\gamma</math>-Diversity</li> <li>•Functionality of BD in ecosystems</li> <li>•Ecosystem Research</li> <li>•Stability and sustainable use</li> <li>•Invasive species</li> <li>•Increase of BD and renaturalization</li> </ul> <p><b>Programs:</b></p> <ul style="list-style-type: none"> <li>•BIOLOG</li> <li>•SHIFT (Mata Atlantica)</li> <li>•BIOTEAM</li> </ul> <p><b>German Science Foundation:</b><br/>Functionality in a tropical mountain rainforest</p> <p>Stability of rainforest margins</p> |

**Figure 1. Major Topics of Biodiversity Research in Germany**

#### Molecular biodiversity-research

Molecular genome inventories are investigated from all kinds of organisms: Microorganisms, fungi, plants and animals. These inventories aim at basic research as well as at useful organisms or at least genes.

#### Molecular biodiversity of microorganisms

Microorganisms accomplish a great multitude of services in natural and anthropogenic habitats, both terrestrial and marine, and are used in many applications, mostly in foodstuff production and pharmacy; and many of them are pathogenic. Major research programs in Germany [(Figure 1)] in which usually several institutions participate aim at:

Inventories of terrestrial microorganisms and marine microorganisms

Detection and cultivation of microorganisms which can be used for detoxification of polluted soils and waters

The contribution of microorganisms to a sustainable fertility of agricultural soils

Food-stuff-relevant microorganisms: Diversity of producers, spoilers and pathogenic organisms

Genetic diversity and variability of microorganisms of medicinal interest is mainly investigated in cooperation with industry and hospitals medicinal aspects of microbial

Species diversity and monitoring of marine phyto- and zooplankton

GenoMik (<http://www.genomik.uni-goettingen.de>) is a research program launched in October 2000 by the Federal Ministry of Education and Research (<http://www.bmbf.de/>) which covers most of the listed topics. It is financed with about 20 Million € for 5 years.

The German Collection of Microorganisms and Cell Cultures (<http://www.dsmz.de/>), maintains the so-called Center of Biological Resources. It harbors the worldwide biggest collection of plant viruses, plant cell cultures and about 13000 bacterial strains.

#### Molecular Biodiversity-Research in Plants

Modern methods of plant breeding require the knowledge of the genetic diversity of crop and forest plants. In 1998 the Federal Government launched a 7-years program "Genome Analysis of Plants as

Biological Systems" (GABI) (<http://www.fz-juelich.de/ptj/datapool/page/455/gabiengl.pdf>) focusing on *Arabidopsis* as model organism and on barley, sugar beet, potato and other important crop plants and fruit trees. Genome sequencing, but also the functions of the genes, proteomics, is the major goals of that program. Many governmental research institutions and universities participate in that program which has a financial volume of 80 Million \$ for 7 years. A special program is on the genetic variability of forests. A comprehensive gene-bank with viable seeds of more than 100000 accessions of 2000 useful plants is maintained at the Institute of Plant Genetics and Crop Plant Research (IPK) in Gatersleben (<http://www.ipk-gatersleben.de/en/>).

For the documentation of all the *ex-situ* stocks of crop plants, medicinal plants and forest plants which are cultivated in the individual German institutions an "Information Centre on Biodiversity" (<http://www.zadi.de/ibv/>) has been established in the Central Office of Agronomic Documentation in Bonn (<http://www.bmvel-forschung.de/>).

Molecular biodiversity-research in domestic animals

Ongoing loss of many breeds of domestic animals is a worldwide problem. In Germany genetic diversity of domestic cattle is one of the major subjects of a Federal Research Institute (<http://www.fal.de/>) maintaining a gene bank of endangered races.

Organismic biodiversity research

Organismic biodiversity-research is predominantly performed on the level of species and populations. It comprises

species diversity of a territory, the so-called  $\alpha$ -diversity,  
the biology of species

and the specific characters of populations such as growth, radiation, maintenance and decline.

Many research institutions contribute with a great multitude of individual or collaborative projects to organismic biodiversity research, which is sponsored by the Federal as well as the Federal States' governments and by the German Research Foundation. It is quite obvious that the knowledge of floristic and faunistic inventory of Germany is much more complete than in tropical countries. Consequently setup and operation of databases with comprehensive information about the organisms on the one hand and basic research into biodiversity on the other dominates the organismic biodiversity research in Germany. The database "Vascular Plants" (<http://www.csdl.tamu.edu/FLORA/gallery.htm>) is one of the most outstanding projects collecting and providing data on the diversity of plants in Germany. Today it contains more than 14 million records of species, populations, plant communities, habitats and ecological and other relevant data. By networking with other databases, information can be easily amplified. In a related project, the potential natural vegetation of Germany is recorded and can be provided for the establishment of the vegetation map of Europe.

A global database headed by the Zoological Museum in Bonn is the "Global Register on Migratory Species" (<http://www.groms.de/>) where all the data on migrations are compiled.

In context with these data bases the "Global Biodiversity Information Facility" GBIF (<http://www.gbif.org>) und (<http://www.gbif.de>) must be mentioned in which Germany participates with a National platform ("node"). GBIF has been established in 2000 and meanwhile more than 70 countries are contributing members.

Programs of Organismic biodiversity-Research in Germany

There are several focal points of Organismic biodiversity-research in Germany which I will briefly mention:

Biodiversity of agricultural areas, as influenced by the various agricultural methods and crops is investigated by several institutions, aiming also at an assessment of potential effects of genetically modified organisms or of invasive species on the organismic communities.

A similar program refers to the accompanying flora of forests, Ecology, reproduction biology and medicinal aspects of the animal wildlife in Germany are investigated in a special program connected to a database for wild animal diseases which also covers animals from outside Europe. Several governmental institutions investigate in collaboration with universities selected issues of marine faunistic and floristic biodiversity:

The German Research Foundation (<http://www.dfg.de/>) which primarily finances projects of basic research has launched a Priority Program "Adaptive Radiation-Origin of Biological Diversity" (<http://mansfeld.ipk-gatersleben.de/radiationen/>). The objective of that research program is a critical

assessment of hypotheses on evolutionary (adaptive) radiations as a source of biodiversity. Evolutionary mechanisms are investigated, that promote morphological and physiological diversity. This Priority Program is sponsored with 2.5 Million € per year.

Ecosystem-related biodiversity research (Figure 2)

Ecosystem-related biodiversity-research takes place at levels of higher complexity, starting with the inventory of the diversity of organismic communities (the  $\beta$ -Diversity) and the diversity of habitats (the  $\alpha$ -Diversity). Another topic is the analysis of the functions of biodiversity in the ecosystem which leads further to the question of stability of the ecosystem. An experiment was performed called BIODDEPTH at 8 locations distributed from the very North of Europe to the very South. Increasing numbers of similar herbal species were planted on separate plots of cleared soil, to mimic different degrees of biodiversity. After 2 years the above-ground biomass was harvested. The results show a clear positive correlation between the biodiversity and biomass production. At that level biodiversity research becomes part of ecosystem research. Key stone species and their functions have to be identified which, however, is possible at most to some extent. Here, also man comes into play, as a user and competitor of biodiversity and as that creature that carries the burden of responsibility for our planet's biodiversity. The striven aim is therefore "protection by adequate, that means sustainable, use of the resources of the ecosystems".

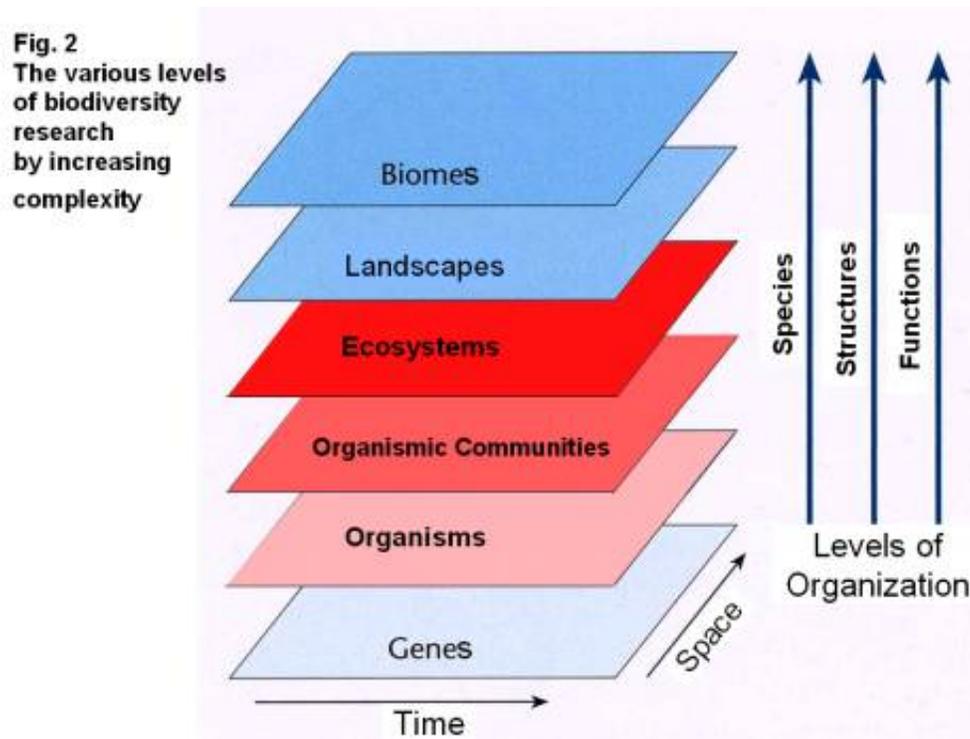


Figure 2. The various levels of biodiversity research by increasing complexity

In Germany biodiversity-related ecosystem research is a genuine task of many governmental institutions and departments. Focal research points are strategies for a sustainable use and maintenance of rural areas of agricultural use, biological problems arising from the invasion of exotic species, such as hybridization with and out competing of indigenous species.

strategies for the renaturalization of abandoned mining areas.

Special German programs of ecosystem-related biodiversity-research

In fulfilling the obligations of the CBD, German Government has launched several research programs dedicated to ecosystem-related biodiversity-research in Germany as well as in developing countries. The two major programs are BIOLOG and SHIFT.

BIOLOG (<http://www.biolog-online.info>) was started in 1999 and 93 projects most of which are clustered, were selected for funding. Work of the projects started out in 2000 and 2001.

The topics of BIOLOG (Figure 3)

There is no doubt that global change is also relevant to marine ecosystems. However, it is of particular and urgent importance to the terrestrial world, in which it gives rise to a great multitude of socio-economic problems. Therefore BIOLOG concentrates on research into terrestrial biodiversity. But since the success of integrated research into biodiversity is dependent on the accessibility of all kinds of species data, biodiversity informatics is another focal point of BIOLOG. Economists enquire as to the value of biodiversity. For that reason, socio-economic aspects of biodiversity and of biodiversity conservation have also been included in the projects of BIOLOG.

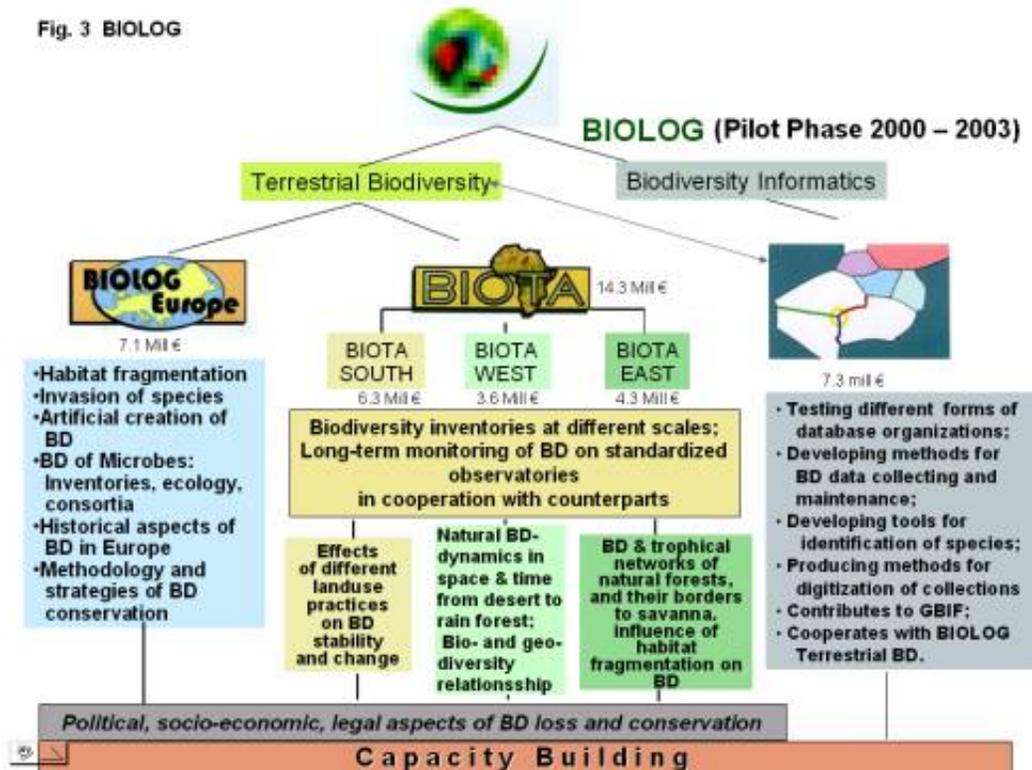


Figure 3. BIOLOG

The Pilot Phase: Research into biodiversity requires capacity building

BIOLOG has therefore given priority to integrative Research and Development Projects, which are based on a fair degree of capacity building, especially on the international level. For a proper placement of the approved projects, BIOLOG was started with a pilot phase of 3 years and successful projects are continuing into the main phase for another 6 or 7 years.

BIOLOG: Why Africa, why Europe?

BIOLOG's policy, as a research program, is to concentrate the projects in regions expressing different levels of biodiversity, in regions of different levels of relevant knowledge and expertise, and in regions of differently endangered biodiversity.

Projects in Central Europe (BIOLOG EUROPE) are being funded because of the well-developed scientific background, on the basis of which even complicated biodiversity-related problems can be investigated. In the BIOLOG EUROPE projects, the effects of fragmentation of the landscape, and of intentional and accidental invasion of exotic species and other impacts on biodiversity are being studied, as well as

the diversity, dynamics and function of microorganisms in terrestrial ecosystems.

Socio-economic implications which are connected with biodiversity as a natural and cultural heritage can also be readily focused upon in Central Europe.

Projects operating in several regions of sub-Saharan Africa (the so-called BIOTA-projects) were selected to start BIOLOG AFRICA. This continent was chosen with respect to the enormous deficiency of even basic knowledge in the fields of biodiversity and ecosystem functions and the urgency of environmental problems related to global change in this continent. In the BIOTA projects special emphasis is given to biodiversity inventories at different scales, combined with long-term monitoring. For that purpose "observatories" were established, which are standardized plots of usually 1 km<sup>2</sup> left untreated or subjected to selected kinds and intensities of utilization. Selected features of the observatories, such as climate, soil, vegetation, wildlife and livestock are monitored at meaningful intervals and in meaningful area sizes. Monitoring will go for a time period of at least 10 years to obtain reliable data. Respective legal stipulations are necessary for the establishment of an observatory. The concept of such observatories has been approved by the International Program DIVERSITAS and will be soon adopted also by the U.S. and hopefully by other countries.

BIOLOG: Biodiversity Informatics ([Figure 3](#))

In addition to the Terrestrial biodiversity programs, the subprogram "Biodiversity Informatics" was set up. An immense number of organismic specimens and related data are deposited in the various Natural History Museums of Germany. A substantial proportion of these data is not yet readily accessible or is incomplete; in particular molecular genetic data is still missing for the majority of the collected specimens. The aims of "Biodiversity Informatics" are to improve the methods of biodiversity data capture and maintenance, to digitalize and network the wealth of the already available data collections, and to interlink biodiversity-related infrastructures nationally and worldwide by joining with the program GBIF.

SHIFT: Studies on Human Impact on Forests and Floodplains in the Tropics (<http://www.internationale-kooperation.de/>)

The SHIFT program ([Figure 4](#)) which is financed by the Federal Ministry of Education and Research with 25.6 Mio € was started in 1989 as a milestone in a long-lasting scientific and technological cooperation between Germany and Brazil. Many projects have already come to an end, and funding of the actual 12 projects shall finish by the end of 2003. SHIFT is closely tied to the International Pilot Program for the Conservation of the Brazilian Rain Forest and it contributes to the global UNESCO research program "Man and Biosphere". The 5 major goals of SHIFT are:

Increase of knowledge about structure and key functions of tropical ecosystems

Knowledge about regulatory ecosystem factors in order to develop concise concepts for sustainable land use and for protection of endangered areas

Developing of measures and management concepts for recuperation of degraded and abandoned areas



**Figure 4. SHIFT and Mata Atlantica**

Improvement of the scientific assessment of human actions with respect to environmental risks and reduction of anthropogenically induced environmental problems

Training of specialists and capacity building for environmental research

The projects are all performed in cooperation of German and Brazilian researchers and are located in four geographic regions with unique ecological, economic and social impacts:

Central Amazonia (which represents the new frontier of agrarian movements into the rain forest and the inundated river margins).

Eastern Amazonia, (a transition zone from forestry systems to pastures and new sustainable land use forms)

The Pantanal (as a central ecosystem of high biological diversity and a social conflict area due to high population pressure).

The Atlantic Forest, Mata Atlantica that is impaired by heavy industrial and agro-industrial activities and a concentration of the population.

Biodiversity research of SHIFT will be continued in the scope of the new program "Ecosystem, Economy and Society in the Region MATA ATLANTICA" of the Federal State Rio de Janeiro (<http://www.biolog-online.info/PT/Umwelt/F70000/F73000>). It was started last year and focuses on the remnants (5 % of originally 1 million km<sup>2</sup>) of the previous rain forests of the Atlantic Coast.

**BIOTEAM**

The German programs of biodiversity research show that biodiversity is understood not only as a matter of biology, but is also recognized as an issue of man, especially with respect to the tremendous increase in population. Therefore biodiversity-research must also cover socio-economic problems of biodiversity utilization and conservation. This claim is not new, but the problems are very complex and promising research strategies are scarce. Biologists and sociologists, economists and lawyers must cooperate. In 2002, a program has been implemented by the Federal Ministry of Education and research, termed "Biosphere research - integrative and application-oriented model projects", "BIOTEAM" (<http://www.biolog-online.info/PT/Umwelt/F70000/F73000>) ([Figure 5]). BIOTEAM aims at an economic validation of conservation measures on the basis of cost-benefit-analyses, an interlinking of ecosystem-targeted research in hotspots of biodiversity with bioprospecting for new

pharmaceutical and construction materials, and a fair benefit sharing, the development of strategies for a local or regional biodiversity management for industrialized areas and against the invasion of Neobiota into the indigenous flora and fauna. Nine projects have been approved, four of which are working in Ecuador, 1 in Chile, 1 in Africa, and 3 in Germany. From the Ecuadorian projects 3 are focusing on benefit sharing with respect to use of indigenous plants. The program is financed with about 9 Million € for 3 years.



### **BioTeam** (2002 – (2005)

Fig. 5 BIOTEAM

#### **BIOTEAM aims at:**

- **An economic validation of conservation measures on the basis of cost-benefit-analyses**
- **An interlinking of ecosystem-targeted research in hotspots of BD with bioprospecting for new pharmaceutical and construction materials, and a fair benefit sharing**
- **Development of strategies for a local or regional BD management for industrialized areas and against the invasion of Neobiota into the indigenous flora and fauna.**

#### **9 Projects have been approved:**

- **4 in Ecuador**
- **1 in Chile**
- **1 in Ethiopia**
- **3 in Germany**



Figure 5. Bioteam

#### German Science Foundation

The German Science Foundation (DFG) in several programs also finances ecosystem-related biodiversity-research. Well known in Ecuador is the DFG-Research Unit: Functionality in a tropical mountain rainforest: Diversity, dynamic processes and potentials of utilization under ecosystem perspectives (<http://www.bergregenwald.de>). This is the project working since 1997 in South Ecuador in the forest of the San Francisco valley and on the previous forested areas, which have been cleared for agricultural purposes (Figure 6). The project is centered around the research Station "Estacion Cientifica San Francisco" which is run by the Foundation NCI. In a multidisciplinary study, comprising at present 32 major projects in relevant bio- and geosciences, in forestry and in sociocultural research, the German-Ecuadorian research group aims at an understanding of the ecosystem "mountain rain forest" in the San Francisco Valley between Loja and Zamora and to develop protocols for reforestation and sustainable use. The study is supported with approximately 2 Million € per year.

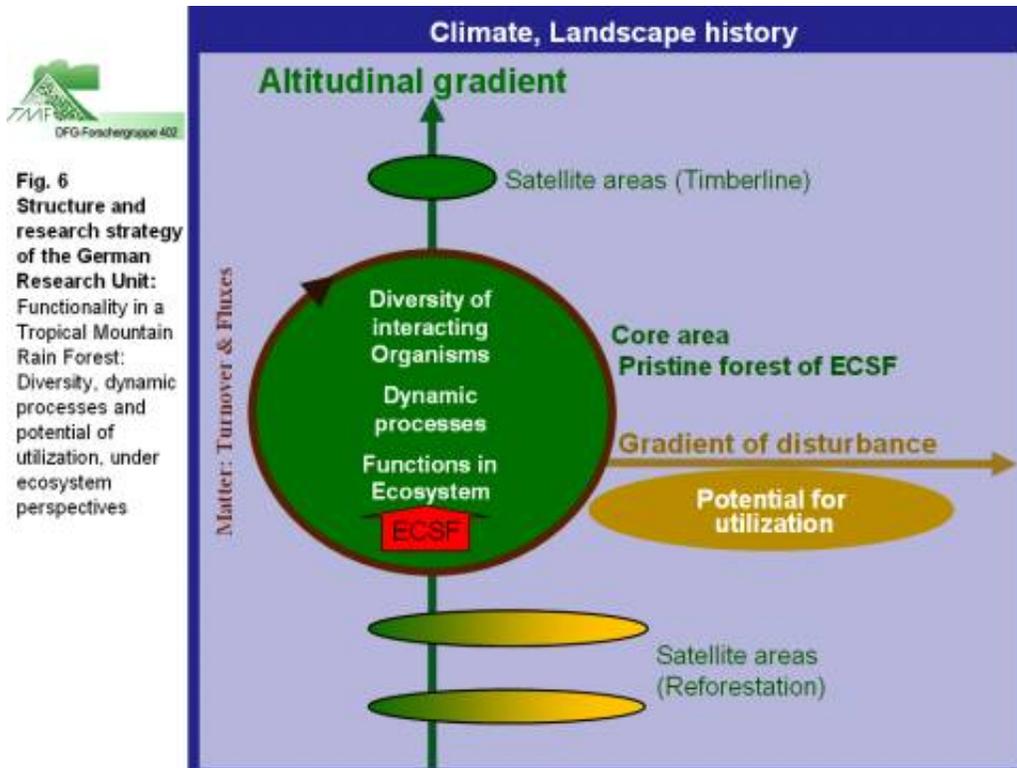


Figure 6. Structure and research strategy of the German Research Unit: Functionality in a Tropical Mountain rain Forest: Diversity, dynamic processes and potential of utilization under ecosystem processes.

### Benefit Sharing in Biodiversity Research and Utilization

#### Monetary biodiversity research

Benefit sharing in biodiversity research is understood mainly with respect to the exploitation of biological and genetic resources, in particular of developing countries where most of the world's biodiversity is found. The CBD recognizes national sovereignty over all biological and genetic resources, and provides that access to valuable biological resources has to be carried out on "mutually agreed terms" and is subject to the "prior informed consent" of the country of origin. When a microorganism, plant, or animal is used for a commercial application, the country of its origin has the right to benefit, but on the other hand the country has to facilitate access to that resource. As the BONN-Guidelines of 2002 state, benefits can include cash, samples of what is collected, the participation and training of national researchers, the transfer of biotechnology equipment and know-how, and shares of any profit from the use of the resources. Although the field of bio-patents still requires much skill and legislation, the regulations of the CBD provide more or less clear elements for the development of practically applicable measures and many models have already been presented. At least a dozen countries have already established rules for control over access to their genetic resources such as the Philippines, Costa Rica, the OAU, and the countries of the Andean Pact.

#### Non monetary biodiversity research

Neither the CBD, nor the BONN Guidelines provide clear ideas about benefit sharing in context with basic and therefore non-monetary biodiversity research. Such kind of research is very much on the upswing in Germany as it was shown before. In this context, benefit sharing is mainly understood as capacity building, training of indigenous scientists and establishment of common data bases. Through the CBD, the industrial nations have agreed to provide financial support to the developing countries to defray the incremental costs of the fulfillment of the obligations of the CBD. However, the regulations how the support meets the obligations are not very precise, and with respect to non monetary biodiversity research are mainly focusing on the Global Taxonomy Initiative

(<http://www.biodiv.org/doc/lists/nfp-gti.pdf>). It is felt that there is a lack of guidelines for benefit

sharing in basic biodiversity research, especially with regard to research into ecosystem aspects undertaken in developing countries.

A working group on benefit sharing in biodiversity-research has therefore been installed in the German Research Foundation and the issue has been taken up by the International Union of Biological Sciences to work on respective guidelines in January 2004. In view of the many promising programs in BIODIVERSITY research which have been started during the last few years, not only in Germany, obstruction of that kind of research due to ill-defined legislative framework must be avoided in any case.