DIVERSITAS

an international programme of biodiversity science

DIVERSITAS Science plan

ICSU IUBS IUMS SCOPE UNESCO

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DIVERSITAS SCIENCE PLAN

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Preface

In 1991, prior to the Rio summit, UNESCO, IUBS and SCOPE[1] launched DIVERSITAS, which at that time was made up of three projects: “Biodiversity and ecosystem functioning”, “Origin, maintenance and loss”, and “Inventorying and monitoring”. In 1996, the partnership was opened to two additional sponsors, IUMS and ICSU, and seven core projects were added to this initial list of three projects. A partnership with the Convention on Biological Diversity was initiated in 1996. Prof. Ghillean Prance (Kew Botanical Gardens, UK) served as the first Chair of the Scientific Committee of DIVERSITAS, and was followed by Prof. José Sarukhan (UNAM, Mexico).

In March 2001, the five sponsors, ICSU, IUBS, IUMS, SCOPE and UNESCO, requested the scientific community to build a new integrative biodiversity research programme. A taskforce of international experts was assembled under the co-chairmanship of Prof. Michel Loreau (Ecole Normale Supérieure, Paris, France) and Prof. Bernhard Schmid (University of Zürich, Switzerland). During its meeting on 30 August - 2 September 2001 in Paris, it drafted a new science plan for DIVERSITAS. The discussions of these scientists were based on a wider web-based consultation of the scientific community, which took place between May and August 2001. The draft science plan was placed on the web for consultation in October 2001. Between October 2001 and May 2002, the draft science plan was presented at a number of international meetings. A new Scientific Committee (see page 1) was formally appointed by the sponsors in January 2002. This Committee met on 12-13 April 2002, and endorsed the science plan presented in this booklet.

This new science plan of DIVERSITAS is the fruit of a will to build a dynamic and integrative approach to biodiversity. Biodiversity changes as a result of its own evolutionary and ecological dynamics, but also as a result of deliberate as well as unintentional human actions. In turn it affects human societies, which have to adapt to these changes. To understand and predict this cycle of interactions, more integration is needed across traditional disciplines. Taking up this challenge is necessary to establish the scientific foundations for appropriate future social actions aimed at maintaining an acceptable level of biological diversity on our planet.

We hope that this science plan will attract researchers from a wide range of disciplines and the support of many countries. We look forward to the implementation of this new integrative programme on biodiversity.

Michel Loreau
Chair, Scientific Committee

Anne Larigauderie
Executive Director

(1) See section 8 for definition of acronyms.

ACKNOWLEDGEMENTS

This DIVERSITAS Science Plan is the product of a major co-operative effort over the past year. We would like to thank the members of the DIVERSITAS Task Force (March -December 2001), who drafted the first version of this manuscript (see page 35). We are particularly thankful to Prof. Bernhard Schmid, from the University of Zürich, Switzerland, for co-chairing this first phase of the programme and reviewing the document at various stages.

The document benefited from comments of participants at the following meetings, where it was presented:

The International Group of Funding Agencies for global change research (IGFA; Stockholm, Sweden, Oct. 01); The Austrian Biodiversity Workshop (Vienna, Nov. 01); The European Platform for Biodiversity Research (EPBRS, Brussels, Dec. 01); BIOLOG (Bonn, Germany, Dec. 01); European Science Foundation "Forward Look" (Stockholm, Sweden, Jan. 02); The "Biodiversity, driving force of life" symposium, (March 2002, prior to COP6-CBD, The Hague); The SC-IHDP (Bonn, Germany, March 02); The SC-GCTE (Canberra, Australia, March 02); The 7th Asia Pacific Network SPG/IGM meeting (Manila, Philippines, March 02); The SC-DIWPA (DIVERSITAS Western Pacific and Asia; Otsu Shiga, Japan, March 02); The 3rd Swiss Global Change Day (Bern, April 02); The US National Committee for DIVERSITAS.

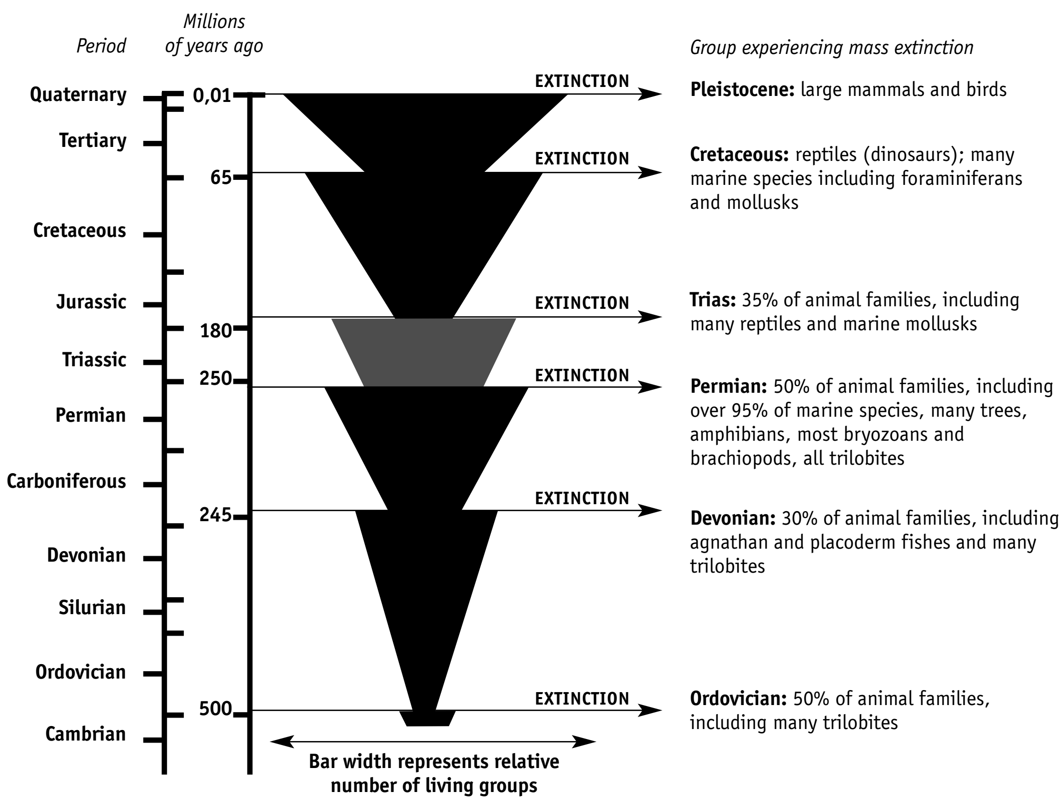
A number of additional scientists, who cannot all be cited, provided valuable comments via a DIVERSITAS web consultation and e-mail.

We thank the following national funding agencies for providing financial support to DIVERSITAS and making this exploratory phase possible: Austria (Federal Ministry of Education, Science and Culture), Germany (BMBF and DFG), Mexico (CONACYT), The Netherlands (KNAW and NWO), Norway (The Research Council), Sweden (NFR), Switzerland (SNF), United Kingdom (NERC), USA (NSF, US-NAS).

Securing this set of national supports was greatly facilitated by the International Group of Funding Agencies for global change research, IGFA, and its successive committed Chairs, Dr. John Marks, Dr. Kirsten Broch Mathisen, and Dr. Hansvolker Ziegler.

Biodiversity is the variety of life on Earth. Scientists commonly measure and describe this variety at the level of genes, species and ecosystems, but scientific interest in biodiversity goes far beyond describing and measuring it. The DIVERSITAS programme was founded to address the scientific questions that need to be answered in order to understand how biodiversity supports life on Earth, what the impacts of the present loss of biodiversity are for human and ecosystem survival and how humans can sustainably use and conserve biodiversity. Therefore, this Science Plan is mainly concerned with the current extinction "crisis" on Earth, which, unlike its predecessors, is occurring at an unprecedented rate, is the direct result of human activities and is occurring at all levels at which diversity is measured — from the genetic diversity of many natural and domesticated species to the diversity of ecosystems and landscapes, through the tremendous richness of species. Current human-induced rates of species extinction are estimated to be about 1,000 times greater than past background rates.

Fig.1 ***Earth has experienced five periods of extinction over the past 500 million years, which were associated with a combination of environmental changes including impacts of extraterrestrial objects, volcanism, lowering of sea level and anoxia. We are now at the start of a sixth episode, the Pleistocene extinction, as human populations eliminate species through various disturbances including habitat destruction and overexploitation of resources. Redrawn from Barbault, 2001 (Encyclopedia of Biodiversity vol.3, Levin, S.A., ed.), with permission, based on Primack, (ed., 1993, Essentials of Conversation Biology).***



Biodiversity loss is a matter of concern, not only because of the aesthetic, ethical or cultural values attached to biodiversity, but also because it could have numerous far-reaching, often unanticipated, consequences for our life-support system. The capacity of natural and managed ecosystems to deliver ecological services, such as the production of food and fibre, carbon storage, nutrient cycling and resistance to climate and other environmental changes, could be reduced. This Science Plan is concerned with assessing the causes and consequences of biodiversity changes, and establishing the bases for the conservation and sustainable use of biodiversity, which are major scientific challenges of our time.

DIVERSITAS aims to address the complex scientific questions posed by the loss of and change in biodiversity globally through establishing and coordinating international, multidisciplinary networks of scientists working on biodiversity and addressing the scientific priorities presented in this Science Plan. The priorities address the needs of the Convention on Biological Diversity (CBD)[2] and of many conservation programmes aimed at protecting biodiversity, as well as providing a focus for many national research programmes dedicated to developing biodiversity science.

(2) The Convention on Biological Diversity defines biological diversity in a conventional scientific way as 'the variability among living organisms from all sources including... terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems'. This Convention describes biodiversity as an attribute of life, distinguished from biological resources which 'include genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity'. However, the Convention then points out that to fulfil legal obligations, parties will have to in fact conserve and manage biological resources and ecosystems. Therefore, this Convention contains the legal powers to govern all uses of life, including agriculture, fisheries, aquaculture and forestry. Agriculture has been touched early by the Convention because of its long and well-documented use and transformation of plant and animal genetic materials. Fisheries and aquaculture uses and their impacts on biodiversity are less well known, and thus aquatic biodiversity issues have generally received little attention.

DIVERSITAS's overall goals

The overall goals of DIVERSITAS are:

- **to promote an integrative biodiversity science, linking biological, ecological and social disciplines in an effort to produce socially relevant new knowledge;**
- **to provide the scientific bases for the conservation and sustainable use of biodiversity.**

DIVERSITAS will achieve these goals by synthesising existing scientific knowledge, identifying gaps and emerging issues of global importance, promoting new research initiatives, building bridges across countries and disciplines, investigating policy implications of biodiversity science, and communicating these to policy makers and international conventions.

DIVERSITAS' structure

DIVERSITAS

CORE PROJECTS

Core Project 1
Discovering biodiversity and predicting its changes

Core Project 2
Assessing impacts of biodiversity changes

Core Project 3
Developing the science of conservation and sustainable use of biodiversity

DIVERSITAS pursues its science plan in the form of three core projects.

- Core Project 1, “Discovering biodiversity and predicting its changes”, will assess (1) how much biodiversity there is on Earth, (2) how it is changing, by contributing to the development of the scientific tools of biodiversity monitoring, (3) why it is changing, by investigating the socio-economic, ecological and evolutionary processes involved in species extinction and speciation, and (4) how it is expected to change, by contributing to the capacity to predict biodiversity changes in the future.
- Core Project 2, “Assessing impacts of biodiversity changes”, will assess how biodiversity changes affect ecosystem functioning and thereby the provision of ecological goods and services of relevance to human societies. Particular emphasis, within the context of ecological services, will be placed on impacts of biodiversity changes on human health.
- Core Project 3, “Developing the science of conservation and sustainable use of biodiversity”, will assess the effectiveness of current regulatory measures and incentives to protect biodiversity, investigate alternative social, political and economic motivators for biodiversity protection, and establish a scientific approach for optimising the multiple usage of biodiversity, considering possible trade-offs between economic and environmental goals.

In addition to the three thematic core projects, a few integrated cross-cutting networks, which embrace issues addressed in all the core projects, will be created around particular topics or ecosystems. Two such networks already exist, the Global Invasive Species Programme (GISP) and the Global Mountain Biodiversity Assessment (GMBA). A new cross-cutting network, “Greening agriculture”, is proposed here.

Lastly, the International Biodiversity Observation Year (IBOY) is an initiative of DIVERSITAS that spans the whole programme. It is a one-time event to celebrate biodiversity during 2001 and 2002.

Core Project 1:

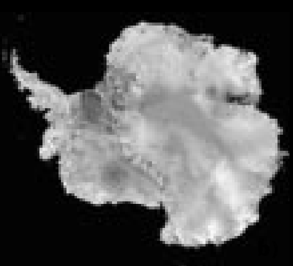
Core Project 1 has three foci:

FOCUS1.1 **Assessing current biodiversity**

FOCUS1.2 **Monitoring biodiversity changes**

FOCUS1.3 **Understanding and predicting biodiversity changes**

To understand and predict the consequences of changes in biodiversity for natural ecosystems and human societies, it is first necessary to know how much biodiversity there is on Earth, how it is changing, and why. Despite the growing interest in biodiversity during recent decades, our knowledge of the true diversity of the life that inhabits our planet is still very limited and fragmentary. While large animals and plants are reasonably well known, only a small fraction of the existing small-sized organisms, such as bacteria, protists, micro-arthropods and insects, has been discovered and described by science. Many of these organisms probably fulfil important functions in biogeochemical cycles, from local to global scales. Even in those taxonomic groups and locations where diversity has been described, diversity is changing rapidly as a result of increasing human activities, so that there is an important need to monitor and assess these changes.



Finally, a predictive biodiversity science requires an understanding of the factors that cause biodiversity changes. Changes in the nature and intensity of human activities are known to lie behind the accelerated loss of biodiversity both locally and globally. These changes reflect demographic, cultural, political and economic factors. They have reduced and restructured most habitats, changed the distribution and abundance of species to support economic production and altered biogeochemical cycles and the chemical composition of soils, water and atmosphere. We need to understand these changes and the way they interact with the complex ecological and evolutionary processes.
Core Project 1 will provide the basic knowledge that is required to assess the impacts of biodiversity changes (Core Project 2) and to develop strategies for the conservation and sustainable use of biodiversity (Core Project 3). It will contribute to assessing current biodiversity, developing the scientific bases for monitoring biodiversity changes, and providing critical knowledge about the processes that determine these changes, with a view to predicting future changes. Attention will be paid, however, to avoid duplication with initiatives that already exist.

Focus 1.1. Assessing current biodiversity

With perhaps 90% of existent species yet to be discovered or described in any detail, our knowledge of existing biodiversity is far from complete and is inadequate for many purposes. A large number of national and international initiatives focus on the inventory and classification of biodiversity, such as GBIF (Global Biodiversity Information Facility), GTI (Global Taxonomy Initiative of the CBD), ETI (Expert Centre of Taxonomic Identifications), Species 2000, and the All-Species inventory project. Some of these programmes focus on the discovery of species and clades, and others on databasing museum specimens, taxonomic names, or phylogenetic knowledge. Most of these programmes are in their infancy, and are not yet well coordinated. DIVERSITAS, through Focus 1.1, will foster sustained and effective communication among these efforts. Through workshops and research activities, it will provide a critical forum for the exchange of information and will facilitate the development of new tools to allow synthesis across existing programmes.

More specifically, Focus 1.1 will stimulate development in areas that require special attention, such as:

- integration of new methods, such as genomic approaches, into the study of biodiversity at species, population, and ecosystem levels;

- linking of species-level taxonomic information to phylogenetic hypotheses and to data on functional ecology;
- synthesis of collection-based information technology with geographic mapping efforts, to better describe the spatial distribution of biodiversity, and to understand how it is organised in areas of endemism, communities, and habitats;
- expansion of the information attached to microbial data, notably by developing integrated databases linking molecular sequences and environmental data.

DIVERSITAS is already recognized for its taxonomy-related activities, especially in connection with the GTI. The coordination envisioned under Focus 1.1 will expand this important point of contact to the CBD.
Focus 1.1 will be designed specifically to promote research on poorly known organisms, and on habitats and geographic areas that have received insufficient attention. Of special importance are micro-organisms, including bacteria, archaea, and many protist and fungal lineages. Most of these organisms have not been cultured in the laboratory, and are therefore effectively unknown. Yet, they play a fundamental role in sustaining the biosphere, especially in global biogeochemical cycles. Moreover, in view of their extraordinary metabolic diversity, microbes are of enormous biotechnological value, and their discovery promises economic dividends in areas such as medicine and bioremediation.

The quest for full understanding of species diversity and phylogenetic relationships (as envisioned by the All-Species and Tree of Life programmes) and the translation of this knowledge into predictive classification systems are central to these activities, and will insure maximum applicability of the results, notably to other DIVERSITAS activities. Special benefits will derive from the systematic analysis of key functional groups. For example, linking knowledge about the functional traits of micro-organisms discovered in soils and marine habitats with knowledge of phylogenetic relationships should make it possible to better assess their role in biogeochemical cycles. Likewise, knowledge about the species diversity and phylogeny of parasites, pathogens and emerging infectious diseases may be crucial in predicting the impacts of global change on human health.

Critical to all of these endeavours are issues concerning access to scientific specimens and associated materials. Through Focus 1.1, DIVERSITAS will actively engage the relevant parties in formulating specific advice concerning the ethics of collecting, permitting, and intellectual property rights, and the formulation of a code of conduct for the biodiversity sciences.

Focus 1.2. Monitoring biodiversity changes

The assessment of the state of, and change in, biodiversity requires monitoring at the relevant scales of space and time. These scales can vary from days to centuries and from millimetres to thousands of kilometres. Monitoring is essential in order to evaluate the success or failure of conservation and restoration measures (e.g. in the framework of the Convention on Biological Diversity) and to calibrate and validate models and scenarios, and thereby improve their performance. The choice of indices, parameters and state variables used in biodiversity monitoring requires a careful consideration of representativeness, cost effectiveness, quality assurance and intercomparibility that is rarely realised at present. New monitoring tools, including rapid assessment techniques, automatic identification and image analysis, new *in situ* sensors and probes, and widespread application of remote sensing, as well as advanced bio-informatics and dynamic GIS-based models, are needed in order to document biodiversity changes world-wide and evaluate the success of biodiversity conservation policies. The unprecedented possibilities offered by the now widespread availability of molecular biological technology must be applied in monitoring, especially with regard to microbial communities.

The objective of this focus is to develop the scientific basis for monitoring biodiversity, as well as the relevant monitoring tools and the use of these tools. This focus also aims to promote the integration of biodiversity monitoring and monitoring tools into global networks of observatories that are under development by other programmes. This focus will:

- foster the development of new methodologies and protocols (including indicators) for monitoring biodiversity changes;
- promote regional and global networks of biodiversity observatories that rely on a commonly agreed methodology;
- integrate modern techniques into monitoring methods (e.g., genomics, remote sensing);
- promote and facilitate the use of monitoring data in the construction of models of biodiversity change, as developed in Focus 1.3.

Focus 1.3. Understanding and predicting biodiversity changes

The major drivers of current biodiversity loss are changes in the nature and intensity of resource use in both terrestrial and marine environments. The increasing integration of the global economy, together with consumption-led demand for land, mineral, water, fuels, fibres and food, have dramatically altered almost every ecosystem on the planet. These changes continue to fragment, restructure and expand the connections between almost all terrestrial habitats. They have altered fundamental biogeochemical cycles, and with them the capacity to support the historical composition and abundance of species. Understanding the interaction between such social processes and the ecological processes they affect poses a major challenge to science. Our capacity to predict the dynamics of species gains and losses at local and regional scales depends on the development of the science of ecological changes in an increasingly tightly integrated world socio-economic system.

Fig 3 *Focus 1.3. Land use changes resulting from agricultural intensification constitute one of the major drivers of biodiversity loss on land. This figure shows: a) a bushfire set to remove a forest prior to cultivation in the Djiguinoum watershed in Basse-Casamance (Sénégal; copyright IRD, Jean-Pierre Montoroi) and b) a deforested field in the dry forest near Odienné (Ivory Coast; copyright IRD, Christian Lévêque).*

Changes in land use and sea use lead to the physical alteration, fragmentation and destruction of natural habitats as well as overexploitation, which constitute the most important causes of current species extinctions. More generally, they are an important determinant of the dynamics of species gain, loss and turnover over ecological time scales, and also affect evolutionary processes from gene flow to long-term speciation rates. These evolutionary implications have rarely been considered in conservation policies, and are only now starting to receive some attention. Focusing on the effects of land- and sea-use changes, therefore, has the potential to forge links between disciplines and to provide new insights into the dynamics and conservation of biodiversity. This focus will seek interaction with the IGBP-IHDP LUCC project on this issue.

A historical perspective would also help illuminate current trends. This focus will also cultivate links with the IBGP-PAGES programme to understand the historical processes that have shaped biodiversity as it exists today, including both natural processes and human actions. Assembling a network of scientists to document species gains, losses and changes over the last millennia as a result of human activities, for example, would be particularly useful.

The aim of this focus is to improve our capacity to predict and hence to respond to biodiversity loss. The basic knowledge obtained will help identify the likely effects on biodiversity of anthropogenic changes at different spatial and temporal scales, and the sensitivity of those effects to variation in climatic and economic conditions. This knowledge is essential if decision makers are to be able to assess the relative costs and benefits of different resource use options. It will support a range of decision-tools, including scenario building.

Accordingly, this focus will:

- foster research into the anthropogenic drivers of change in biodiversity in terrestrial and aquatic systems;
- develop theoretical, experimental and empirical knowledge of the ecological and evolutionary processes that have shaped biological diversity in the past and determine it today;
- develop an understanding of the impact of changes in the pattern and intensity of human resource use on ecological structure and processes, and the implications of this for biodiversity at multiple spatial and temporal scales;
- contribute to the capacity to predict future biodiversity changes, in order to support conservation and the sustainable use of biodiversity at appropriate spatial and temporal scales.

Collaboration with foci 1.1 and 1.2 will provide relevant information on phylogeny-related species traits and documentation of current trends. This focus in turn will provide Core Project 2 with critical knowledge to predict future impacts of biodiversity changes, and Core Project 3 with information on the drivers of biodiversity change and threats to conservation efforts.

Core Project 2:

CORE PROJECT 2 HAS TWO FOCI:

FOCUS2.1 **Impact of biodiversity changes on ecosystem functioning and ecosystem services**

FOCUS2.2 **Impacts of biodiversity changes on health**

The potential impacts of biodiversity loss on the functioning of ecosystems and of the biosphere are currently receiving increasing attention, for two main reasons. First, little was known about the causal relationships between biological diversity and ecosystem processes until recently, despite numerous observational studies. Second, if biodiversity does affect ecosystem functioning, it could have important indirect impacts on the provision of ecosystem goods and services upon which human societies depend, such as production of food and fibre, carbon storage, soil fertility, nutrient cycling and resistance to climate and other environmental changes. Recent experimental and theoretical studies have provided evidence that this may indeed be the case. This considerably strengthens the need to further assess how changes in biodiversity will affect human societies in the long term through the provision of ecological goods and services.

Core Project 2 will actively promote the development of research in this area, building on the existing collaboration between DIVERSITAS and IGBP-GCTE. It will investigate how the biodiversity changes studied and predicted in Core Project 1 affect ecosystem functioning and ecosystem services, thereby influencing strategies for the conservation and sustainable use of biodiversity (Core Project 3). It will further develop a particular focus on the impacts of biodiversity changes on human health.

Focus 2.1.
Impacts of biodiversity changes on ecosystem functioning and ecosystem services

Our current knowledge and theoretical framework concerning the impacts of biodiversity loss on ecosystem functioning is based mainly on experiments on plant communities in temperate grasslands. To reach greater generality and predictive ability, it is now vital to extend this knowledge to other organisms (animals, micro-organisms), other trophic levels (herbivores, predators, decomposers) and other ecosystems (forest, tropical, freshwater and marine ecosystems), in which environmental constraints and ecological processes may be vastly different from those explored so far.

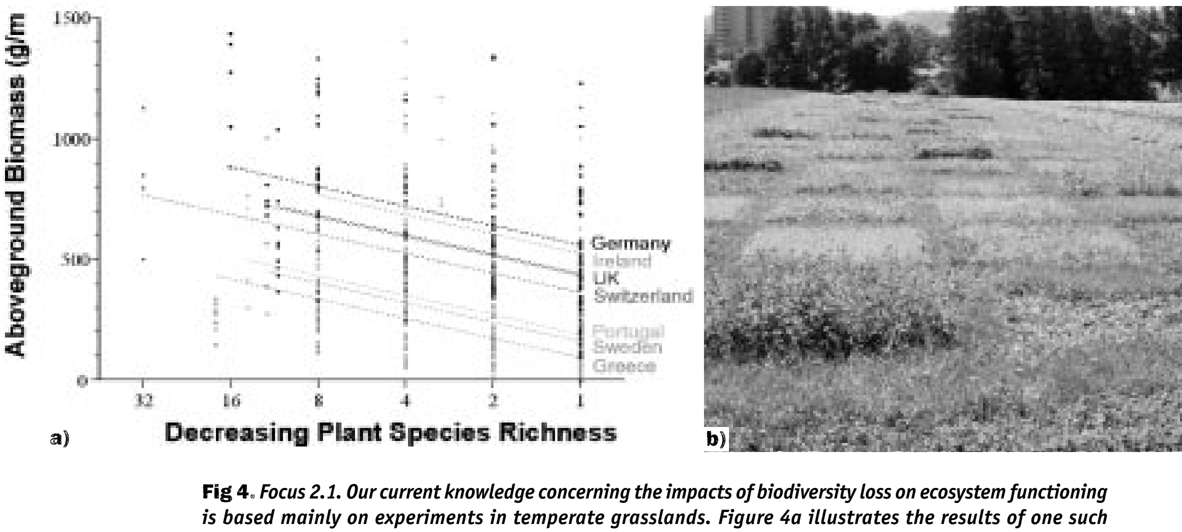


Fig 4. ***Focus 2.1. Our current knowledge concerning the impacts of biodiversity loss on ecosystem functioning is based mainly on experiments in temperate grasslands. Figure 4a illustrates the results of one such experiment, the European Community Project, Biodepth, involving eight countries that used a common experimental design. These experiments suggest a reduction in productivity as plant diversity declines. Figure 4b shows the Swiss site of Biodepth in which plant diversity was experimentally manipulated (Photos courtesy of Andy Hector and Bernhard Schmid).***

Emphasis in terrestrial science should also be progressively shifted from the small scale typically considered in recent experiments to larger spatial and temporal scales, at which management decisions and human-induced biodiversity changes take place. In contrast, in marine biodiversity science, with the exception of the intertidal areas, there is still a considerable lack of knowledge about small-scale processes and experimental verification, whereas the large scales have been better studied on the whole.

As mentioned in focus 1.3, land-use changes are currently the most important driver of biodiversity changes on land, a trend likely to be reinforced in the future by the increasing pressure exerted on land use due to demographic and economic changes in human societies. Therefore, the knowledge developed in focus 1.3 on the impacts of land-use changes on biodiversity should be used to assess the impacts of realistic scenarios of biodiversity loss induced by land-use changes on ecosystem processes at landscape scales. An analogous approach is needed to assess the impact on aquatic biodiversity of fisheries and – in coastal and freshwater areas – of aquaculture and of changes in water use.

Lastly, it is important to go beyond a basic science assessment of the effects of biodiversity changes on ecosystem functioning, and include impacts on ecosystem goods and services of societal relevance, which few studies have done so far. The development of research in the area of ecosystem goods and services will add a missing socio-economic perspective to current research into the relationship between biodiversity and ecosystem functioning, and require collaboration with Core Project 3.

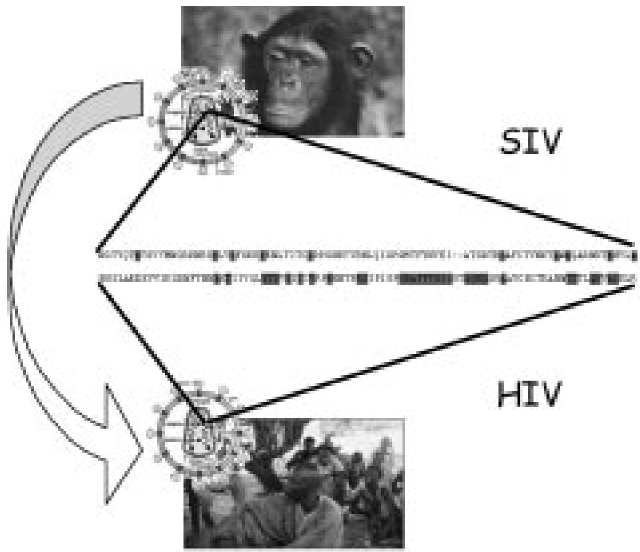
Thus, the priorities for this focus will be:

- to extend current knowledge on plant-based processes in temperate grasslands to other organisms, other trophic levels and other ecosystems;
- to assess impacts of biodiversity changes at larger temporal and spatial scales in interaction with other environmental changes, in particular land- and water-use changes;
- to identify the impacts on the provision of ecosystem goods and services of relevance to human societies.

Focus 2.2.
Impacts of biodiversity on health

A topic of great societal relevance in this area concerns the potential impacts of biodiversity changes on health. This focus will develop an ecological context for health, and in particular an understanding of the ecological bases for infectious diseases, including emerging diseases. Historically, approaches to the study of emerging diseases have focused on treating infectious agents and producing medicines to combat them. These approaches have not generally placed infectious agents (viruses, bacteria, parasites) in their ecological context. Nor have they examined the complex anthropogenic factors leading to the emergence and spread of diseases. For example, changes in land use with accompanying decreases in local and regional species diversity entail the simplification and homogenisation of the landscape, in which diseases might spread with greater ease.

Fig 5. *Comparative analysis of molecular adaptation of simian (SIV, top sequence) and human (HIV, bottom sequence) immuno-deficiency virus. These sequences code for an epitope of the membrane protein shown in yellow on the viral illustration. Strong selection pressure is exerted by the host immune system on this epitope. Molecular adaptation (red portions of the sequence) represents the mechanism allowing the virus to escape its host immune system. The SIV which has co-evolved with chimpanzee over thousands of years, shows relatively few sites of molecular adaptation, compared with HIV, derived from SIV recently introduced in human populations. This type of analysis is increasingly used to understand micro-evolutionary processes involved in infectious agents of human populations. This kind of study has been poorly used so far for comparative studies of infectious diseases acquired from animal reservoirs (UMR 99926 CNRS/IRD, Choisy et al.; Courtesy of M. Choisy and JF Guégan).*



The second phase of the Global Invasive Species Programme (GISP) is currently considering the implementation of control strategies for a range of invasive species. However, it is not undertaking the basic research required to answer some fundamental questions. What is the impact of climate change, deforestation, invasive species or habitat fragmentation at the regional level on the occurrence and rate of transmission of infectious diseases? What is the significance of changes in the structure of world markets for trade, transport and travel?

The invasion of pests and pathogens is generally the intended or unintended consequence of human decisions involving the use of exotic species in production and consumption, the conversion and fragmentation of habitats, or the movement of goods and people. These are affected by the regulatory and market structures governing peoples' choices. Epidemiological predictions and control policies both require understanding of the incentive effects of existing institutional, regulatory and market conditions. The ultimate goal of this focus is to contribute to the development of a broader, predictive science of infectious diseases.

The project will:

- develop an understanding of the connection between pathogen pathways and changing patterns of trade, transport and travel;
- promote improved predictive models of the invasion of pests and pathogens;
- foster research into the impact of land use change on vulnerability to invasive pests and pathogens;
- foster research into changes in biodiversity and biological interactions that affect the epidemiology of human diseases.

Core Project 3:

Core Project 3 has two foci:

FOCUS3.1 **Evaluation of the effectiveness of conservation measures and incentives for achieving the conservation and sustainable use of biodiversity**

FOCUS3.2 **Establishing scientific approaches for optimising multiple uses of biodiversity, considering possible trade-offs between economic and environmental goals, and the uncertainty associated with novel developments**

The judicious use of biodiversity is essential both for the maintenance of our life-support system and for the sustainable development of our world's resources. The primary driver of changes in biodiversity is human activity. Effective solutions for the sustainable management of biodiversity therefore lay in understanding how individuals and societies value that biodiversity, especially those who own and use living resources and the biogeochemical systems on which they depend. Many of the present international conventions and directives, national policies and local regulatory tools have not resulted in the sustainable management of biodiversity because they do not recognise and deal with the underlying motivations of individuals and governments (see, e.g., the global failure of marine fisheries policies). Addressing the causes and consequences of biodiversity loss requires good basic and applied science, together with their integration with the social sciences.

There has been considerable progress in understanding the more proximate mechanisms generating biodiversity changes, such as land-use changes, habitat fragmentation, pollution, and invasive species (Core Project 1), as well as the effects of such changes on ecosystem processes, goods and services (Core Project 2). Incorporating such information into strategies that provide incentives for the sustainable use of biodiversity requires the integration of the natural sciences with political science, sociology and economics. Establishing such an interdisciplinary community of like-minded researchers is one of the primary aims of DIVERSITAS under Core Project 3. The task will be challenging and will most likely require the establishment of new methodologies to occupy the vacant ground between the traditional sciences. This core project will seek advice from and collaboration with IHDP.

Focus 3.1.

Evaluation of the effectiveness of conservation measures and incentives for achieving the conservation and sustainable use of biodiversity

This focus has two objectives. The first is concerned with the scientific evaluation of the effectiveness of existing conservation measures. The second identifies the socio-economic causes of the failure or success of conservation measures.

3.1.1. Effectiveness of current conservation measures and regulations

Measures to conserve biodiversity in natural and managed systems have been in place for some time, but they clearly vary in their effectiveness. At present, there is little scientific analysis of the effectiveness of such measures from which to draw lessons. Whilst there is a plethora of claims concerning the virtues of particular policy types, such claims need to be subjected to rigorous scientific evaluation.

This project will:

- analyse international, national, local and non-governmental biodiversity conservation measures and associated policies in managed and unmanaged landscapes;

- identify existing databases on resource and indicator species relevant to those policies to evaluate their success in achieving their stated aims;
- develop comparative analyses of biodiversity measures and policies to establish their effectiveness in different socio-economic contexts and on different spatial and temporal scales.

3.1.2. Biodiversity changes: social, political and economic motivators

If current strategies have undesirable but unanticipated consequences for biodiversity, we need to understand why. Focus 3.1.1 will identify measures and policies that have failed or succeeded in the past. This focus will review the socio-economic causes of failure, and the possible ways in which these causes might be addressed. Interdisciplinary teams of researchers from the ecological, social and economic sciences are needed to clarify which causes are most important under different conditions.

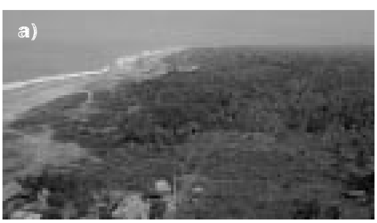


Fig 6. *The science behind DIVERSITAS Core Project 3 (Focus 3.2) is well illustrated by this programme on the Tonameca Watershed, in Oaxaca state, southern Mexico. Here, an imaginative plan is being drawn up whereby the multiple biodiversity uses in the catchment can be optimised to provide for sustainable development. The initiative for this programme has come from the local community in the coastal village of Ventanilla (6a) who have founded a co-operative to manage their local biodiversity assests, which include an extensive area of mangrove habitat that supports a high biodiversity of birds, green iguana and crocodiles. In addition, the local beach is visited in huge numbers (tens-hundreds of thousands) by several species of nesting turtles. These resources allow the co-operative to provide for sustainable eco-tourism. However, the coastal fringe is potentially impacted by changes in water quality and quantity of the Tonameca river which feeds the mangrove system. Water quality and quantity are potentially affected by logging of the pine-oak woodlands at the top of the watershed, by washings from coffee production from the shade-grown coffee operations within the rainforest, by agricultural operations in the lowlands and by fisheries within the mangrove lagoonal system. Finding an optimum solution to managing all these aspects in a sustainable way is the basis of a programme carried out from the university of York by a Mexican scientist Sophia Avila Foucat, under the direction of David Raffaelli and Charles Perrings.*

General view of the Ventanilla community with the mangrove and turtle beach stretching away to the north (6a); Rainforest vegetation provides shade for coffee plants (shade coffee, 6b) which could not otherwise grow in the uplands. The presence of coffee thus ensures the sustainable use of the rainforest. Bonnifacio is the leader of the community and is shown here with mangrove seedlings (6c). (Photos courtesy of David Raffaelli).

The project will:

- identify the effects of individual and social preferences; of culture, tradition and spiritual values; of property rights, legal and regulatory measures; of local, federal, and international environmental policies and agreements; of incentive effects of local and global market conditions and economic policies on the conservation and sustainable use of biodiversity;
- identify local, national and international governance and market structures that promote the conservation of biodiversity on the appropriate temporal and spatial scales;
- identify the nature of property rights, including intellectual property rights, that support biodiversity conservation;
- foster research into novel economic and regulatory instruments to promote sustainable biodiversity use;
- research the ways in which local biodiversity conservation efforts that yield global benefits may be encouraged.

Focus 3.2.

Establishing scientific approaches for optimising multiple uses of biodiversity, considering possible trade-offs between economic and environmental goals, and the uncertainty associated with novel developments

Societies make choices regarding land management, such as the conversion of a natural system to a production system, or the incremental changes in a production regime, which have impacts on biodiversity and ecosystem services. These impacts are often not taken into account, and the trade-offs between the production of market commodities and ecosystem services are not assessed. This may be because the scientific information on which to assess alternatives is lacking. It may also be because decision-makers lack incentives to take the effects of biodiversity loss into account.

This focus will develop the science required to optimise multiple uses of biodiversity, including the production of goods for the market, the provision of ecological goods and services, and the recreational/cultural value of scenic areas and native species. Modelling the sustainable use of biodiversity in this way could facilitate adaptive management plans that respond to changing economic and ecological factors.

The focus has two objectives. One is to identify the economic consequences of biodiversity change in particular systems or landscapes, to evaluate the trade-offs involved in alternative strategies, and to identify the scope for biodiversity enhancement. A second is to develop the scientific basis of precautionary decision-making, and to apply this in specific cases.

3.2.1. Optimising multiple uses of biodiversity

It is important to develop studies of the optimal use of biodiversity in agricultural landscapes, forests, rangeland, and fisheries, as well as in animal production systems (e.g., chicken, pigs, aquaculture). There are currently few such studies, and all take a very restrictive view of biodiversity.

The project will:

- foster research into the economic consequences of biodiversity changes due to new technology and other human activities;
- promote studies of the vulnerability of managed systems and the ecological, economic, and institutional regulation and political measures required to prevent such systems from reaching critical thresholds;
- develop crosscutting networks for agricultural and forestry goods and services which will consider trade-offs between economic and environmental goals (see the "Greening agriculture" network).

3.2.2. Establishing the scientific bases for applying the precautionary principle

The precautionary principle holds that if the costs of current activities are uncertain but potentially both high and irreversible, society should take action before the uncertainty is resolved. It has been widely adopted, but its application has been largely *ad hoc*. There is little agreement on what a precautionary decision or a precautionary approach involves. The approach needs to be made more precise and placed on a rigorous scientific footing if it is to be used operationally. One basic concern is the nature of the biological and ecological tests required to implement the principle. The scientific community needs to provide guidelines about what information is needed to apply the principle, when care needs to be exercised (e.g., identify situations where nonlinearities in biodiversity change make the precautionary principle particularly important) and when ignoring caution leads to biodiversity change. A major objective of this project is the identification of the precautionary tools required to objectively and rigorously apply the principle in different contexts.

The project will:

- foster research on the existence of biodiversity-related thresholds in natural and managed ecosystems;
- identify the critical thresholds, if they exist, that need to be avoided with the aid of the precautionary measures;
- promote development of protocols for precautionary action in the face of novel activities involving potentially irreversible costs;
- foster research into measures and instruments to support precautionary decision making;
- illustrate the application of precautionary approaches using, for example, the cases evaluated under 3.2.1.

Focus 3.2.
Future Foci

In addition to these two foci, DIVERSITAS will be interested, in the future, in developing under Core Project 3 particular aspects of conservation and restoration strategies related to biodiversity. Conservation and restoration ecology are relatively young fields that are central to the mission of DIVERSITAS.

In conservation ecology, many new approaches have proved useful, especially research on metapopulation dynamics, reserve design, and the use of DNA markers to understand processes like migration, colonisation, founder effects, inbreeding, and hybridisation. Further studies along these lines will be extremely useful for managers and decision makers.

In the field of restoration ecology, many efforts focus on regaining basic ecosystem services such as erosion control and improved water quality, but this may or may not entail restoring or improving biological diversity. For example, restored or artificial wetlands often have low biodiversity. Given the importance of biodiversity to many human endeavours, further research is needed to understand how various restoration methods affect biodiversity. A future DIVERSITAS project could encourage research on the methods and economics of restoring biodiversity in various habitats and regions.

Cross-cutting

In addition to the three thematic core projects, a few integrated cross-cutting networks, which embrace issues addressed in all the core projects, will be developed around particular topics or ecosystems. Two such networks already exist, the Global Invasive Species Programme (GISP) and the Global Mountain Biodiversity Assessment (GMBA). A new cross-cutting network, "Greening agriculture", is proposed.

Global Invasive Species Programme (GISP)

The Global Invasive Species Programme (GISP) is a partnership among specialists on invasive alien species dedicated to minimising the spread and impact of these species in a timely and effective manner. These specialists include scientists, lawyers, environmentalists, educators, policy makers, economists, and resources managers from multiple sectors worldwide. GISP was established in 1997, following a UN Conference on Alien Species held in Trondheim, Norway, that clearly pointed to the need for greater efforts to be made in raising awareness of invasive alien species problems and in developing and sharing best practices for their prevention and management.

The Scientific Committee for Problems of the Environment (SCOPE), along with partners from the United Nations Environment Programme (UNEP), The World Conservation Union (IUCN), and CAB International (CABI), initiated the collaboration required to address this issue and continue to engage with new partners in an innovative programme dedicated to addressing the threats of invasive alien species with a holistic approach. GISP joined DIVERSITAS in 1998. The mission of GISP is to assist governments, international organisations, and other institutions in their efforts to minimise the spread and impact of invasive alien species.

GISP is now in its second phase, the goals of which are:

- to evaluate best management practices;
- to develop new tools to improve pest prevention and control systems;
- to articulate a new global strategy and action plan to help nations come to grips with the problems of biological invasions.

For more information about GISP, please visit: http://**jasper.stanford-edu/gisp/**

Fig 7. ***Invasive Species. Newborn slider turtles (Trachemys scripta elegans; Fig. 7a) have been exported in large amounts by US farmers world-wide since the 1950's. The growing turtles have often been released by their owners in the wild where they proliferate, such as in this pond around Paris, France (Photo courtesy of Marc Girondot).***
The invasion by water hyacinth (Eichhornia crassipes) of this river of the state of Jalisco, Mexico, prevents navigation (Fig. 7b). It results from an excessive use of fertilisers in the cultivated portions of this river's watershed (copyright IRD, Claude Dejoux).

Global Mountain Biodiversity Assessment (GMBA)

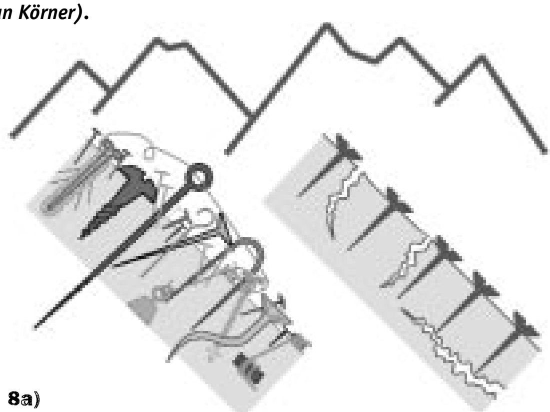
Mountains of the world are hotspots of biological diversity. The compression of thermal life zones and the fragmentation of the landscape into a multitude of microhabitats, each inhabited by a suite of specialists, create this extremely high diversity. Biological diversity is considered essential for the persistent functioning and integrity of mountain ecosystems, and this dependency is likely to increase as environmental conditions change. Steep terrain and mountain climate in combination with severe land use pressure cause mountain ecosystems to rank among the most endangered landscapes worldwide.

The Global Mountain Biodiversity Assessment, launched in 2000, synthesises knowledge on the ethical, ecological, economic, and aesthetic values of high mountain biodiversity, in order to tackle issues of societal relevance such as mountain biological diversity and land-use management (fire, grazing and erosion). Workshops are attended by biologists, social scientists and local land-use managers.

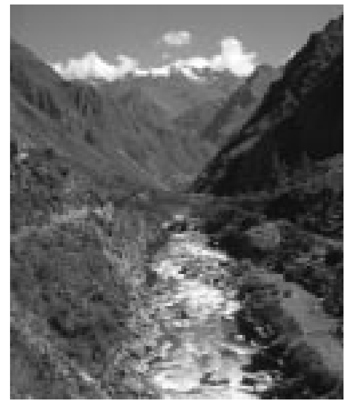
The GMBA has the following objectives:

- to document and synthesise knowledge on the biological richness of the mountains of the world and the change of this richness through direct and indirect human influences;
- to investigate the mechanisms which create and maintain mountain biodiversity and the functional consequences in both natural and rural high-elevation terrains;

Fig 8. *Mountain biodiversity. This analogy with tools (8a) illustrates the idea that biodiversity provides insurance against soil erosion in alpine areas. The integrity of steep mountain slopes is secured by plants, in particular by the diversity of their belowground structures. These living "screws and nails" act as a prevention against erosion. It takes a multitude of diverse tools, as shown on the left portion of Fig 8a, to do the job (Figure courtesy of Christian Körner).*



8a)



8b) *Inca valley in Peru (Figure courtesy of Anne-Hélène Prieur-Richard).*

- to stimulate new research activities with a comparative emphasis and of a large scale scope;
- to shape a corporate identity of the global scientific community on mountain biodiversity;
- to communicate findings and engage in dialogs with national and international policy forums.

For more information about the GMBA, please visit: http://**www.unibas.ch/gmba**

International Biodiversity Observation Year, 2001-2002

The International Biodiversity Observation Year (IBOY) taking place in 2001 and 2002, is an initiative of DIVERSITAS. It is a pulse of activity within the biodiversity research community and a focal point for science-based information on biodiversity. IBOY's goals are to (i) promote and integrate biodiversity research, advancing a holistic understanding of biodiversity and (ii) increase communication to a broad audience of science-based information on biodiversity and its importance for human welfare.

At the core of IBOY are one-hundred and ten diverse projects with activities in more than 140 countries. Each project is delivering important information for one or more of the following questions:

- What biodiversity do we have, and where is it? Surveys are cataloguing and mapping life, including chemosynthetic communities around deep-sea vents, fauna of anchialine caves, microscopic soil organisms and caterpillars of tropical rainforest canopies.

- How is biodiversity changing? Projects include new monitoring programs across Asia and Africa and global task forces to provide urgently needed information on declining amphibian populations, coral reef bleaching and species invasions.
- What goods and services does biodiversity provide? International experiments include the role of soil biodiversity in decomposition and the influence of landscape diversity on gas and energy fluxes. Global syntheses are providing policy makers with assessments including the importance of biodiversity to human health and future scenarios for ecosystem services.
- How can we conserve biodiversity? New science-based tools to conserve biodiversity are being developed, including selective breeding combined with economic programs to conserve honeybees and threatened crop species, and DNA-Banks to help conserve endangered species.

The IBOY Secretariat coordinates the projects in activities that stimulate information exchange between disciplines and nations and promote emerging research in biodiversity and sustainability. Its scientific meetings and publications are raising interdisciplinary awareness and seeding new partnerships. Its outreach, including seminars, educational materials, articles, and press releases are raising the profile of biodiversity research and its significance among media, policy makers and the public.

For more information about IBOY visit: http://**www.nrel.colostate.edu/projects/i**

Fig 9 *illustrates two projects of the International Biodiversity Observation Year (IBOY). In Figure 9a, cave biologist Dr. Tom Iliffe, from Texas A&M University at Galveston, USA operates a Phantom ROV (Remotely Operated Vehicle) to document surveys of anchialine caves in Bermuda, as part of the IBOY project Exploration and Conservation of Anchialine Fauna. Anchialine caves are flooded inland marine caves inhabited by poorly known fauna that are long-term survivors of ancient lineages, such as (top to bottom) Typhlatya iliffei, Lucayarina catacumba, Parhippolyte sterreri (Photo Courtesy of Tom Iliffe)*

In Figure 9b, scientists from the Tropical Soil Biology and Fertility Programme (TSBF) of CIAT (International Centre for Tropical Agriculture of CGIAR) collect litterbags from Kakamega Forest as part of the IBOY Project, Global Litter Invertebrate Decomposition Experiment (GLIDE). GLIDE is the first experiment to examine global biogeographical patterns of fauna that dwell in the plant litter layer and their influence on decomposition. For more information see http://www.nrel.colostate.edu/projects/glide/ (Photo courtesy of Frederick Ayuke, TSBF, Nairobi, Kenya)

b)

Greening agriculture

This cross-cutting network will focus on agricultural and plantation systems. It will promote research on how contrasting land-use patterns affect biodiversity, ecological economics, and standard economic gains. Consider a landscape in which native species are largely confined to a few discrete nature reserves that are separated by large areas of intensively farmed crops. This could be contrasted with a landscape in which small, interconnected patches of natural and semi-natural habitat are scattered throughout. In the latter case, patches that are suitable for native species occur over large areas of private land that has multiple uses and is farmed less intensively.

Questions to be addressed include:

- What are the economic costs and benefits of each system for farmers, and how might these factors be modified to include ecological economics?
- How should remnant patches of forest or grassland be configured to provide farmers with ecological services such as soil conservation, pollination, and reduction of pest populations?
- What types of natural biological diversity does each type of landscape support, and how sustainable is each system in terms of the conservation of biodiversity?
- How does the agricultural biodiversity of cropping systems and crop species, including GMOs, affect natural biodiversity?
- What is the optimal size and distribution of natural and semi-natural patches for conserving biodiversity in a given region?
- What economic incentives can be used to increase the amount of biodiversity that can be maintained on privately owned farmland?

Data are directly relevant to possible changes in the European Common Agricultural Policy, and possibly elsewhere, towards a “greener agriculture”.

Programmatic

Many of the scientific questions presented in this science plan are of interest to national and international partners. This offers numerous opportunities for collaboration.

National Programmes

DIVERSITAS will continue developing its formal network of national committees in order to enlarge the scientific and policy network of DIVERSITAS, and establish a strong link between national biodiversity programmes and DIVERSITAS. These committees will adapt DIVERSITAS to local and regional concerns.

The Earth System Science Partnership

The Earth System Science Partnership, or ESSP, was established in July 2001, following the Amsterdam Global Change Open Science Conference "Challenges of a Changing Earth:". Its four partners are:

- WCRP (the World Climate Research Programme),
- IGBP (the International Geosphere-Biosphere Programme),
- IHDP (International Human Dimensions Programme on Global Environmental Change) and
- DIVERSITAS

Together, these partners have adopted the Amsterdam Declaration on Global Change (see page 32-33). The ESSP corresponds to a will to do science in a more integrative way, and to contribute to the design of science based solutions to global environmental problems.

The ESSP has launched two global-scale collaborative joint projects, one on food security, called Global Environmental Change and Food Systems (GECaFS), and one on the carbon cycle, called the Global Carbon Project (GCP), and is developing a third one on water resources and global change.

Collaboration with particular projects such as LUCC or GCTE will intensify.

Links

The Convention on Biological Diversity

DIVERSITAS signed in 1997 a Memorandum of Co-operation with the Secretariat of the Convention on Biological Diversity (CBD). Scientists involved in DIVERSITAS have been proud to be requested to contribute to the work of this Convention and its SBSTTA (Subsidiary Body for Scientific, Technical and Technological Advice), in particular with respect to the Global Taxonomy Initiative (GTI). The Global Mountain Biodiversity Assessment (GMBA) is currently contributing with others to the work of the Secretariat of the CBD on the theme of mountain biodiversity, in the context of the International Year of the Mountain (2002). Collaboration with the CBD, and possibly with other Conventions, will continue, as appropriate.

Other international initiatives

Additional opportunities for collaboration exist with programmes mentioned in this science plan (e.g. Census of Marine Life, CoML; Global Biodiversity Information Facility, GBIF). These possibilities will be explored as DIVERSITAS develop its activities.

The scientific communities of four international global change research programmes - the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme on Global Environmental Change (IHDP), the World Climate Research Programme (WCRP) and the international biodiversity programme DIVERSITAS - recognise that, in addition to the threat of significant climate change, there is growing concern over the ever-increasing human modification of other aspects of the global environment and the consequent implications for human well-being. Basic goods and services supplied by the planetary life support system, such as food, water, clean air and an environment conducive to human health, are being affected increasingly by global change.

Research carried out over the past decade under the auspices of the four programmes to address these concerns has shown that:

- **The Earth System behaves as a single, self-regulating system comprised of physical, chemical, biological and human components.** The interactions and feedbacks between the component parts are complex and exhibit multi-scale temporal and spatial variability. The understanding of the natural dynamics of the Earth System has advanced greatly in recent years and provides a sound basis for evaluating the effects and consequences of human-driven change.

- **Human activities are significantly influencing Earth's environment in many ways in addition to greenhouse gas emissions and climate change.** Anthropogenic changes to Earth's land surface, oceans, coasts and atmosphere and to biological diversity, the water cycle and biogeochemical cycles are clearly identifiable beyond natural variability. They are equal to some of the great forces of nature in their extent and impact. Many are accelerating. Global change is real and is happening now.

- **Global change cannot be understood in terms of a simple cause-effect paradigm.** Human-driven changes cause multiple effects that cascade through the Earth System in complex ways. These effects interact with each other and with local- and regional-scale changes in multidimensional patterns that are difficult to understand and even more difficult to predict. Surprises abound.

- **Earth System dynamics are characterised by critical thresholds and abrupt changes. Human activities could inadvertently trigger such changes with severe consequences for Earth's environment and inhabitants.** The Earth System has operated in different states over the last half million years, with abrupt transitions (a decade or less) sometimes occurring between them. Human activities have the potential to switch the Earth System to alternative modes of operation that may prove irreversible and less hospitable to humans and other life. The probability of a human-driven abrupt change in Earth's environment has yet to be quantified but is not negligible.

- **In terms of some key environmental parameters, the Earth System has moved well outside the range of the natural variability exhibited over the last half million years at least.** The nature of changes now occurring simultaneously in the Earth System, their magnitudes and rates of change are unprecedented. The Earth is currently operating in a no-analogue state.

On this basis the international global change programmes urge governments, public and private institutions and people of the world to agree that:

- **An ethical framework for global stewardship and strategies for Earth System management are urgently needed.** The accelerating human transformation of the Earth's environment is not sustainable. Therefore, the business-as-usual way of dealing with the Earth System is not an option. It has to be replaced – as soon as possible – by deliberate strategies of good management that sustain the Earth's environment while meeting social and economic development objectives.
- **A new system of global environmental science is required.** This is beginning to evolve from complementary approaches of the international global change research programmes and needs strengthening and further development. It will draw strongly on the existing and expanding disciplinary base of global change science; integrate across disciplines, environment and development issues and the natural and social sciences; collaborate across national boundaries on the basis of shared and secure infrastructure; intensify efforts to enable the full involvement of developing country scientists; and employ the complementary strengths of nations and regions to build an efficient international system of global environmental science.

The global change programmes are committed to working closely with other sectors of society and across all nations and cultures to meet the challenge of a changing Earth. New partnerships are forming among university, industrial and governmental research institutions. Dialogues are increasing between the scientific community and policymakers at a number of levels. Action is required to formalise, consolidate and strengthen the initiatives being developed. The common goal must be to develop the essential knowledge base needed to respond effectively and quickly to the great challenge of global change.

BERRIEN MOORE III	ARILD UNDERDAL	PETER LEMKE	MICHEL LOREAU
Chair, IGBP	*Chair, IHDP*	*Chair, WCRP*	*Chair DIVERSITAS*

Challenges of a Changing Earth: Global Change Open Science Conference
Amsterdam, The Netherlands 13 July 2001

Next Steps

The next step is the establishment of one International Core Project Office for each of the three Core Projects. Each of these three International Project Offices will be under the leadership of one Chair, or two co-Chairs. These Chairs will be responsible, with a scientific planning team, for developing a science plan that lays out the scientific questions to be addressed. A subset of the DIVERSITAS Scientific Committee will produce in 2003 one implementation plan for the whole programme, which includes scientific plans of each of the core projects, and locates them in a set of common connecting themes (e.g. agriculture, mountain, water, health). The production of a unique science plan for the whole programme with common themes is meant as a way to vigorously promote an integrative implementation across the whole programme.

In parallel to the development of its scientific activities, DIVERSITAS will develop its fund raising strategy. It will intensify its dialog with national funding agencies with the help of IGFA, the International Group of Funding Agencies for global change research, and develop a planned approach of private foundations.

The activities that DIVERSITAS intends to undertake will include: funding and organising workshops which build bridges across countries and disciplines to address specific questions, publishing scientific syntheses, organising open science conferences, contributing to international policy fora. Additional activities may include the co-ordination of international courses on biodiversity science, and the establishment of a seed grants programme.

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The task force, which met in September 2001 to draft the science plan, was composed of the following scientists:

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