



An Initiative of DIVERSITAS
2001-2002

IBOY Projects

At the center of the IBOY is a diverse portfolio of research, informatics, and education and outreach projects that address the questions:

- 1) *What biodiversity do we have and where is it?*
- 2) *How is biodiversity changing?*
- 3) *What goods and services does biodiversity provide?*
- 4) *How can we conserve biodiversity?*

More information on each of these projects can be found at
<http://www.nrel.colostate.edu/IBOY/projects2.html>

Core Network Projects

1) What biodiversity do we have and where is it?

Assembling the Tree of Life

Phylogeny is the evolutionary pedigree or genealogical history of an organism. Like piecing together an enormous family tree, scientists are trying to map the history of life in a phylogenetic Tree of Life.

In 2001 the Tree of Life Symposium will bring together dozens of the world's authorities to produce a summary of our current knowledge of life's history that will propel the science forward to a new understanding and also explain its significance to the general public. A major objective of the symposium is to bring the Tree of Life into society and the classroom. A book resulting from the Symposium will be published in late 2002.

Project Leaders: Joel Cracraft and Michael Donoghue

Biodiversity in Deep – Sea Chemosynthetic Communities

Chemosynthetic ecosystems are ecological communities based on chemical energy, rather than light energy. Bacteria use the chemical energy to produce the organic carbon that sustains the rest of the organisms in the foodweb. Deep-sea chemosynthetic communities around hydrothermal vents and cold seeps are poorly known. They should be priority areas of research since: they are biodiversity hotspots with a high proportion of endemic species subject to degradation and habitat loss; many new species will be found; the species have potential for biotechnological and pharmaceutical applications; and knowledge of their distribution will provide important information on non-latitudinal and non-climatic controls on biodiversity patterns

During IBOY an ambitious survey to understand patterns in diversity and community composition of chemosynthetic ecosystems at local, regional and global scales will take place. The study will focus on mussel-bed communities, which will enable local and regional processes to be compared in chemosynthetic ecosystems across the globe and even with non-chemosynthetic ecosystems.

The project's findings will be published in peer-reviewed journals throughout 2001 and 2002. Outreach and education to a broad audience is also an important part of the project and will include web-casts from at-sea expeditions and articles for the general public.

Project Leader: Cindy Lee Van Dover

Biodiversity Resources for Inventorizing and Monitoring

Governments around the world have set aside national parks, nature reserves and wildlife refuges to protect areas of great natural beauty or high conservation importance. Yet, in the vast majority of cases comprehensive inventories of the plant and animals in these areas are lacking and changes in biodiversity are not being monitored. This severely limits scientists' ability to assess the value of the world's protected areas as conservation centers.

The Man and the Biosphere (MAB) Biodiversity Resources for Inventorizing and Monitoring (BRIM) constitute the world's largest publicly accessible source of plant and animal information for protected areas. The databases seek to provide documented species inventories of the world's Biosphere Reserves and additional participating protected areas. This effort has two components: (1) the development and distribution of computer software (MABFlora for plants and MABFauna for animals), which is used by biologists to hold the results of biological inventories, and (2) compilation of this information in global MABFlora /MABFauna databases which are published on the internet, making available for the first time documented, standardized species inventories of the world's biosphere reserves.

In 2001 and 2002 the database will be expanded to include more protected areas and taxa, and enhanced Internet versions. During the IBOY, BRIM also plans to launch the 'BRIM Scientists Without Borders Monitoring Network,' the world's most extensive biological diversity monitoring network.

Project Leader: Roger Soles

Charting and Documenting the World's Ants and Social Wasps

Ants are one of the ecologically most important groups in the world, but they are relatively poorly known. Many species are vulnerable or threatened, by factors including habitat loss and invasive species, but some are extremely successful invaders, such as the fire ants.

AntBase will provide the best possible access to the still very fragmented information on ants, most of it in few Websites and close to 30,000 publications, of which 3,500 cover ant taxonomy. AntBase will link all the information together through the unique Latin binomen of each species. The system will include: the existing names for all ants and social wasps; a geographic information system to provide access to specimen data; descriptive data such as full text descriptions and imagery; applications on how to collect biodiversity information in a standardized, comparable way; automatic links to other major Internet based information systems regarding those species and a

continuously updated counter of all the ant species known world wide. In late 2002 leaders of AntBase will develop a reassessment of the Red-listed ants of the world and an early warning system of invasive ant species

Project Leaders: Donat Agosti and Norm F. Johnson

DIVA - Latitudinal Gradients of Biodiversity in the Deep Sea of the Atlantic Ocean

Knowledge of deep-sea benthic organisms is very poor and although their diversity is believed to be high, there exists no reliable estimate of species numbers in the deep sea. It is generally not known for most taxonomic groups:

- how large the area colonized by species is
- how large and patchy areas of high or low diversity are
- what trends of regional differentiation exist

To help understand the deep sea better, a consortium of researchers across a large number of biodiversity institutions is collaborating to study the fauna of a selected region, a latitudinal gradient of the Atlantic Ocean, with the same methods. This coordinated approach will yield unprecedented data for a large number of taxa from a large geographic area, enabling patterns in diversity and distribution to be identified.

It is expected that the first results will be announced in fall 2001. Final results will be available in 3 years.

Project Leader: J. Wolfgang Waegele

Ecoishare

The private sector and more specifically multinational corporations hold in their archives, as well as within current development activities, an enormous amount of biodiversity and other environmental data at a variety of spatial scales. Ecoishare, developed by UNEP-WCMC is developing readily accessible internet-based information systems to provide open access to this data gathered and held by contributing multinational partners.

The data used for Ecoishare will be available in a variety of formats. However, the initial pilot phase, being conducted in partnership with BP, Rio Tinto and Shell during 2001, will focus on the utilization of Environmental Impact Assessments and the creation of metadata sets arising from these. After the initial pilot phase, an expanded Ecoishare will incorporate raw data, information from remediation and restoration studies, and from a breadth of ecosystem assessments and evaluations.

Project Leader: Mark Collins

Exploration and Conservation of Anchialine Faunas

Anchialine habitats are flooded inland marine caves and ground waters that lack any direct surface connection with

the open sea. They are inhabited by remarkable animals, long term survivors of ancient lineages, which are threatened by changes in their fragile habitat. In recent years approximately 250 new species, 50 new genera, at least 10 new families, two new orders and even a new class of crustaceans have been described from anchialine caves. Cave diving has been referred to as "the most dangerous science" but a better understanding of anchialine fauna is expected to yield many benefits: these primitive 'living fossils' can help us understand the origin of life on Earth; groundwater organisms like these can be used as an 'early warning system' to detect human disturbances to ecosystems; and some of these animals may contain important chemicals, for example certain cave sponges may have much higher anti-cancer activities than related sponges living outside caves in the open ocean.

Expeditions to anchialine caves during the IBOY include explorations of caves in Texas (including a cave where entry has been prohibited for the past 20 years) (March 2001); the north Coast of the Dominican Republic (Spring 2001), the Bahamas, Bermuda, Mexico (Yucatan), Spain (Mallorca and the Canary Islands) (Summer and Fall 2001); and Japan (2002). Information resulting from these expeditions on the many newly discovered taxa, and on the distribution, ecology and threats to anchialine fauna will be made available in publications, in films and on the internet.

Project Leader: Tom Iliffe

Frogwatch USA

Over the past 150 years, rapid growth in agriculture, industry and urban development has resulted in dramatic changes in our environment. The changes pose significant challenges for animals and plants, as seen with the decline of frogs, toads and salamanders. Understanding the decline of amphibian populations is crucial in uncovering how people's activities are effecting water quality, wildlife habitat and other aspects of our environment. We share our environment with amphibians and their decline may foreshadow challenges we will have to face in the 21st century.

Frogwatch USA is a long-term anuran (frog and toad) monitoring program, which actively engages the public in the conservation of local wetlands while complementing and facilitating broader efforts to implement amphibian monitoring across the United States. During the IBOY, the project will extend it's reach to yield continent-wide information as it assists an international monitoring program for The Nature Conservancy and Association for Biodiversity Information in Central and South America and through collaborations with Canadian FrogWatch. In 2001 and 2002, the data collected will provide valuable information about anuran species distributions, population

trends at individual wetlands, and yearly vocalization phonologies.

Project Leader: Sam Droege

INSECT@THON

There is a wealth of information on biodiversity in museums and other collections that exists in non-digital forms, inaccessible to a broad audience and for quantitative analysis. This information needs to be rapidly computerized to make it available for research, conservation and education programs. Insect@thon is an international school contest, created by the National Museum of Namibia that computerizes important biodiversity data and at the same time increases access to the Internet in schools. Children from competing schools enter paper-based information into computerized databases. For many children, it is the first time they have seen a computer. Winning schools receive support to connect to the Internet and winning individuals will receive prizes including trips to natural history museums abroad and participation in biodiversity safaris.

In Namibia the 1999 and 2000 Insect@thons have been enormously successful, enabling 70% of non-computerized insect data at the National Museum of Namibia to be digitized. It will have connected 200 Namibian schools to the internet by the end of 2001. Insect@thon is also helping to repatriate Namibian biodiversity data held in museums in the first world, as winning teams travel to museums in Europe and North America where they computerize their Namibian insect records. Insect@thon hopes to raise funds to take its road show to museums and schools in Zimbabwe and Zambia in 2001 and 2002.

Project Leader: Joris Komen

Inventory of the Caterpillars, Their Parasitoids, Their Food Plants, and Their Gut Microbes, in a Costa Rican Tropical Dry Forest, Cloud Forest and Rainforest

This project is surveying species of caterpillars in the Area de Conservacion Guanacaste (ACG) conserved wildland in northwestern Costa Rica. Caterpillars are crucial components of tropical forest ecosystems. They are major consumers of tropical vegetation (consuming more living tropical foliage than any other group of animals) and essential prey for many birds, mammals, other insects, fungi, bacteria, and viruses. They are also major movers and multipliers of the microbial community. Caterpillars make many interesting defensive and communication chemicals that are potential sources of lead molecules in biodiversity prospecting. Furthermore, butterflies and moths – adult caterpillars - are critical pollinators and important for ecotourism.

Despite their importance, few tropical caterpillars have been scientifically described and matched with their adults.

It is expected that in 2001, the project will discover and place on the web at least 500 species of previously unknown caterpillars, their host plants, and their parasitoids. In June 2002, a workshop will be held in the ACG on how to find and rear caterpillars, and document their biology on the Internet. Throughout 2001 and 2002, papers providing new information on caterpillar distributions, taxonomy, trophic relations and ecology will be published. Because the ACG is a conserved wildland, this survey will also provide baseline data against which biodiversity loss can be measured.

Project Leader: Daniel Janzen

MACROFAUNA - An Endangered Resource in a Changing World

The next great challenge for agriculture development is to save the biodiversity and enhance the use of biological resources that have been totally neglected during the decades of the green agricultural revolution. Soil invertebrates are irreplaceable actors of soil formation and conservation in natural ecosystems and the general unsustainability of agricultural systems worldwide is attributable, at least partly, to their local disappearance.

A particularly important soil faunal group is macrofauna, which includes large invertebrates (e.g. ants, earthworms and termites), that determine activities of other smaller organisms through the mechanical activities that they realise in soil. Intensive agricultural systems generally severely deplete macrofaunal diversity and abundance. Management of their communities will improve sustainability of agricultural systems, but will necessitate much more comprehensive knowledge of communities worldwide, and their reaction to soil conditions and disturbances, than exists today.

The MACROFAUNA Project is bringing together forty scientists from 32 countries to share their knowledge to develop the first global assessment of the state of soil macrofauna. They are pooling their data in the MACROFAUNA database and developing standardized research methods to examine how soil biodiversity is influenced by (1) factors such as geography, vegetation, climate and soil type and (2) different land use practices. This information will enable scientists to determine which agricultural practices are best able to support life in the soil. A website is being created with a description of methods, illustrations, identification keys, databases and information on technologies to stimulate faunal activities.

Project Leader: Patrick Lavelle

Ocean Biogeographic Information System (OBIS)

There is no adequate system for the global retrieval of data on ocean biology. The few existing databases do not usefully summarize known distributions of marine life, nor are they organized to encourage frequent use and inter-comparison of data. During 2001 and 2002 an international consortium of marine researchers will develop the Ocean Biogeographical Information System (OBIS), an on-line, user-friendly system for absorbing, integrating and assessing data about life in the oceans. OBIS will enable scientists to answer urgent questions about marine biodiversity, its origin and maintenance that have been simply impossible to address with present data and data access.

Online users will be able to search for information taxonomically (by entering an organism's name) or geographically (by clicking on any map area). Information on species distributions, how they vary in space and time, correlations to environmental factors, location of specimens and a history of the research will be available.

Much of the initial information available through the OBIS system will be compiled from existing databases, but some research projects are also collecting new data. These databases will lead to the development of new Internet atlases that display aspects of marine life from the distribution of squid to the DNA sequences of tiny zooplankton.

Project Leader: Fred Grassle

Ocean Oasis

Ocean Oasis is a giant-screen film about Baja California, to tour world-wide in 2001, with an accompanying website and teachers' guide. Baja California seems to be two separate worlds: one is a long spine of rock and desert where plants store water for years and some animals never drink and urinate crystals. The other is a sea that boils with life, a place so appealing that some of the greatest creatures on Earth travel thousands of miles to get there in order to mate or give birth, where birds gather by the thousands, where there is such richness in the sea that it becomes an oasis of nourishment and shelter for living things for thousands of miles around. The film tells the story of the profound links between the two worlds through the voices of several people who love this place and try to understand it: a fisherman, an ecologist, a zoologist, a naturalist and a marine biologist.

Ocean Oasis premiered at the Samuel C. Johnson IMAX Theater, at the Smithsonian Institution's National Museum of Natural History, September 12, 2000. Its European Premiere followed on September 14, 2000 at the Giant Screen Theater Association, Frankfurt, Germany. It will

premiere in its hometown of San Diego on March 31, 2001 from which it will embark on its international tour.

Project Leader: Michael Hager

Prokaryote Survey

In recent years, there have been dramatic advances in our understanding of the prokaryotes (organisms such as bacteria and archaea, with no membrane separating the DNA-containing area from the rest of the cell). In particular, new molecular techniques that enable examination of prokaryote diversity with or without cultivation have rapidly accelerated knowledge of these organisms, showing, for example, that groups known as the Bacteria and the Archaea are as different from each other as they are from us. Furthermore, these groups contain dozens of sub-groups that are each as distantly related to each other as are animals to plants. Therefore, it is reasonable to consider these sub-groups equivalent to microbial "kingdoms." Recent surveys in natural habitats have found several previously unknown kingdoms, and more are being found during ongoing research.

During 2001 and 2002, prokaryote researchers will be surveyed to synthesize recent findings from microbial surveys around the world. The resulting synthesis will be published in scientific journals and online for both specialists and the public.

Project Leader: Jed Fuhrman

Species 2000

The names of organisms are the key to biodiversity communications, and as such, provide access to the accumulated knowledge of all life on earth. However, no catalog or comprehensive indexing system exists for the estimated 1.75 million species of plant, animal, fungi and microorganisms named by science. This lack of a widely accessible index, with an inbuilt mechanism for maintenance and updating is a significant impediment to research, as it hinders the synthesis of biological information from numerous sources needed for a holistic understanding of biodiversity. It also hinders nations wishing to fulfill their obligations under the Convention of Biological Diversity.

While no comprehensive species list exists, many regional datasets, and species lists for groups of organisms do exist, collated and maintained by a diversity of disparate organizations. The initial aim of Species 2000 is to bring these together with the common purpose of making their species lists available to interested parties worldwide. By providing a validated species index, Species 2000 will act as a clearing house or single entry point for different species lists, allowing species related information to be more easily drawn upon and providing a global comparator for inventories.

Bisby estimates that a critical mass of 300,000 species will be covered by 2001. In 2001 a CD-ROM based 'Species 2000 Catalog of life Annual Checklist 2001' and an internet-based 'Dynamic Checklist' will be published.

Project Leader: F.A. Bisby

Survey of Stickleback Parasite Biodiversity

Parasites are ideal organisms to use as indicators of biodiversity and ecosystem structure, and to monitor change. They possess: varied life cycles and respond differently to various environmental conditions; rapid generation times compared to their hosts, so that environmental effects are manifested more quickly; complex life cycles involving intermediate hosts and predator-prey relationships that can be used to evaluate foodweb structure and trophic interactions of communities. All these properties result in parasites being excellent early bioindicators of impending ecosystem stress.

Sticklebacks are ideal parasite hosts for comparative studies across a broad biogeographic range of aquatic ecosystems, since they are among the most widely distributed fish in the northern hemisphere, occur in coastal, brackish and freshwaters, and in both disturbed and pristine habitats. Furthermore, there is already considerable baseline data and they are easy to catch.

In 2001 and 2002 scientists from eight countries across the northern hemisphere are collaborating to survey parasites of stickleback fish. In the summers of 2001 and 2002, they will collect protozoan and metazoan parasites of sticklebacks from diverse habitats in North America, Europe and Asia. They will build an international database on the distribution and abundance of stickleback parasites and a database of stickleback tissue that will provide important information on their biogeography and ecology and how they may be used as indicators to examine the impacts of environmental stressors on biodiversity.

Project Leader: David Marcogliese

Television Trust for the Environment - Earth Report

For IBOY Four twenty-five minute films on biodiversity will be produced as part of Television Trusts for the Environment Earth Report. They will first be broadcast on BBC World, then translated into thirty languages and distributed to land based stations around the world to a global audience approaching two billion people.

In the first of these programs leaders from the world's top environmental organizations came together to debate and discuss *The Future of Life On Earth*. The BBC/TVE Wildscreen debate featured key international figures with prime responsibility for safeguarding global biodiversity.

The debate was held at the Arnolfini complex in Bristol, UK on October 13th, 2000.

Edited highlights of the BBC/TVE *Earth Report* millennial debate were broadcast on BBC World on: Saturday 21st October, 2000 at 1810 GMT, Sunday 22nd October, 2000 at 0810 GMT and 1210 GMT.

Project Leader: Robert Lamb

United States Geological Survey Gap Analysis Program (USGS GAP)

The Gap Analysis Program (GAP) provides information on the distribution and status of native plant communities and animal species in order to provide land managers, planners, scientists, and policy makers with the information they need to make better-informed decisions.

In 2001 and 2002 GAP will map land cover and predicted distributions of vertebrate species, and overlay the maps of these biotic elements with maps of land ownership and types of biodiversity management, so that the degree to which vegetation types and vertebrate species are represented in protected lands can be assessed. GAP provides first-ever snapshots of biotic distributions and status over large regions at detailed spatial resolution. In 2001 and 2002 the GAP is also coordinating with Mexico and Canada to develop similar programs. Throughout the IBOY the GAP will issue reports and datasets on the conservation status of biodiversity across the USA and will assist in the development of similar Canadian and Mexican reports, for continental-wide assessments.

Project Leader: Kevin Gergely

WOMAD Tour

The World Music and Dance global concert tour 2001-2002 will have the theme of biodiversity for IBOY. The tour will examine the influence of biodiversity on culture through music and dance, and invited lecturers will speak on key biodiversity issues. The tour will reach a young global audience that is not traditionally exposed to information on biodiversity.

Project Leader: Ivan Hattingh

2) How is biodiversity changing?

AmphibiaWeb

Frog populations have declined alarmingly over the past decade. The cause or causes of this decline are unknown, and cannot always be attributed to habitat loss. Factors such as increased radiation, chemical pollution, pathogens or stress factors associated with climate change have all been postulated as causes of the decline. In order to understand what is happening to amphibian populations, there is a great need for accessible, accurate and authoritative information on the current status of populations of amphibian species worldwide. AmphibiaWeb, launched in February 2000, is a web-based communication and database system, which aims to make a definitive statement about the status of every amphibian species in the world.

2001 and 2002 will see a major effort to secure global participation in the development of AmphibiaWeb. It already contains at least partial species accounts for all of the species of amphibians in the world (about 5300), and maintains up to date lists of all of the amphibian species in the world, as well as lists per country. Importantly, a current status report for the amphibian populations will be available for each species, information that is currently not readily available. For instance, it is not widely known that many amphibian species from tropical regions have not been seen since their original discovery.

Project Leader: David Wake

ARKive – A Global Digital Library of Images and Recordings of Endangered Species

Current extinction rates mean that future generations may only be able to see and hear many species through photographs, films, videos and sound recordings. There have been no safeguards for the preservation of these natural history images and sounds, which are currently scattered in a variety of commercial and specialist libraries and private collections throughout the world, with little or no public access.

The WILDSCREEN Festival 2000 held in October 2000 in Bristol UK, saw the launch of ARKive - a centralised, digital library of films and photographs, preserved for all time, of the species and habitats in our natural world and accessible to all via the Internet.

The ARKive website proper will be launched towards the end of 2001. In addition to featuring film clips, photographs and sound recordings, an important part of the ARKive website will be its educational component, for use by schoolchildren. It will explain biodiversity, extinction and conservation issues via interactive on-line education module. The first of these, featuring the award-winning

conservation story of the world's rarest snake, was launched in spring 2001.

Project Leader: Harriet Nimmo

BIOMARE - Implementation and Networking of Large-scale, Long-term Marine Biodiversity Research in Europe

2001 and 2002 will see unprecedented cooperation and the establishment of a network of marine scientists and research institutes across Europe, to build capacity to address long-term and large-scale marine biodiversity research questions

As part of this program, three work packages will:

- 1) identify a network of reference sites for long-term and large-scale marine biodiversity research in Europe.
- 2) identify internationally standardized and normalized indicators of marine biodiversity
- 3) build capacity for international biodiversity research by promoting networking and information dissemination.

In October 2002, the final report and results will be published in specialist and non-specialist journals and in *COASTline* the journal of the European Union for Coastal Conservation.

Project Leaders: Carlo Heip and Herman Hummel

Biodiversity Monitoring Transect Analysis (BIOTA Africa)

Under a 'business as usual' scenario, the relatively less degraded biomes in Africa can expect rapid changes in the future, associated with a remarkable loss of species richness.

BIOTA-Africa will analyze and monitor the changes of biodiversity in the most important biomes of the African continent, using an interdisciplinary and integrative approach. The overall goal of the project is to provide information for decision-makers, to support practical, efficient and sustainable management of biodiversity, taking into account the functioning of ecosystems as well as the socio-economic framework. Feasible socio-economic land use practices will be analyzed in combination with scientifically based conservation concepts in order to preserve the resource biodiversity.

The activities, findings and products of BIOTA-Africa will be published on-line on the BIOTA-Africa website, in the program's newsletter, and in reports and peer reviewed publications.

Project Leader: Norbert Jürgens

DAPTF's regional working groups. Completion date: December 2001.

Committee on Recently Extinct Organisms (CREO) - A Preliminary List of Recently Extinct Species

Reliable information on species extinction is a vital tool for assessing the status of biodiversity and ecosystems, for identifying the most threatened taxonomic groups and habitats, and for identifying threats, priority conservation and research activities. The Committee on Recently Extinct Organisms (CREO) aims to foster improved understanding of species extinctions that have occurred in recent times.

During IBOY, CREO will publish an online prototype extinction database documenting extinctions that have occurred from 1500. Seventy-four scientists from 24 countries have provided advice in developing criteria for evaluating possible extinctions. Reported extinctions of mammals and fish were evaluated according to these criteria, and in July 2001 the extinctions were published in the prototype database. Evaluations of bird and reptile extinctions will be added during the IBOY. The database contains searchable fields on taxonomy, date of extinction, evidence for extinction, habitat and range and possible cause of extinction.

CREO is also engaging in outreach activities to raise awareness of species extinction and the research that seeks to document them. For example, a video about a search for a putatively extinct catfish in Columbia has been presented at the AMNH Hall of Biodiversity.

Project Leaders: Ross MacPhee and Ian Harrison

Declining Amphibian Populations Task Force (DAPTF)

Amphibian populations across the world are showing an alarming decline. Scientists are anxious to assess the extent and cause of the declines in order to: (1) understand the implications for ecosystem and human health, and global change; and (2) improve amphibian conservation.

During the IBOY the Declining Amphibian Populations Task Force (DAPTF) will coordinate three major projects to increase understanding and awareness of declining amphibian populations:

- A multi-authored book, *Amphibian Population Declines*, published by Cambridge University Press, that will provide an up-to-date review of the nature, scope and causes of the declining amphibians phenomenon by leading researchers. Scheduled for publication, December 2002.
- A Declining Amphibian Database (dad) that will provide researchers with all available data, in CD-ROM format, on the status of amphibian populations worldwide. Scheduled for completion, July 2002.
- A compendium of reports from DAPTF Regional Working Groups, which will assemble information on the current status of amphibian populations, particular threats to amphibians and any declines documented by

Project Leaders: Tim Halliday and James Hanken

Detecting Environmental Change: Science and Society - July 16-20, 2001, London

Society has always had to deal with environmental change, but the type, pace and change have altered dramatically in the closing decades of the 20th century. Concerns over issues such as changes in water quality and quantity, biodiversity loss, atmospheric pollution, climate change and sustainable development have revealed the tremendous importance of long-term observations of change. It is important that such 'monitoring' meets the needs of society.

This international, multidisciplinary conference will review methods of monitoring environmental change, learn from experiences across different disciplines, and consider improvements that need to be made in monitoring programs in the twenty-first century.

A key symposium of the conference, 'The Global Change in Biological Capital,' will consider existing biodiversity monitoring programs and how they address needs, including the general need for observing systems that address the requirements of major international conventions such as the Convention on Biological Diversity.

Project Leaders: Rick Battarbee and Terry Parr

DIWPA-IBOY - Biodiversity Assessment Program in the Western Pacific and Asia Region

Recent international agreements and strategies, including the Convention on Biological Diversity, Agenda 21, and the Global Biodiversity Assessment, have called for increased inventorying and monitoring of biodiversity, and collaboration across nations to answer large scale questions about biodiversity and its management.

2001 sees the launch of an unprecedented biodiversity assessment program across the Western Pacific and Asia, coordinated by DIVERSITAS in Western Pacific and Asia (DIWPA). The research area spans a latitudinal gradient where a zone of humid climate spans the far north (Siberia) to south (New Zealand) supporting an area of unusually high biodiversity and productivity. It is also experiencing rapid economic expansion and ecosystem change.

Approximately 100 research sites in forest, coastal and freshwater ecosystems across more than 20 countries are collaborating and using standardized comparable protocols to assess biodiversity within sites and across sites. They

are finding answers to important questions about distribution, functioning and change in biodiversity.

Project Leader: Tohru Nakashizuka

DYNAMO - Dynamics of Biodiversity: Ostracods as a Model in Freshwater Ecosystems

To understand and manage human impacts on biodiversity, anthropogenic effects must be separated from natural cyclicity of diversity. In 2001 and 2002, scientists across Europe will collaborate in DYNAMO, to examine patterns of change in biodiversity in space and time.

DYNAMO will collect data on the diversity and distribution of current and fossil ostracods (small freshwater crustaceans) to examine spatial and temporal patterns of diversity. Ostracods are ideally suited to this study since they have an abundant fossil record preserved in-situ, allowing direct comparison between fossil and living assemblages, and there is sound taxonomic and ecological baseline data for the study of extant populations.

The ultimate products will include publication of a methodology to monitor extant diversity changes against a background of natural cyclicity using non-marine ostracods as a model group. The methodology will be published on CD-ROM and distributed to decision makers and managers relating to freshwater biodiversity. Important new information will also be published describing the natural influences on the dynamics of freshwater ostracod diversity against which anthropogenic effects can reliably be distinguished.

Project Leader: Koen Martens

Global Registry of Migratory Species (GROMS)
Biodiversity cannot be comprehensively inventoried, monitored and managed within geopolitical boundaries, but requires international cooperation across the scales relevant to the species' range. Never is this more apparent than for migratory species. At present there are several international monitoring programs and numerous national observation programs collecting data on migratory species, but these are not coordinated.

During 2000 data from existing projects on migratory species worldwide were coordinated into a Global Registry of Migratory Species (GROMS). GROMS summarized knowledge on migratory species in a relational database in combination with a geographical information system (GIS). The information will now be made available on-line and in a CD-ROM to a broad audience including researchers, managers and the public. The GROMS database will support the Convention on Migratory Species and contribute to the Clearinghouse Mechanism under the Convention on Biological Diversity.

In 2001 the data contained in the GROMS database will be analyzed to identify gaps in knowledge of populations, status and threats, particularly for endangered groups such as small whales or migratory fish. Based upon these findings, during the IBOY new monitoring programs for migratory species will be launched and recommendations for conservation and for strengthening existing programs and conventions will be made.

Project Leaders: Clas Naumann and Klaus Reide

Impacts of Biological Invasions

Ever increasing international trade and travel is accelerating rates of species invasions into novel ecosystems, which is a major cause of global change. Species invasions are considered the second greatest threat to biodiversity, next to habitat loss. The International Geosphere-Biosphere program Global Change in Terrestrial Ecosystems (GCTE) has launched a new initiative to assess the susceptibility of terrestrial ecosystems to invasions. It will provide important information for managers to fight the global invasive species problem.

On September 19-22, 2001, an international meeting in Barcelona, Spain, will draw researchers together to pool their datasets for a global assessment of the rates, geographical extent and ecological impacts of invasive species.

The meeting findings will be published in three papers assessing:

- Current areal extent and abundance of biotic invaders across the Earth's surface
- Ecosystems comparative vulnerability to invasion
- Effect of the invaders on ecosystem processes

Project Leaders: Montserrat Vila, Mark Lonsdale, Richard Mack, and Pep Canadell

Recovery of Coral Reef Biodiversity Following Bleaching: International Coral Reef Observation Year

An important question concerning coral reef biodiversity is how well reefs have recovered following widespread bleaching and death of corals, cause by extremely hot weather around the world's tropical oceans in 1998.

During 2001 and 2002, scientists at the Australian Institute of Marine Sciences (AIMS) and the Florida Institute of Oceanography are leading the IBOY project to assess recovery of coral reef biodiversity following bleaching. The data will be provided by around 100 individuals (some scientists, mostly volunteers) working through the International Global Coral Reef Monitoring Network, Reef

Check and several regional and national coral reef monitoring activities.

In 2002, AIMS will produce a report on the state of the reefs, with particular reference to coral recovery since the 1998 event. Based on the IBOY report we expect to learn whether previously luxuriant coral communities have recovered to the stage that would be expected within just three years, and what the prospects are for the coming decade and beyond.

Project Leaders: Terry Done and John Ogden

3) *What goods and services does biodiversity provide?*

Biodiversity: Its Importance to Human Health

There has been little attempt to cover the full, complex range of consequences for human health from species loss and ecosystem disruption. The Center for Health and the Global Environment, the World Health Organization (WHO) and UNEP agreed to be partners in an assessment of "Biodiversity and Human Health," in which leading scientists and health professionals from around the world will compile 'state of the art' knowledge about the importance of other species to human health and present a report to the United Nations in June 2002. The assessment will contribute to the Millennium Assessment and to the deliberations of the Convention on Biodiversity, so that human health can inform its policy decisions. The report will be released to the general public in other formats, including on-line and possibly as a book.

Project Leaders: Robert Bos and Eric Chivian

Biodiversity 911: Saving Life on Earth

Biodiversity 911: Saving Life on Earth is a lively exhibition that will travel across museums in the US in 2001 and 2002. It tells the important story of biodiversity using science, humor and creativity. This innovative hands-on exhibition breaks down the complex topic of biodiversity and its interactions with human society into visitor friendly concepts of what biodiversity is, why it is declining and how we can help protect it.

The exhibition's centerpiece is the Biodiversity Theater, an introductory presentation that features an entertaining film produced by *Aardman Animations* (the Academy Award-winning creators of the claymation characters Wallace and Gromit and the feature-length film *Chicken Run*). Using an engaging dialogue and a creative documentary format based in a hospital emergency room, a live-action doctor interacts with animated "patients" to explore biodiversity issues such as habitat loss, pollution and climate change. The exhibit will also include six interactive exhibit areas, a

"what you can do" computer kiosk, a listening station featuring Public Radio stories on expeditions, and a music video by environmental singer/songwriter Billy B.

Project Leader: Judy Braus

Catalog of the Wild Relatives of the World's Crops

The wild relatives of the world's crops have evolved over a long period of time and have co-evolved with pests and diseases. They make enormously important contributions to plant improvement, and genetic material from the wild relatives is essential for the breeding of new and enhanced cultivars for the world's crops and thereby are essential for maintaining food security. They are a priority group for conservation, both *in situ* and *ex situ*, and sustainable use.

Information on the identity, distribution, and availability of germplasm of the wild relatives of the world's crops is both seriously incomplete and uneven. For IBOY a global database is being developed with data on the relatives of wild crops from five countries around the world, collating data that is currently held nationally, regionally, and by international organizations.

Project Leader: Vernon Heywood

FLUXNET - The Metabolic Diversity of Terrestrial Ecosystems

Over the last decades of the 20th century the Earth's atmosphere and biosphere have experienced much change. Linkages between climate and biosphere functioning are complex and interdependent, but understanding them will be key to assessing how changes to the biosphere affect the atmosphere and to predicting future global change.

FLUXNET is a global network of long-term micrometeorological flux measurement sites, which focus on measuring and interpreting the exchanges of carbon dioxide, water vapor and energy between the biosphere and the atmosphere. These fluxes can be considered the 'breathing' of ecosystems and can be measured at timescales from micro-seconds to centuries. Collecting and analyzing this data will provide valuable information on the diversity (temporal and spatial variability) of ecosystem metabolism, providing a measure of functional diversity at the ecosystem level. Furthermore, since the collective behavior of these diverse ecosystems is responsible for much more steady and robust global patterns such as atmospheric CO₂ concentration, ultimately this project will provide important information towards understanding biotic controls on global meteorological and biogeochemical processes.

Project Leader: Dennis Baldocchi

Global Litter Invertebrate Decomposition Experiment (GLIDE)

The diversity of fauna in the soils and litter (leaves and wood) beneath our feet is in orders of magnitude greater than the more familiar life above them. However, this biodiversity is very poorly understood relative to aboveground biodiversity, in part because of the darkness of the habitats and the microscopic size of many of the organisms. We do know that these organisms play a vital role in the removal of waste from the Earth's surface through decomposition, regulating the rate of decay and the amount and form of carbon sequestered in the soil. Global patterns of soil and litter biodiversity, or the significance of the very high belowground biodiversity for rates of decomposition is not known.

In 2001 and 2002, international research networks will collaborate in an unprecedented global survey of global patterns of litter biodiversity and decomposition - the Global Litter Invertebrate Decomposition Experiment (GLIDE).

In late 2002, preliminary results, providing new information on global patterns of litter biodiversity and decomposition will be published in scientific literature and on the Internet.

Project Leaders: David Bignell, Mark Dangerfield and Diana Wall

Global Terrestrial Observing System-Net Primary Production Demonstration Project (GTOS-NPP)

As part of the Global Terrestrial Observing System (GTOS) estimates of Net Primary Productivity (NPP), for every terrestrial km² (excluding the snow-covered arctic and Antarctic) are being derived from MODIS satellite imagery. For the IBOY, an international collaborative effort, involving independent research stations, international research networks and data centers around the world, will compare the estimates of NPP with species richness data. This analysis will provide new information on the relationship between biodiversity and an important ecosystem process at large spatial scales.

The project's assessment of large-scale relationships between biodiversity and NPP will be published in 2002.

Project Leader: Jim Gosz

Lost Worlds - An IMAX Film on Biodiversity and Conservation

The producers of the Academy Award Nominated IMAX film *Cosmic Voyage* have joined forces with the American Museum of Natural History to produce this film and educational support program on biodiversity. From the lost city of Tikal in Guatemala, through the hidden underground universe that nourishes New York, to the mysterious

mountains of Venezuela that inspired Sir Arthur Conan Doyle's *The Lost World*, audiences will experience the amazing diversity of life on earth, and its profound importance to all of us.

Project Leader: Bayley Silleck

Millennium Ecosystem Assessment

The Millennium Ecosystem Assessment (MA) is the first global attempt to assess and predict the ability of ecosystems to supply the many ecosystem goods and services needed by societies. It was launched on the 2001 World Environment Day, June 5, with the help of the United Nations Secretary General, Kofi Annan, at the U.N. Headquarters, New York, USA. MA will provide information in the short-term, and will build human and institutional capacity for sustainability over the long-term.

From regional to global scales working groups will assess the condition of ecosystems, develop future scenarios of ecosystems capacity to deliver needed goods and services, and develop response options to support continued delivery of these goods and services. Outreach and education, to engage users from policy and civil society, and disseminate findings, will be an important part of the MA.

The first year of the MA is the design year, in which goals, approaches and workplans of the groups are being finalized. It will result in the first ever methodology for how to assess the capacity of the world's ecosystems to continue to provide goods and services needed by society. This methodology will be published as a stand-alone volume in mid-2002 and will be a major contribution to the IBOY

The MA will be completed in 2005, and ideally will be repeated every 5-10 years to facilitate monitoring of ecosystem changes, progress in response to those changes and to incorporate new findings.

Project Leader: Walter Reid

OUTREACH - Biodiversity Series: Information for Educators and Communicators

The poor, especially those in developing countries and rural areas, are disproportionately affected by worsening environmental conditions, including biodiversity loss. One of the greatest challenges that education providers in the developing world face is gaining access to appropriate learning materials that focus on real-life issues; that help youth develop practical problem solving skills; and that provide students with the knowledge base which can equip them to deal with environmental and health realities.

During 2001-2003 OUTREACH will develop a series of educational materials on biodiversity and distribute them to

educators and communicators in developing countries, both via the web and by mail for those communities without access to the Internet. They will explore the diversity of living species, the ability of species to adapt to their environments, the goods and services that ecosystems provide and the direct and indirect threats to species diversity.

Three packs on Genetic Diversity and Food Crops have already been printed and distributed through the OUTREACH network.

Project Leaders: James Conner and Gillian Dorfman

4) How can we conserve biodiversity?

Conserving and Increasing Use of Neglected and Underutilized Crop Species

Global food security has become increasingly dependent on only a handful of crops, yet ethnobotanic surveys indicate that 7,000 plant species across the world are cultivated or harvested from the wild for food. The majority of these species are neglected by research and development, threatening their existence and thus the livelihood options for the rural poor that depend on them.

During IBOY the International Plant Genetic Resources Institute (IPGRI) is launching participatory regional programs focusing on a wide range of neglected crops across the world. The programs will assess the crops' diversity and conservation status, implement plant breeding programs to improve varieties and improve marketing. The programs include: Survey of Pomegranate Diversity in the Central West and North Africa Region; Pistachio Diversity in Syria and Asia; Conservation and Use of Native Tropical Fruit Biodiversity in Asia; Improving the Nutritional Resource Base in Africa Through the Use Enhancement of Indigenous Vegetables; Underutilized species in Lebanon and Fig Genetic Resources in Syria.

Project Leader: Stefano Padulosi

DNA Banks for Endangered Species

Captive breeding provides an insurance policy against extinction and for some species may be the only hope of survival. It requires input from population genetics to preserve high levels of genetic diversity, and from reproductive physiologists to promote the establishment of pregnancies, for example by artificial insemination. Cryopreservation of gametes and embryos has a role to play, while in the future nuclear replacement cloning from established cell lines might prove of value. Such strategies may succeed in saving a small fraction of endangered species, at least for a time. Greatly improved information on and access to the DNA of endangered species will be needed to support these efforts.

In 2001 and 2002, the first steps towards developing DNA Banks for Endangered Species will take place. The location and types of DNA of endangered species stored in scattered facilities around the world will be identified and catalogued. The information will be maintained and published on a website to register these 'DNA' banks, listing who is responsible for them and which species they include. This systematic compilation will reveal which DNA resources exist already and reveal the gaps. Importantly, it will also help structure the conservation communities thinking about approaches for the enormous task of organizing DNA such that it may readily be used in species conservation efforts.

Project Leaders: Anne McLaren and Oliver Ryder

Indigenous Honeybees in the Himalayas: A Community Based Approach to Conserving Biodiversity and Increasing Farm Productivity

Indigenous honeybees can play a very important role in the sustainability and development in the Hindu Kush region of the Himalayas. Honey and other bee products have traditionally been gathered from kept or wild native bee species, and as farmers turn increasingly towards cash-crops, their important role in pollination has increasingly been recognized. They are also important for pollinating native flora.

Survival of the native species is threatened by numerous factors, including introduction of the non-native high honey-yielding species, global change such as habitat loss and climate change, increasing use of pesticides, and environmental impacts of eco-tourism.

In order to promote conservation of native honeybee species the International Center for Integrated Mountain Development (ICIMOD) and partners from other research institutions and local communities have embarked on a

program to increase understanding of the role of native honeybee species in regional ecosystems and local honey-hunting, farming and beekeeping communities, and to increase the capacity of these communities to maximize the benefits from native honeybees.

Project Leader: Farooq Ahmad

Integrated Conservation Biology Curriculum Materials for Tropical Countries

A community-wide initiative has been launched to design and foster the implementation of an integrated set of conservation biology training modules and teaching resources within university programs in tropical countries.

The project is collaborating with conservation biologists and instructors from tropical countries around the world to create an integrated set of conservation biology teaching modules. The modules are designed to fit within existing university programs at the undergraduate, graduate and professional levels in tropical countries. Faculty members and conservation leaders in tropical countries will be able to modify modules to fit their needs. Each module will include:

- 1) An expert summary of a topic or an annotated bibliography of relevant summaries;
- 2) A collection of the original scientific literature for each topic for an instructor's personal use (with an emphasis on literature relevant to the region associated with a particular university);
- 3) A set of easily modifiable visual presentations and discussion questions for use in lectures or seminars;
- 4) And an extensive problem-solving exercise.

Categories of topics that will be addressed include the human context, principles of conservation biology, threats to biodiversity, conservation research, ecological monitoring and assessment, conservation planning, managing for conservation, habitat-specific management, sustainability, skills in communicating about conservation, conservation education, conservation organizations, and conservation politics. Ultimately, the goal is to produce 150+ multi-purpose, inquiry-based, conservation biology curriculum modules.

Project Leaders: Eleanor Sterling and James Gibbs

LITUS - Interactions of Biodiversity, Productivity and Tourism on Sandy Beaches

Although at first sight sandy beaches may appear barren, they support a diverse fauna and flora and are very productive ecosystems. The production of biomass supports inputs of organic matter into terrestrial and marine ecosystems, nursery grounds for fisheries, and even economies such as shellfish and seaweed harvesting. The productivity of sandy beaches and other ecosystem

processes are regulated by their fauna and flora and drive important ecological connections between terrestrial and marine ecosystems. Beaches are also often the site of intense human activity through tourism and the impact of tourism on the biodiversity and productivity of sandy beaches is not generally known.

During 2001 and 2002, researchers from eight countries are collaborating to assess the fauna, flora and productivity of sandy beaches. A key element of this project will be to translate the new information on the biodiversity, ecosystem processes and impacts of tourism on sandy beaches to clear protocols for management of sandy beaches under heavy impacts of tourism.

Project Leaders: Magda Vincx and Jan Marcin Weslawski

Sacred Gifts for a Living Planet

On November 15, 2000, at a summit in Kathmandu, Nepal, the World Wide Fund for Nature (WWF) and the Alliance of Religion and Conservation (ARC) unveiled twenty-six 'Sacred Gifts for a Living Planet.' The Gifts are groundbreaking actions, pledged by the world's eleven leading faiths, to combat loss of biodiversity, forest and marine destruction, climate change and a wide range of other environmental issues.

ARC and WWF are continuing the Sacred Gifts initiative for a further 3 years. New gifts added in 2001 include a program to put 80% of religiously owned forests in Europe and North America into sustainable forestry management schemes by 2010, and the Sacred Seas program which will bring together faith and conservation communities to protect the seas around Britain.

Project Leaders: Martin Palmer and John Smith

Satellite Projects

Satellite Projects are often smaller in scope than the Core Network Projects and address local, national or regional biodiversity.

More information on Satellite Projects can be found at <http://www.nrel.colostate.edu/IBOY/projects>

National Biodiversity Events

Nations around the world are coordinating activities to celebrate biodiversity and the IBOY.

More information on National Biodiversity Events can be found at <http://www.nrel.colostate.edu/IBOY/biodevents.html>