Commissioned Issue Paper of the

UN Millennium Project

Task Force on Environmental Sustainability

Biodiversity and Human Livelihoods – The State of the Planet in 2004

by

David Brackett, Rodrigo A. Medellín, Carolina Caceres and Susan Mainka

June 2004

Abstract

Biodiversity is under-valued and under threat. Our ability to establish values and understand threats is far from complete. While the threats to various components of biodiversity vary according to region, the principal underlying threats are human population dynamics; wealth, poverty and inequity; consumer attitudes and preferences; and market failures and policy distortions.

Attempts to prioritise areas for biodiversity conservation have concentrated on areas of high diversity of biodiversity components and do not include evaluation of the ecosystem services provided. Keeping in mind that ecosystem services are crucial even in areas of low diversity, each country should develop and implement a national biodiversity strategy and action plan.

If the world is to meet the 2010 biodiversity target, the ability to measure impacts and responses to management interventions is hindered by the lack of fundamental biodiversity information. We recommend addressing the institutional challenge of mainstreaming biodiversity within all sectors in the development world. We further recommend addressing the technological challenge of putting in place a Global Life Observation System.

Note to readers

The UN Millennium Project Task Force on Environmental Sustainability has commissioned a series seven topical issue papers to provide background information and evidence to lead up to our recommendations for how governments can address problems related to environmental degradation. The mission of the UN Millennium Project, and our task force, is to develop a framework action plan that will be useful to policymakers and environmental managers alike in working towards achieving the Millennium Development Goals (MDGs). The final report of this task force, *Environment and Human Well-being: A Practical Strategy*, is available on the Millennium Project website <http://www.unmillenniumproject.org>.

This task force has addressed the question of how to achieve Goal 7, Ensure environmental sustainability and specifically Target 9, Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources. Reaching this target will require lasting changes in the use of environmental resources and the provision of new and additional financial and technical resources to developing countries that may not have the capacity to implement sustainable use patterns without outside assistance.

This paper, "Biodiversity and Human Livelihoods – The State of the Planet in 2004", was commissioned to provide a detailed account of the current state of our knowledge on biodiversity. The paper identifies the principle threats to biodiversity, defines the the obstacles and challenges to biodiversity conservation and makes recommendations on how to make biodiversity conservation happen.

This publication does not necessarily reflect the views of the United Nations Millennium Project or the United Nations Development Programme (UNDP), its Executive Board or its Member States.

Please cite this paper as Brackett, David, Rodrigo Medellín, Carolina Caceres, and Susan Mainka. 2004. "Biodiversity and Human Livelihoods - The State of the Planet in 2004." Background paper commissioned for the UN Millennium Project Task Force on Environmental Sustainability. UNDP, New York.

Why Bother with Biodiversity?

Biodiversity's many components play vital roles that may be taken for granted in our busy everyday lives. Because of the 'invisible' nature of the benefits, most people are unaware of the crucial services provided to humans by ecosystems, species and genes. Most of these processes and interactions happen away from the urban landscapes where most policy makers live, and this may have something to do with the reduced appreciation for these services. We only perceive the negative effects of not having these services in an indirect manner. For example, price increases and scarcity of food products such as fish and agricultural goods, floods, increased pesticide use and their related increase in toxicity-related diseases, are all affected to a greater or lesser degree by negative impacts on services provided by biological diversity created by our unsustainable activities.

For the most part, there is a lack of understanding of the direct link between human well being and biodiversity, so the latter is still not recognized as a priority focus for development work. Costanza et al. (1997), in a controversial study that opened the door to ecosystem valuation, piloted an evaluation of the goods and services provided by the world's ecosystems - an estimated average of USD 33 trillion per year. At the time, that amount represented almost twice the global GNP. Short-term strategies that place priority on economics often negatively affect biodiversity, with severe consequences costing orders of magnitude more to resolve than biodiversity conservation itself. Inadequate or poorly targeted incentives and subsidies for agriculture, fisheries, and forestry have created vast unproductive terrestrial and marine areas.

Biodiversity is important not only for the contribution of its various components to our physical well being, but also for our culture. It is interesting to note that 16 of the 25 countries with the highest number of endemic species are also countries that have a high number of endemic languages (Harmon, 2002). In fact, Harmon argues for 'evolutionary reciprocity' meaning that although biological and cultural diversity are not completely overlapping, they do show remarkable similarities and patterns. We should concern ourselves with the 'biocultural presence' in our world as a decrease in either will impact us all (Harmon, 2002).

The importance of biodiversity to human well-being has been enshrined in the text of several multilateral environmental agreements. The preamble to the Convention on Biological Diversity (CBD) notes *"..the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components",* while the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is "Conscious *of the ever-growing value of wild fauna and flora from aesthetic, scientific, cultural, recreational and economic points of view*". Implementation of these agreements includes specific references to the need to identify and monitor the status of natural resources in order to conserve them – in particular the CBD's Article 7 (Identification and Monitoring). The Johannesburg Plan of Implementation also highlights the goal of reducing the current rate of loss of biodiversity by 2010 (para. 44) while the Millennium Development Goals (MDGs) include "Ensuring environmental stability" (Goal 7) as a way to eradicate poverty. In fact, meeting and sustaining the MDGs including livelihoods, food security, health, and vulnerability will depend to a large extent on meeting the WSSD para. 44 goal. In 2002, he United Nations established the WEHAB initiative, focusing on five key thematic areas of crucial global importance: Water, Energy, Health, Agriculture and Biodiversity (WEHAB), to bring additional impetus on action at the World Summit for Sustainable Development. The relationships of biodiversity within the WEHAB framework are highlighted in Box 1.

Box 1. Examples of biodiversity relationships within the WEHAB framework

WATER

- The Nakivubo wetland in Uganda provides more than USh 2 billion (USD 1 million) per year in services to the local people and the bulk of this comes from water treatment and purification services provided by this ecosystem (Emerton *et al.*, 1999)

ENERGY

- Of studies in 23 African countries, all except the Seychelles qualify wood energy as the primary form of energy used in the country. In addition, a shift to charcoal by urban dwellers is increasing the per capita demand as charcoal requires up to twice the amount of wood for the same end-use energy (Drigo, 2001)
- Wood fuels account for ~15% of primary energy supply in developing countries and up to 80% in some countries in sub-Saharan Africa and Asia. (Matthews *et al.*, 2000)
- Biodiversity products - Woodfuel (56%), dung (19%) and straw (18%) - represent the vast majority (>90%) of energy sources in 6 states of rural India (ESMAP, 2002)

HEALTH

- The World Health Organisation estimates that up to 80% of people depend on animal and plant based medicines, in both the developed and developing world (WHO, 2002). In Europe, 2000 medicinal and aromatic plant species are used on a commercial basis with only two thirds of these being native to the continent (Lange, 1998). Critical antiviral drugs such as Ara-A and AZT and the anticancer agent Ara-C were developed from extracts of sponges found on a Caribbean reef (Bruckner, 2002).
- The proteins derived from fish, crustaceans and molluscs account for between 13.8 and 16.5 percent of the animal protein intake of the human population, and provide important sources of Omega-3 fatty acids. The total food fish harvest has been growing at a rate of 3.6 % per annum since 1961. (FAO, 2000)

AGRICULTURE /AQUACULTURE

- Pollinators: Species involved in pollination include about 100,000 invertebrates (bees, wasps, flies, butterflies, moths, and beetles), and over 1,000 vertebrate species (bats, hummingbirds and other birds, and reptile). Since the middle of the last century, pollinator declines due to habitat destruction, pesticides, or disease, have brought important reductions in crop production or even crop failure. At least 20% of these species already have shown declines and are considered threatened by IUCN; 20 to 25 species are already extinct. In the United States alone, annual losses were estimated at between $ 5 and $ 8 billion dollars annually. The distinctive fruit Durian, whose flowers need to be pollinated by bats, represent a cash crop of over 100 million dollars every year to several southeast Asian countries. (Allen-Wardell *et al.*, 1998; Buchman and Nabhan, 1995)
- Pest Control: Africa produces up to 72 million tons of fresh cassava each year. Insect pests can be responsible for as much as 40% cassava crop reductions. Depending on the scenario, biological controls provided by predatory insects have a positive impact of USD 9-26 billion a year. Among the more than 1,000 species of bats, fully two-thirds are insectivorous. Each million Mexican free-tailed bats, for example, destroys ten tons of insects every night, the majority of it composed of the agricultural pest corn earworm moth. Use of biological pest controls has the additional benefits that no pesticides would be applied and no consequent toxicity of man or wildlife.
- Aquaculture has grown considerably since the 1970s and is now the fastest growing animal food production sector. In 2000, this production accounted for 27% of the world's fish, crustaceans and molluscs supplies. Interestingly, unlike terrestrial systems, there is a great diversity in species used in aquaculture with more than 210 different species reported in cultivation in 2000 (FA0, 2002a).

BIODIVERSITY SERVICES

- In China, a recent estimate of the value of some of the ecosystem services provided by nature yielded a figure exceeding 4,500 billion RMB (US$ 500 billion) per year. Even without estimates for many of the ecosystem services, this is greater than the current GNP (BWG, 2001).
- Forest resources directly contribute to the livelihood of 90% of the 1.2 billion people living in extreme poverty and indirectly support the agriculture and food security of one half of the developing world (World Bank)
- A total of 71% of fish produced world-wide (both wild caught and through aquaculture) are for human consumption. Fish represent ~ 16% of the total animal protein consumption globally. (FAO, 2002a). Marine ecosystems, and the vast variety of fisheries that they support, provide the predominant source of fish protein for human consumption at present, with the largest portions of that consumption coming from wild capture fisheries

What do we know about biodiversity?

At the ecosystem level

The World Resources Institutes has undertaken Pilot Assessments of Global Ecosystems. Conditions across all 5 ecosystems studied are uniformly declining (see Annex I). Similarly, UNEP-WCMC has attempted to inventory the current understanding of global terrestrial, marine and inland water biodiversity (WCMC, 2000).

An additional consideration is that a significant portion of ecosystems have already been degraded to the point where they no longer provide the ecosystem services on which people rely. Soil erosion and complete removal of vegetation are unfortunately increasingly common, but most frequent in tropical countries. Over 250 million people are directly affected by desertification. (UNCCD) The same problems occur with marine ecosystems. In addition to providing goods such as fishery products, marine ecosystems provide essential services such as: (1) global materials cycling, (2) transformation, detoxification, and sequestration of pollutants and societal wastes, (3) support of coastal and ocean-based recreation, tourism, and retirement industries, (4) coastal land development and valuation, and (5) provision of cultural and future scientific values (Peterson and Lubchenco, 1997). Unless they are the subject of active effective management/conservation programs, services provided by these degraded systems will continue to decrease.

Assessment of biodiversity at the ecosystem level and including ecosystem goods and services is underway through the Millennium Ecosystem Assessment which began in 2000 and is expected to conclude in 2005. However, as the units of biodiversity for which the greatest knowledge (and potential to increase knowledge) exists, species are the natural units for measuring and monitoring changes in biodiversity over time.

At the species level

Since the first attempts to catalogue life on Earth begun by Linnaeus and his contemporaries in the mid-eighteenth century, ~1.7 million species have been identified and described. Estimates of undiscovered species on Earth range from 10 million to 100 million. In order to fill in the gap, a number of species-based biodiversity information initiatives are being developed and implemented at various levels from the Global Biodiversity Information Facility (an inter-governmental initiative - http://www.gbif.org/) to the All Species Inventory (a non-profit organisation - http://www.all-species.org/) (see Annex II). Most of these initiatives concentrate on cataloguing existing collections within museums, herbaria and academia. Some, such as IUCN's Species Information Service, are also attempting to identify and evaluate current *in situ* populations. However, the magnitude of the task is huge and a coordinated global effort is needed to understand the status of a representative array of biodiversity at the species level.

Taxonomy has become a significant focus in both governmental and non-governmental arenas. The Global Taxonomy Initiative (http://www.biodiv.org/programmes/cross-cutting/taxonomy/) is operating under a CBD mandate while Species 2000 is the work of a "federation" of database organisations working closely with users, taxonomists and sponsoring agencies (http://www.species2000.org/). Within described species, a significant proportion has been identified more than once and there are complicated issues of taxonomic synonymy. For example, one estimate suggests that approximately 13,000 new species are named each year, the current rates of resolving synonymies reduce this number to around 10,000 distinct species for a synonymy rate of 20% in named species (May, 1999). The recent report on Chinese freshwater turtles and the potential controversy of their status as true species or hybrids is a case in point. (Dalton, 2003). Finally, the species which have been named are not available in a single reference work or index.

At the genetic level

A systematic effort to measure diversity at the genetic level for all species has, understandably, not been undertaken. Genome-mapping projects have primarily focussed on microorganisms, particularly those that are human pathogens, with a few notable exceptions such as the human genome project. Nature.com maintains a freely accessible database of genomics research published in Nature for 33 species, six of which are multicellular organisms (http://www.nature.com/genomics/papers/).

In addition, the benefits of bioprospecting, or searching for useful genetic resources in plants, animals and microorganisms, has also resulted in increased attention being given to genetic diversity (Wildman, 1998; Young, 1999). In particular, microorganisms (including fungi) have been the greatest contributors to new pharmaceuticals derived from natural products, yet microorganism biodiversity is among the least understood. Preliminary efforts to understand and document microorganism diversity are being made. For instance the Idaho National Engineering and Environmental Laboratory is developing a web-based system for mapping Yellowstone's microbes as a tool for researchers and bioprospectors, which they someday hope to expand globally (see http://www.inel.gov/featurestories/09-01microbedatabase.shtml).

Also, a great deal of effort is targeted to understanding genetic diversity in cultivated and domestic species, primarily plants. The UN Food and Agricultural Organization is taking steps to document the state of the worlds plant genetic resources and develop indicators of genetic diversity (i.e. FAO, 2002b). In addition, the International Treaty on Plant Genetic Resources for Food and Agriculture was adopted at the November 2001 FAO Conference. The treaty recognises the need for the conservation and sustainable use of plant genetic resources, as well as a regime for fair and equitable sharing of benefits from their use.

From the geographic perspective

While there is a concerted effort to enhance our understanding of the full scope of biological diversity, there have also been significant efforts to identify geographic areas with the greatest concentrations of diversity in an effort to assist with prioritisation of action. Mittermeier and Mittermeier (1997) have developed a list of **megadiversity** countries using a scoring method that evaluates species diversity and ecosystem diversity. Conservation International has adopted **conservation hotspots** which are regions that harbour a great diversity of endemic species and, at the same time, have been significantly impacted and altered by human activities. BirdLife International has identified **Important Bird Areas** (IBA). A site is recognised as an IBA only if it meets certain criteria, based on the occurrence of key bird species that are vulnerable to global extinction or whose populations are otherwise irreplaceable. WWF has chosen the "**global 200** ecoregions" from outstanding examples of each major habitat type including the unique faunas und floras of the world. IUCN and WWF have identified **Centres of Plant Diversity** based on one or both of the following two characteristics: (1) the area is evidently species-rich, even though the number of species present may not be accurately known; (2) the area is known to contain a large number of species endemic to it. Although analysis of biodiversity hotspots in the marine realm is less well developed, Roberts et al. (2002) propose that biodiversity hotspots be extended to marine areas, particularly tropical reefs, to protect against extinctions and conserve centres of endemism.

Interestingly there is significant overlap amongst these various prioritization systems; namely 68% between the hotspots and the EBAs, 82% between hotspots and Centres of Plant Diversity, and 92% between hotspots and the Global 200 regions (Myers *et al*., 2000). Theory suggests a diverse system will be more resilient when faced with environmental change and thus show greater ecosystem stability. In essence, a greater diversity of species performing similar functions within an ecosystem may result in a greater probability of ecosystem processes being maintained in the face of environmental change and some recent evidence supports this hypothesis (see McCann, 2000).

While understanding where the geographic regions rich in amount of biodiversity are located is important, we should note that the assessments mentioned above are based primarily on species and

genetic diversity. They do not include any assessment of functional (versus taxonomic) diversity or the range of relationships among individual components within an ecosystem. By this we mean the added value of individual components operating and linking together as a single unit. In addition, to date there has been no comprehensive global assessment of ecosystem service values on a geographic basis. In addition to understanding the relative importance and value of ecosystem services in different geographic regions of the world, the value of those services at the local scale should also be investigated. As the foundation of sustainable livelihoods, even at the smallest scale possible, and in relatively biodiversity-poor regions, biodiversity provides important services for local inhabitants and should be conserved. Unfortunately, our level of understanding of the true scope and scale of biodiversity status and services is insufficient to support a well informed decision making processes at all scales.

Current Direct Threats to Biodiversity

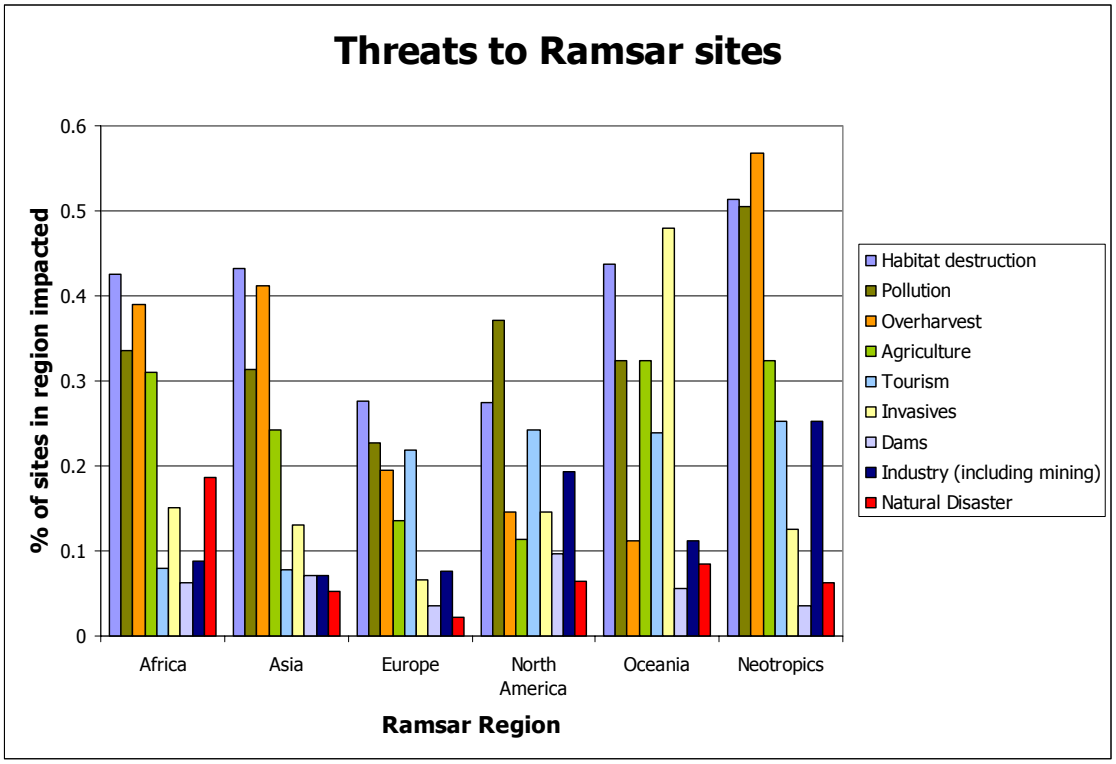
The failure of national and international institutions to understand and respond to the fundamental position of biodiversity as a key to sustainable livelihoods (see introductory section) has created the serious situation in which we now find ourselves. The inability of national and international governance systems to reflect the necessary degree of integration between biodiversity conservation and the actions needed to meet human needs have resulted in an unsustainable approach to human development, including addressing poverty and human hunger. Mankind has been drawing down our global natural capital at a rate that can no longer be maintained.

Humans are responsible for several over-arching threats that are impacting all components of biodiversity, namely climate change (and the increased impact of natural events such as El Nino), invasive alien species and growing urbanisation of our expanding population.

At the Ecosystem level

The 2002 Living Planet Report measures population trends in forests, freshwater and marine ecosystems and reports significant declines over the past 30 years. The Living Planet report constructs population indexes for forests (based on 282 bird, mammal and reptile species), freshwater (based on 195 birds, mammals, reptiles, amphibians and fish from lakes, rivers, and wetland ecosystems) and marine (based on 217 bird, mammal, reptile and coastal ecosystems) ecosystems. As a whole, The Living Planet index showed a decline of 37% between 1970 and 2000. Individually, the Forest Species Population Index declined by 15% during the same period, the Freshwater Species Index declined by 54%, and the Marine Species Population Index 35%. More detailed information is more difficult to obtain. Much of the data pertaining to species is qualitative or anecdotal, and there is no baseline data from which to measure change, or comprehensive monitoring.

A review of threats affecting Wetlands of International Importance (Ramsar sites) indicates that habitat destruction, pollution, agriculture and overharvest are significant threats to the world's wetlands, generally affecting at least 30% of sites. In Oceania, invasive alien species are reported as the most significant threat, but this may be under-reported in other regions. Most sites are reported to be affected by more than one threat and the level of threat reported (as a proportion of total number of sites in the region) is greater in the other Ramsar regions than in Europe and North America.



.

Figure 1 - Threats to Ramsar sites.
NB. Most sites are impacted by more than one threat. This report has been generated from the Ramsar Sites Database. The information is as reported in the latest submission by Ramsar Parties and in some cases may not be the most current available.

WRI reports that human activities and the increasing human population are influencing all ecosystems:

- People living upstream undertake activities that eventually impact coastal systems including adding pollutants and conversion of watershed forests that prevent erosion and flooding downstream. (Burke *et al*., 2000)

- Land conversion for agriculture as well as clearing for infrastructure in developing countries, forest fires, pollution and climate change results in major loss of forest and grasslands (FAO, 1999; White *et al*., 2000).

- Intensive agriculture and rapid urbanisation degrade surface and groundwater in almost all regions of the world by, aggravating the water scarcity problem. At the same time, pollution related to fertilizer use is increasing. (Revenga *et al*., 2000).

- Climate change has been causing changes in physical and biological systems in many parts of the world and the forecast is for this effect to continue (IPCC, 2001)

At the Species level

Threatened animal species are found across the taxonomic spectrum. The 2000 IUCN Red List of Threatened Species reports a depressing story: 24% of mammals and 12% of birds are threatened. Preliminary studies on other major taxa indicate that 20-30% of reptiles, amphibians and fishes are also threatened. Unfortunately very little is yet known of the level of threat facing invertebrate taxa (which contain very large numbers of species), but early indications are that the great majority of

species in freshwater habitats are under extreme threat. The rapidly deteriorating situation for freshwater turtles, in particular in Southeast Asia, was highlighted in the 2000 Red List and 30% of fishes (mainly freshwater species) are listed by IUCN as globally threatened while 37% of freshwater fish in the USA are considered threatened. A further reason for concern is the increase in the numbers of assessed threatened mammals and birds in the Red List's Critically Endangered and Endangered categories in the four years from 1996 to 2000. For example, there has been an increase from 235 Endangered birds in 1996 to 321 in 2000 (Hilton-Taylor, 2000).

A preliminary evaluation of major threats to species was conducted as part of the 2000 Red List and applied to 64% of threatened mammals, all threatened birds and 41% of threatened plants. Habitat loss/degradation affected 83% of threatened mammals, 89% of threatened birds and 91% of plants sampled. Direct loss/exploitation affected 34% of mammals, 37% of birds and 7% of plants. Estimates suggest commercial fishing has depleted predatory fish communities to 10% of their pre-industrial biomass (Myers and Worm, 2003). The list of threatened species was further examined and hunting/trade activities impacted 29% of mammals, 28% of birds but only 1% of plants.

Already 74 species of mammals, 129 birds, 28 reptiles and amphibians, 81 fishes, and at least other 373 species of animals and a minimum of 73 plants have become extinct, dozens of species more are considered to be extinct in the wild (Hilton-Taylor, 2000). More disturbing is the fact that the rate of extinctions is increasing. Since 1600, approximately 485 animal and 584 plant species have been certified extinct and more than 50% of those extinctions occurred within the last century (Smith *et al.,* 1993).

At the genetic level

Generally, genetic diversity is expected to decline as populations are reduced in size or disappear. Reduced genetic diversity, or increased inbreeding, is believed to ultimately lead to a loss of adaptation (evolutionary) potential, demonstrated through effects such as increased susceptibility to disease (Keller and Waller, 2002; Wolfe, 2000).

Genetic diversity can be threatened by introgression (the spread of genes from one species to another due to hybridization). Hybridization can result in the permanent alteration of a species' genetic makeup (known as genetic contamination). Studies have shown the incorporation of genetic material from domesticated animals and crop species into wild relatives (e.g. Davison *et al*., 1998; Linder *et al*., 1998; Wilson, 1997). Thus, it is logical to assume wild species may be threatened, at the genetic level, by hybridization with introduced species that are close relatives. The threats posed by introgression are most often raised when considering the potential risks associated with genetically modified organisms. It is very likely that genetically modified organisms (GMOs) will hybridize with their wild relatives, but the potential frequency, extent and consequences of hybridization are not well understood (Hails 2000).

Widespread use of a few commercial species or plant cultivars is also resulting in the loss of genetic diversity. In their 1997 report, the UN Food and Agriculture Organization note the pervasive loss of local crop varieties as a major cause of genetic erosion in crop species (FAO, 1997). Similarly, wild relatives of domestic animals or crop species are also often threatened with extinction and attention is being drawn to conservation actions needed (Brisbin, 1995; Wilson, 1997).

Biotechnology is a particularly controversial aspect of genetic biodiversity. GMOs have been advocated as a basis for increasing food production, without the need to convert more land to cultivation, reducing chemical inputs or making crops more nutritious. These claims, however, are often balanced by the claims that GMOs may have impacts on lands and ecosystems other than the lands under cultivation. Two things are clear from a review of issues in the GMO/biosafety "debate":

- Biotechnology is under particularly intense discussion in respect of 1) The concern of biological/genetic sciences for loss of biodiversity 2) Development economics and the expected economic benefits of biotechnology and 3) Socio-cultural issues including the impacts of biotechnology on the rural poor, and on indigenous and traditional communities.

- Many or perhaps most of the most prominent voices in each of these areas are focussed only on their own area, and not entirely aware of the other two.

There remains considerable uncertainty within the biotechnology field, so much so that the concept of "precaution" is being addressed in concrete and sometimes controversial ways. Perhaps the single most important factor in making progress within this field is the development of reliable information and analysis, in fields of biology, ecology, law, economics, ecosystem management, and social policy

Underlying causes of genetic and species diversity loss

The direct causes of biodiversity loss include loss of genetic diversity as a result of the spread of modern commercial agriculture/aquaculture/mariculture; loss of species as a result of habitat loss and degradation, the impact of alien invasive species, unsustainable harvesting of plants and animals; and loss of ecosystems due to climate change, through conversion to farming (including all production purposes from agriculture, aquaculture, plantation forestry, etc) and urban development. However, most of these direct causes of biodiversity loss are themselves effects resulting from complex underlying socio-economic factors (Wood *et al*., 2000), including:

☑ Human population dynamics;

☑ Wealth, poverty and inequity;

☑ Consumer attitudes and preferences; and

☑ Market failures and policy distortions.

Human Populations

In 2000, the world's population was 6.1 billion people with an annual growth rate of 1.2%. Projections for global population by 2050 vary from 7.9 - 10.9 billion people. This compares to a population of 5.7 billion and a growth rate of 1.3% a mere five years ago. The UN projects that the rate of increase will continue to decline over the next 50 years. (UN, 2000). However, nearly 50% of the current population live in the 12 megadiversity countries as defined by Mittermeier and Mittermeier (1997) and for at least the next 25 years, the growth rate in those countries is expected to exceed that of the global average. In addition, population density in many megadiversity countries is significantly higher than the global average. Almost 90% of the human population living in 'megadiversity' countries live where there are higher than expected numbers of threatened species.

Wealth, poverty and inequity

Natural resource use is affected by people's level of income, the composition of their expenditure, and the distribution of income as reflected in inequity and poverty. While it is clear that some environmental problems are more closely associated with poverty, others are symptomatic of wealth. There is growing consensus that much environmental damage is largely a consequence of affluence rather than deprivation. The WWF Living Planet Report 2002, notes that the ecological footprint per person of high income countries was on average six times higher than that of low income countries (WWF, 2002). The top 20% income countries are, in essence, borrowing – some might even say stealing - from the bottom 20%. Given the earth is a finite system, these trade-offs do not result in a win-win situation. We cannot move everyone to the consumption levels of the developed world while maintaining current levels of biodiversity.

Consumer attitudes and preferences

One of the four major divides identified by the GEO 3 report (UNEP, 2003) is the lifestyle divide: "one side of the lifestyle divide is characterized by excesses of consumption by the minority one-fifth of the world population, which is responsible for close to 90% of total personal consumption; the other side by extreme poverty where 1.2 billion live on less than US$1 per day".

Market Failures

One of the most pervasive causes of biodiversity loss is the failure of markets to reflect the full environmental costs and benefits of production and consumption. Some markets *do* reflect many environmental values, at least to some extent. For example, agricultural land prices may reflect natural soil fertility; prices of tourism destinations reflect the presence of natural amenities; prices of natural products reflect their scarcity value; some ecosystem services may be marketed, such as pollination by honey bees. Nevertheless, much work remains to be done to widen and deepen the internalization of environmental values in the market place, particularly with respect to biodiversity. The main effect of environmental market failures and policy distortions is to alter the relative financial returns and thus the incentives to undertake activities that protect or degrade the environment (or undermine social equity). For example, agricultural subsidies encourage expansion into areas that would be more suitable for other uses while pesticide subsidies and oil depletion allowances promote poor environmental stewardship. Similarly, fisheries subsidies can lead to overcapitalisation and overfishing (NRC, 1999). Problems arise when subsidies continue long after they are necessary leading to a dependency on them, at which point it is politically difficult to remove those subsidies from the marketplace (Schrank, 2003).

Likely impact on human well-being and ecosystem functioning

It is difficult to measure the long term impact of these root causes of biodiversity loss. Of all the global level analyses, The Wellbeing of Nations[i], supported by IUCN, the International Development Research Centre (IDRC), the International Institute for Sustainable Development (IISD) and the World Resources Institute (WRI), provides the most comprehensive picture of human and ecosystem wellbeing.

The Human Wellbeing Index (HWI) measures progress toward a high (ideal) level of human wellbeing. This is a different approach from other reports such as the Human Development Report because the HWI measures progress toward a goal or vision, rather than escape from deprivation. Similar to the HWI, the Ecosystem Wellbeing Index (EWI) measures progress to the goal of ecosystem wellbeing. The report notes the key pressures on the ecosystem as conversion and occupation of ecosystems, resource extraction, translocation of species, emissions and waste disposal, and soil degradation.

The HWI shows that two-thirds of the world's population lives in countries with a poor or bad score. Only one-sixth live in countries with a good or fair HWI. In Africa, this disparity is most pronounced – only four countries have even a medium HWI, and the rest have poor or bad HWI scores. No country has a good EWI score. Countries with a poor or bad EWI cover almost half of the planet's land and inland water surface. Those with a medium EWI cover a further 43%. Only 8.6% of land area is covered by countries with a fair EWI.

The Wellbeing of Nations classes performance by comparing HWI with EWI:

- 37 countries are ecosystem deficit countries that have high levels of human development, but place excessive impacts on the global environment;
- 27 countries are human deficit countries, placing fairly low pressure on ecosystems, but having poor levels of human development;

- 116 countries are double-deficit countries and combine weak environmental performance with inadequate human development.
- 18 countries are extreme double-deficit countries, and have either poor or bad HWI and EWI scores. Eight are in West Asia, four in Central and East Asia, two each in Northern Africa and West Africa.
- 141 countries have higher levels of ecosystem stress (the opposite of ecosystem wellbeing) than human wellbeing, illustrating that most development is inefficient and overexploits the environment.

Combining and comparing human and ecosystem wellbeing sends a very clear message: no country is sustainable or even close to sustainability. Therefore, pressures on biodiversity will continue and the potential long term threat to livelihoods will increase.

Setting priorities for achieving the Millennium Development Goals

The megadiversity countries do include significant portions of the world's poor people. For example, one half of the world's malnourished people live in these countries (Mainka, 2002). However, for the purposes of ensuring environmental sustainability and poverty alleviation, emphasising megadiversity countries does not prioritise large parts of the world with the highest levels of poverty. Countries with fewer components of biodiversity are not any less dependent on the goods and services that the biodiversity provides. Indeed, in areas with less richness in biodiversity components there is perhaps even greater threat to livelihood since there is more chance that biodiversity loss will eliminate essential services. We should recognize that biodiversity conservation measures should take place everywhere in the world. Each country should be encouraged to establish and implement national biodiversity strategies that are well integrated with their human development strategies.

As to the major donor agencies, a quick comparison of megadiversity countries compared to the Human Well-Being index, the UNDP Human development indicators, and where current ODA funding is going shows relatively little overlap (Annex III). While acknowledging that each country will be deciding biodiversity conservation priorities according to their own situation, donors will also be faced with decisions on where to invest scarce resources. These decisions require a complex discussion of priorities at ecological, social, economic and cultural levels. They must include considerations beyond simply looking at the areas of highest diversity to examining the full scope of ecosystem services as identified by the Millennium Ecosystem Assessment framework (supporting, regulating, provisioning and cultural services). Other factors to consider include clear identification of goals, cost effectiveness and scale of action.

Burgess *et al* (2002) discuss the need for clear goals when developing conservation programmes as well as the importance of scale in conservation planning. A comparison of effectiveness in capturing biodiversity within Africa when using species-based criteria versus process/ecosystem based criteria demonstrated that neither was a suitable proxy for the other. Ecosystem-based systems such as Conservation International's Tropical Wildernesses, did not include species diversity as well as species-based systems, such as BirdLife's Endemic Bird Areas. Similarly, a focus on species may not effectively reflect the ecosystems and their functions.

Balmford *et al*. (2000) suggest that it is important to integrate cost considerations into conservation. They completed a review of countries with high levels of biodiversity compared to the relative costs of implementing conservation and the resulting priority lists go beyond the megadiversity countries to include states in Africa. Nonetheless, donors should recognise that biodiversity conservation actions are key to successful development in all countries and not just in those with higher species/genetic diversity.

Redford *et al.* (2003) recently reviewed the principles and targets of approaches taken by 13 conservation organizations and found, in many cases, there is a common assumption that coarse spatial scale actions will conserve fine scale targets. They note some targets, such as conservation of rare and endangered species or local-scale ecosystems, will not be captured at the coarse level. It is clear, whether conserving species, ecosystems or their services, the underlying conservation target and scale of action must be clear.

At least 21 different approaches at prioritizing biodiversity conservation have been conducted. Examining these approaches to seek common grounds, both from the geographical and the conceptual perspectives, is an important exercise. Although the results (Redford *et al*. 2003) are still preliminary, some important messages are apparent. First and foremost, biodiversity would benefit from a common, unified stance among NGOs and conservation agencies towards identifying priorities and working collaboratively towards those goals. Second, there is less competition and less incompatibility than perceived at first from the different approaches reviewed. The former is a message that should be addressed by the wider development sector while the latter is good news for those already undertaking conservation/development works.

Challenges to managing biodiversity

Conservation and sustainable use of biodiversity is a consequence of balancing an array of factors, which vary according to the context. Achievement of sustainability is dependent on institutional capacities to adapt to changing conditions based on monitoring and feedback – adaptive management. Effective adaptive management will require long term monitoring of biodiversity, however there are a number of challenges to this objective.

Knowledge

There are significant knowledge gaps about all components of biodiversity. For example, we have only identified 10% of existing species. Filling the gap between what we know about biodiversity and what we don't is a huge task and complicated by a number of factors. Emerging technologies in genomics are making it 'easier' to identify species through advanced techniques such as polymerase chain reactions (PCRs) and exponential advances in information management allow more rapid access to reference sources. (McNeely, 2002) Nonetheless, there are significant challenges ahead including coming to agreement on species definitions, increasing national capacities in taxonomy and supporting wide accessibility of all knowledge related to biodiversity. As well, knowledge about ecosystem restoration is only emerging, yet restoration is much more expensive, sometimes orders of magnitude more, than conservation of the same ecosystems.

Capacity

Trained staff and financial resources to support training and ongoing monitoring are currently lacking. Being able to manage biodiversity long term also represents a capacity challenge in many parts of the world. In addition, in many if not most countries, existing capacities (human and financial) are poorly utilised. On the positive side, the ability to access information sources – either to update or to download – is increasing as the digital divide decreases but such access is by no means universal.

Management

The final constraint to long term management of biodiversity is related to a suite of issues around information management. There are many questions to be answered. Who will oversee data input and data quality to ensure reliability and comparability? How can we ensure timely, efficient access to those who need the information? How can we avoid political/cultural influences? Who will bear the cost of maintaining the information in a useful format? Finally, clarity on intellectual property rights over the existing and newly generated information is required.

What is needed for successful biodiversity conservation and sustainable development?

The knowledge, capacity and management challenges are also apparent at the level of achieving the Millennium Development Goals. Yet, given the undeniable importance of biodiversity and its critical role in achieving the Millennium Development Goals it is clear that there are both the institutional and technical level needs that must be addressed.

Addressing institutional challenges

First and foremost, the case for biodiversity must be established within other sectors of the development world. Biodiversity conservation and sustainable use must be integrated into all actions intended to alleviate poverty and achieve sustainable livelihoods. Achieving this integration will depend to a large extent on general understanding of the role of biodiversity in human welfare. A more targeted communications and public awareness strategy should be undertaken.

A corollary to this mainstreaming of biodiversity is the need to ensure adequate resources (both human and financial) to implement these actions. All countries should seek to increase the efficiency of current expenditures for biodiversity conservation across all sectors (ie. agriculture, fisheries, forestry and economic development as well as environment ministries). In some cases, decreasing expenditures for subsidies that are detrimental to biodiversity may be the most efficient way forward. At the same time, there will need to be increased amounts of development funding directed at biodiversity as well as improved incentives for biodiversity conservation. In addition, capacity building and technology transfer programmes must take biodiversity into consideration.

Good governance is key to successful achievement of the MDGs and this will certainly require improved co-ordination, synergy and partnership among all participating agencies and organizations. At Johannesburg, an emphasis was placed on the importance of partnerships in achieving sustainable development. To that end, the potential role of the private sector and civil society in development work, including the conservation of biodiversity, must be recognised and welcomed.

Addressing technical challenges

As stated earlier, knowledge about biodiversity is scattered and incomplete. Significant work to synthesise what exists, identify gaps and develop indicators that will help monitor biodiversity is needed. It is important to recognise that we can not hope to complete a global biodiversity inventory within the time frame of the 2010 target established at WSSD. Indicators that provide an accurate view of the status of biodiversity should be agreed and monitored as soon as possible if we are to have an initial reading by 2010. While the specific indicators may vary from country to country, they should share certain characteristics relating to their specificity, measurability, achievability and incorporation of timelines. There are already many indicators in use and being developed. Reports such as the GEO 3 (UNEP, 2003) incorporate such indicators and provide a global overview of the situation. The CBD, at the 7th Conference of the Parties, adopted a framework for indicators and processes for implementation at the national level (Decision VII/8: Monitoring and Indicators)

Enhanced capacity, particularly in the field of taxonomy is also required and the training should be linked more directly to measurement and monitoring programmes in country.

This is not a one-off activity and a longer term monitoring of our impact on the world should be ensured. There is a need for a Global Life Observation System, as a complement to the global Earth Observation System being developed through the global climate change community.

The goal identified at Johannesburg is to reverse the current rate of loss of biodiversity by 2010. The Millennium Development Goals seek to ensure environmental sustainability. All of these goals necessitate an understanding of the state of biodiversity, both today and in the long term. The time to act is now.

Acknowledgements

The authors would like to thank Jeff McNeely, Ellen Pikitch and Christine Santora as well as other members of the Task Force 6 for valuable input that helped improve the manuscript.

References

Allen-Wardell, G., P. Bernhardt, R. Bitner, A. Burquez, S. Buchmann, J. Cane, P. A. Cox, V. Dalton, P. Feinsinger, D. Inouye, M. Ingram, C. E. Jones, K. Kennedy, P. Kevan, H. Koopowitz, R. A. Medellín, S. Medellín-Morales, G. P. Nabhan, B. Pavlik, V. Tepedino, P. Torchio, and S. Walker. 1998. The potential consequences of pollinator declines on the conservation of biodiversity and stability of food crop yields. Conservation Biology 12:8-17.

Balmford, A., K. J. Gaston, A. S. L. Rodrigues, and A. James. 2000. Integrating costs of conservation in to International Priority Setting. Conservation Biology 14: 597:605.

Brisbin Jr., I. L. 1995. Conservation of the wild ancestors of domestic animals. Cons. Biol. 9:1327-1328.

Bruckner, Andrew W. 2002. Life-saving products form coral reefs: coral reefs are storehouses of genetic resources with vast medicinal potential, but they must be properly managed. (Perspectives). Issues in Science and Technology, 18(3): Spring 2002: 39.

Buchmann, S. L., and G. P. Nabhan. 1995. The forgotten pollinators. Island Press.

Burgess, N. D., C. Rahbek, F. W. Larsen, P. Williams, and A. Balmford. 2002. How much of vertebrate diversity of sub-Saharan Africa is catered for by recent conservation proposals?. Biological Conservation 107: 327-339.

Burke, L., Y. Kura, K. Kassem, C. Revenga, M. Spalding, and D. McAllister. 2000. Pilot analysis of global ecosystems: Coastal ecosystems. World Resources Institute, Washington, DC

BWG. 2001. Restoring China's Degraded Environment - The Role of Natural Vegetation. A report of the Biodiversity Working Group (BWG) of the China Council for International Cooperation in Environment an Development (CCICED).

Costanza, R., R. d'Arge, R de Groot, S. Arber, M. Grasso, B. Hannon, K. Limburg, S Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Sutton and M. van den Belt. 1997. The value of the world's ecosystem services and natural capital. Nature 387: 253-260.

Dalton, R. 2003. Mock turtles. Nature : 219-220.

Davison, A., J.D.S. Birks, H.I. Griffiths, A.C. Kitchener, D. Biggins, and R.K. Butlin. 1999. Hybridization and they phylogenetic relationship between polecats and domestic ferrets in Britian. Biol. Cons. 87: 155-161

Drigo, R. 2001. Wood energy information in Africa. Review of TCDC Wood energy country reports and comparison wit the regional WETT study. Project GCP/RAF/354/EC – EC-FAO Partnership Programme.

Emerton, L., L., Iyango, P. Luwum, and A. Malinga. 1999. The present economic value of Nakivubo urban wetland, Uganda. IUCN.

ESMAP, 2002. Energy strategies for rural India; Evidence from six states. Joint UNDP/World Bank Energy Sector Management Assistance Programme, World Bank, August 2002. http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2003/03/07/000094946_03012304145641/Rendered/PDF/multi0page.pdf

FAO, 1997. State of the World's Plant Genetic Resources for Food and Agriculture. (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPS/Pgrfa/pdf/swrfull.pdf)

FAO, 1999. State of the World's Forests. (http://www.fao.org/forestry/FO/SOFO/SOFO99/sofo99-e.stm)

FAO, 2002a. State of the World Fisheries and Aquaculture. (http://www.fao.org/docrep/005/y7300e/y7300e00.htm)

FAO, 2002b. Criteria and Indicators for Sustainable Forest Management: Assessment and Monitoring of Genetic Variation. Forest Genetic Resources Working Paper (http://www.fao.org/DOCREP/005/AC649E/AC649E00.HTM).

Hails, R. S. 2000. Genetically modified plants – the debate continues. TREE 15:14-18.

Harmon, D. 2002. In light of our differences: How diversity in nature and culture makes us human. Smithsonian Institution Press, Washington. DC.

Hilton-Taylor, C. (compiler). 2000. 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, UK.

IPCC, 2001. Summary for Policymakers. Climate Change 2001: Impacts, adaptation and vulnerability. (http://www.unep.ch/ipcc/pub/wg2SPMfinal.pdf)

Keller, L.F., and D.M. Waller. 2002. Inbreeding effects in wild populations. TREE 17:230

Lange, D. 1998. Europe's medicinal and aromatic plants: their use, trade and conservation. TRAFFIC International, Cambridge, UK.

Linder, C.R., I. Taha, G.J. Seiler, A.A. Snow, L.H. Rieseberg, 1998. Long-term introgression of crop genes into wild sunflower populations. Theor. Appl. Genet. 96: 339-347.

Mainka, S.A. 2002. Biodiversity, poverty and hunger – Where do they meet? Pp. 11-17 In S. Mainka and M. Trivedi, (eds). Links between biodiversity conservation, livelihoods and food security: the sustainable use of wild species for meat. IUCN, Gland, Switzerland.

Master, L. L., B. A. Stein, L. S. Kutner, and G. A. Hammarson. 2000. Vanishing assets. Conservation Status of US species. In: Stein, B. A., L. S. Kutner, and J. S. Adams (eds). Precious Heritage. The status of biodiversity in the United States, pp. 93-118. Oxford University Press, Oxford, New York.

Mathews, E., R. Payne, M. Rohweder, and S. Murray. 2000. Pilot analysis of global ecosystems: Forest Ecosystems. World Resources Institute, Washington, DC

May, R. M. 1999. Conservation: Dealing with Extinction. Pp 57-76. In: McNeely, J. A. (ed.). Imagine Tomorrow's World. IUCN, Gland, Switzerland.

McCann, K. S. 2000. The diversity-stability debate. Nature 405: 228-233.

McNeely, J. A. 2002. The role of taxonomy in conserving biodiversity. Journal of Nature Conservation. 10(3): 145-154.

Mittermeier, R. A, and C. G. Mittermeier. 1997. Megadiversity. Cemex. Mexico, DF, Mexico.

Myers, N, R. A. Mittermeier, C. G. Mittermeier, G A B da Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature 403: 853-858.

Myers, R.A. and B. Worm. 2003. Rapid worldwide depletion of predatory fish communities. Nature 423: 280-283.

NRC (National Research Council). 1999. Sustaining Marine Fisheries. National Academy Press: Washington, D.C.

Peterson, C. H. and J. Lubchenco. 1997. Marine ecosystem services. Chapter 10 of Nature's Services: Societal Dependence on Natural Ecosystems. Washington, D.C.: Island Press.

Prescott-Allen, Robert. 2001. *The Wellbeing of Nations*. Washington: Island Press. This section refers to pg. 13 (Human Wellbeing), pg. 59 (Ecosystem Wellbeing) and pp. 107-114 for overall wellbeing.

Redford, K. H., P. Coppolillo, E. W. Sanderson, G. A. B. da Fonseca., E. Dinerstein, C. Groves, G. Mace, S. Maginnis, R. A. Mittermeier, R. Noss, D. Olson, J. G. Robinson, A. Vedder and Michael Wright. 2003. Mapping the conservation landscape. Conservation Biology 17: 116-131.

Revenga, C., J. Brunner, N. Henninger, K. Kassem, and R. Payne. 2000. Pilot analysis of global ecosystems: Freshwater systems. World Resources Institute, Washington, DC.

Roberts et al. 2002. Marine Biodiversity Hotspots and Conservation Priorities for Tropical Reefs. Science 295: 1280-1284.

Schrank, William E. 2003. Introducing Fisheries Subsidies. FAO *Fisheries Technical Paper* 437. Rome.

Smith, F. D. M., R. M. May, R. Pellew, T. H. Johnson, and K. S. Walker. 1993. How much do we know about the current extinction rate? Trends in Ecology and Evolution 8: 375-378.

UNCCD. 2003. Media Brief: Desertification is a Global Problem. www.unccd.int

UNEP. 2003. *GEO Global Environmental Outlook 3*. New York: UNEP.

White, R. P., S. Murray, and M. Rohweder. 2000. Pilot analysis of global ecosystems: Grassland Ecosystems. World Resources Institute, Washington, DC.

Wildman, H.G. 1998. Pharmaceutical bioprospecting and its relationship to the conservation and utilization of bioresources. Invited lecture presented at the International Conference on Biodiversity and Bioresources: Conservation and Utilization, Phuket, Thailant, November 1997. (http://www.iupac.org/symposia/proceedings/phyket97/wildman.html)

Wilson, R.T. 1997. Animal genetic resources and domestic animal diversity in Nepal. Biodiversity and Conservation 6: 233-251

Wolfe, M.S. 2000. Crop strength through diversity. Nature 406: 681-682

Wood, A. (Ed.), P. Stedman-Edwards (Ed), J. Mang (Ed.). 2000. The Root Causes of Biodiversity Loss. Earthscan.

Wood, S., K. Sebastian, and S. J. Scherr. 2000. Pilot analysis of global ecosystems: Agroecosystems. World Resources Institute, Washington, DC.

World Conservation Monitoring Centre. 2000. Global Biodiversity: Earth's living resources in the 21st century. By: Groombridge, B. and Jenkins, M.D. World Cosnervation Press, Cambridge, UK.

World Health Organisation. 1996. Traditional Medicine fact sheet. http://www.who.int/inf-fs/en/fact134.html

WWF. 2002. Living Planet Report. (http://www.panda.org/downloads/general/LPR_2002.pdf)

Young, R.N. 1999. Importance of biodiversity to the modern pharmaceutical industry. Plenary lecture presented at the 2nd International Conference on Biodiversity. Belo Horizonte, Brazil, July 1999. (http://www.iupac.org/publications/pac/1999/71_09_pdf/7109young_1655.pdf)

Annex I – Summary of Pilot Assessment of global ecosystems (adapted from Mainka, 2002)

Ecosystem	Condition	Trend	Population Pressure
Coastal[1]	▪ 20% of land area ▪ 19% of land within 100 km of coastline is altered for agriculture or urban use	▪ 5-80% of original mangrove lost	▪ 39% of world's population lives here
Forests[2]	▪ 25% of land area ▪ only 40% undisturbed by human activity ▪ 80% of endemic bird areas are in forests	▪ 20% decrease since pre-agricultural times ▪ since 1980, at least 10% decline in developing countries	▪
Freshwater[3]	▪ <1% of land area but services estimated at USD trillions ▪ large dams impound 14% of world's runoff	▪ 50% of world's wetlands lost during the 20th century	▪ 1.5 billion people rely on groundwater as their only source of drinking water
Grasslands[4]	▪ 40% of land area ▪ almost 50% of Centres of Plant Diversity include grassland habitat ▪ 12% of threatened birds are specific to grasslands ▪ nearly 49% lightly to moderately degraded	▪ significant loss due to conversion for agriculture	▪
Agroecosystems[5]	▪ 28% of earth's surface ▪ 31% is cropland (primarily cereal production) with 69% under pasture	▪ pasture area increasing at 0.3% annually ▪ areas under irrigation increasing ~1.6% annually	▪ agroecosystems provide 94% of the protein and 99% of the calories consumed by humans

[1] Burke et al., 2000, [2] Mathews et al.,2000., [3]Revenga et al., 2000, [4]White et al., 2000, [5]Wood et al., 2000

Annex II– A Sample of Current Species-based Information Initiatives

Name (website)	**Objective**	**Data Sources (as of May 03)**	**Current Work Programme**
Global Biodiversity Information Facility (www.gbif.org)	"to make the world's biodiversity data freely and universally available"	- 23 countries - 14 associate countries/economies - 18 associate participants	- GBIF information system - standards for interoperation of biodiversity databases (DADI) - Electronic Catalogue of Names of Known Organisms (ECAT) - digitising of natural history collection data (DIGIT) - outreach and capacity building (OCB) - Providing tools and recommendations for GBIF Participant Nodes and for databases that wish to affiliate with GBIF.
Species 2000 (www.species2000.org)	-enumerating all known species of organisms on Earth (animals, plants, fungi and microbes) as the baseline dataset for studies of global biodiversity.	Included in the Species 2000 programme: Viruses, Bacteria, Corals, Molluscs, Crustacea, Diptera, Ichneumon Wasps, Moths & Butterflies, Curculionid Beetles, Fishes, Birds, Mammals, Fungi, Cacti, Palms, Legumes, Umbellifers and Fossil Plants.	- A dynamic Common Access System on the - The Species 2000 Annual Checklist, - Completion of the array of taxonomic databases - Establish a system of onward links connecting each species entry in the checklist with a wide range of other species databases.

Name (website)	Objective	Data Sources (as of May 03)	Current Work Programme
Global Taxonomy Initiative (http://www.biodiv.org/programmes/cross-cutting/taxonomy/)	to remove or reduce the knowledge gaps in our taxonomic system (including those associated with genetic systems), the shortage of trained taxonomists and curators, and the impact these deficiencies have on our ability to conserve, use and share the benefits of our biological diversity.	Parties to the CBD	-
All Species Foundation (www.all-species.org)	the complete inventory of all species of life on Earth within the next 25 years - a human generation.	-networks of taxonomists around the world	An integrated suite of tools for taxonomists including the ALL Species Search Engine (ties together disparate existing species databases) and The ALL Specimen Browser created in partnership with the California Academy of Sciences.
Species Information Service	Current and universally accessible biodiversity information that encourages and promotes the achievement of effective conservation and sustainable forms of development.	- the IUCN SSC network of 7000 scientists around the world	- a web-enabled system for data input and retrieval using taxonomy as the base - - major analysis of biodiversity status for 2004 World Conservation Congress

Annex III - Human Well-being vs. Megadiversity

Megadiversity Countries (HWI, EWI, WI)	Countries with more threatened birds than expected (IUCN Red List)	Lowest Wellbeing Index (HWI, EWI)	Lowest 12 Human Development Index (2000 value)	Top 12 Recipients based on total net ODA ($ million) received between 1997 and 2001	Countries with lowest Foreign Direct Investment in 2001
Brazil (45,36,40.5)	New Zealand	Iraq 25 (19,31)	Sierra Leone (0.275)	China	Indonesia
Indonesia (36,48,42)	Philippines	Syrian Arab Rep 26.5 (28,25)	Níger (0.277)	Egypt	Aruba
Colombia (43,42,42.5)	Indonesia	Afghanistan 27 (6,48)	Burundi (0.313)	India	Yemen
Australia (79,28, 53.5)	Brazil	Uganda 27 (10,44)	Mozambique (0.322)	Indonesia	U. Arab Emirates
Mexico (45,21,33)	Western Samoa	Saudi Arabia 27 (31,23)	Burkina Faso (0.325)	Viet Nam	Libya
Madagascar (24,50,37)	Madagascar	Tonga 28 (26,30)	Ethiopia (0.327)	Bangladesh	Suriname
Peru (44,62, 53)	Fiji	Mauritania 28.5 (17,40)	Guinea-Bissau (0.349)	Tanzania	Kuwait
China (36,28,32)	Cook Islands	U. Arab Emirates 28.5 (41,16)	Chad (0.365)	Pakistan	Macau
Philippines (44,32,38)	India	India 29 (31,27)	C.A.R. (0.375)	Mozambique	Solomon islands
India (31,27,29)	Solomon Islands	Sudan 29.5 (13,46)	Mali (0.386)	Bosnia &Herzegovina	Fiji
Ecuador (43,56,49.5)	China	Zambia 29.5 (16,43)	Malawi (0.400)	Ethiopia	Gibraltar
Venezuela (43,36,44.5)	Vanuatu	Oman 29.5 (31,28)	Rwanda (0.403)	Uganda	Iraq

HWI, EWI and WI – From Well-Being of Nations, Prescott Allen
HDI – Human Development Indicators 2000, UNDP Human Development Reports, http://www.undp.org/hdr2002/
Megadiversity countries from Mittermeier and Mittermeier (1997)
Foreign Direct Investment data from UNCTAD http://www.unctad.org/Templates/WebFlyer.asp?intItemID=2110&lang=1