Biodiversity and Poverty Reduction;

The importance of biodiversity for ecosystem services.

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UNEP-WCMC - Biodiversity and Poverty Reduction

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Purpose of this Report

This report reviews existing scientific knowledge regarding the links between biodiversity and the sustainable provision of ecosystem services, and considers the implications of these links for development policy. It does not set out to assess the value of ecosystem services to the poor, on which there is a growing understanding presented in other reports and publications, and so does not present the economic valuation of biodiversity or ecosystem services. The report considers biodiversity in the broadest sense, to include variety at the genetic, species and ecosystem levels, and interactions between components of biodiversity, and is therefore not restricted to a consideration of species diversity alone. The links between biodiversity and ecosystem services presented in this report underpin the relationship between the environment and development, and as such contribute towards an understanding of the most effective national, bilateral, and international efforts to achieve the Millennium Development Goals, and towards an improved understanding of the true values of biodiversity.

Importance of Biodiversity for the supply of Ecosystem Services

Biodiversity underpins the ecosystem services that all people ultimately depend on at all scales, from the individual to the global, rich and poor alike. Important ecosystem services on which poor people are particularly dependent, include:

- varied diet (including flavourings and micronutrients), famine foods and food security - provided directly by components of biodiversity that are consumed, and through a wide range of biodiversity that is crucial for food production, including that involved in the services of pollination, pest and disease control, and soil fertility.
- water quality and availability (including regulation of flooding events), and erosion control - affected variously by vegetative cover at local and landscape scales
- medicines and health, both through the supply of natural medicines, and through the regulation of infections and emerging diseases.
- cultural values, closely tied in many societies to components of biodiversity, typically at the species or landscape level.

Current levels of scientific understanding of the links between biodiversity and ecosystem services have established that:

- Interactions between components of biodiversity (such as pollination, decomposition, and interactions between plants and soil organisms) are fundamental to the functioning of ecosystems, and to supporting the continued supply of ecosystem services.
- Diversity at genetic and species levels is important for maintaining the adaptability of ecosystems to changing environmental conditions, for example increasing climate variability and predicted changes in global and regional climate, and for maintaining the capacity of ecosystems to supply the combinations of a variety of services.
- Many of the substitutes for ecosystem goods and services, where available, have significant collateral costs – for example, use of pesticides has important human health implications; use of fossil fuels has climate change and often aerosol pollution implications; use of fertilisers has water quality implications. Sometimes these costs may be born by the users of the substitutes (eg. implications for farmer health of on-farm use of pesticides), but they are often externalised (eg. downstream problems of water quality caused by runoff from farms with high fertiliser input).
- Threshold effects in declining biodiversity are important in many instances. These are manifested when reduction in biodiversity to a certain level causes a sudden collapse in a system's ability to deliver particular services. These have most clearly been demonstrated in aquatic ecosystems, for example where increasing nutrient loading has led to dramatic reduction in oxygen levels and the emergence of so-called "dead zones" in lake and coastal waters, and where the persistent

overharvesting of fish stocks has caused sudden, apparently irreversible collapse in those stocks. Threshold effects caused by reductions in biodiversity on land are less well documented, but have been demonstrated in a range of habitat types.

And so it is clear that some level of biodiversity is absolutely necessary for human existence, rich and poor people alike. However, there is no simple answer to the questions "how much biodiversity do we need?" or "how much biodiversity can we afford to loose?" This is for a number of reasons:

- Biodiversity is a complicated concept with many dimensions. There is no single measure or metric that can adequately describe it. Similarly, ecosystem services are themselves multidimensional. These questions will therefore have a different answer in different contexts and at different scales.
- There is considerable scientific uncertainty, and vigorous debate, about the exact role of diversity in ecosystems and the relationship between the amount of any particular component of biodiversity in an ecosystem and the way that ecosystem functions. Three main approaches have been used to examine such relationships: theoretical, experimental and observational. Each can provide valuable insights, although each is also heavily compromised.
- Although capabilities for predicting some thresholds are improving, and increased *risks* of change can be determined, for most thresholds in most ecosystems, current understanding is unable to predict the thresholds where change will be encountered.
- Many ecosystem services may at some scales be substituted for by non-biodiversity alternatives, derived from technology, inorganic materials (of which petrochemicals are a special case) and human labour. In some instances, and at local scales, ecosystem services may be brought in from outside

Implications for the World's Poor

The limited purchasing power of poor people leaves them less capable of buying-in substitutes for local ecosystem services from outside. They are therefore highly dependent on the integrity of their local environment, for example for the supply of wild foods during times of famine, insecurity or conflict. Maintenance of a heterogeneous local environment provides the widest possible range of ecosystem services, reduces the exposure of local people to risk and lessens their dependence on the vagaries of global markets or on development assistance. When considered from the perspective of poor people it is this *local* level of biodiversity that is important: the distribution and abundance of wild species, the range of crop plants and livestock and the diversity of ecosystem types directly available to them. Not only are poor people generally not in a position to buy in substitutes for ecosystem goods and services, they are often forced to bear the externalised costs of other people's use of substitutes for ecosystem goods and services – for example, they may live in places that suffer the effects of pollution and eutrophication, or are displaced by hydroelectric projects, or conversion of natural or semi-natural forests to high intensity agriculture.

Implications for Development Policy

Recognition of the role that biodiversity plays in underpinning the ecosystem services has development policy implications at all levels from the international to the local or community.

International policy implications

Partnerships between development agencies and other government departments are essential to ensure coherent and consistent policies regarding biodiversity and poverty in all policy arenas. This includes including those concerned primarily with trade and finance, as well as those with a focus on environment and development.

Development agencies are well-placed to encourage appropriate strategies to meet development and environmental targets and indicators at national and international level, for example under in the Millennium Development Goals. MDG 7 'ensuring environmental sustainability' underpins all the other goals, as without it elimination of poverty will only be at best temporary and at worst illusory.

The incorporation of the CBD's 2010 biodiversity target into MDG7 has already contributed to this objective, and to ensuring policy coherence between biodiversity and poverty sectors, although in many instances, MDG7 is not considered or addressed by development agencies to the extent of other goals.

Influencing policies and institutions at the national level
Development agencies could further encourage governments to harmonise their various strategies and action plans, including sectoral plans, poverty reduction strategies, national strategies for sustainable development and national environmental and biodiversity strategies and action plans. Of particular importance in this regard are:

- adoption of participatory bottom-up planning approaches
- adoption of a people-centred ecosystem approach as agreed under the CBD
- promotion of systems of tenure and access to resources that are equitable and that promote sustainable use of natural resources through long-term management
- adoption of legal frameworks that allow for the integrated planning and management of resources at the landscape level
- information sharing within and between governments, including that arising from environmental assessment processes, and government-funded science.

Influencing policies and planning at the regional level
Development agencies could encourage management and planning practices that maintain or restore environmental heterogeneity at the landscape level. This is the simplest way to ensure that poor people have access to the range of ecosystem services that they need while at the same time allowing individuals or families to manage their own resources in ways that most suit them. Experience to date has shown that it is possible to develop multi-stakeholder plans and information sharing mechanisms successfully at the landscape level (particularly in coastal zones through integrated coastal zone management approaches), but that it is often then difficult to establish legal frameworks for the implementation of these plans. Hence the importance of encouraging national-level legal reform, as indicated above.

Influencing activities at the community, farm or individual level
The adoption of low-impact management practices should be encouraged in production systems where these can be shown to deliver significant on-site benefits. Two important examples are the use of integrated pest management techniques and commercial production of environmentally-friendly goods. In both cases barriers to adoption by poorer people can be relatively easily overcome with external assistance.

Where the livelihoods of poor people depend on or involve harvest of wild resources, at minimum efforts should be made to ensure that the harvest of these specific resources is sustainable. Although it is in principle not difficult to design sustainable harvest regimes, it has proven difficult to find successful mechanisms for their implementation. Development agencies could play a useful role here in widely disseminating best practice in natural resources management.

1 Introduction to study

1.1 Purpose and focus of report

This document provides an overview of the state of science relating to the role of biodiversity in the supply of "ecosystem services" (the benefits that people derive from ecosystems), highlighting what is known about how changes in biodiversity affect ecosystem services. It then presents the implications of these connections for development policy. It does not set out to assess the value of ecosystem services to the poor – it is assumed that the reader already has an understanding of the importance of agricultural production, waste processing, natural medicines, regulation of water quality and quantity, and other ecosystem services, information on which is widely available in a range of other reports, such as the range of Millennium Ecosystem Assessment technical and synthesis reports (available from www.MAweb.org). Where information is available, an emphasis is placed on demonstrating thresholds and the consequences of abrupt or non-linear changes to biodiversity.

Biodiversity is considered here in a broad sense, including variety at the genetic, species and ecosystem levels, and is therefore not restricted to a consideration of species diversity alone. This report presents the state of knowledge regarding how much biodiversity is needed for the sustainable supply of ecosystem services in the present, and into the future (see Figure 1). The report also reviews the level of understanding of the reliance of ecosystem services on various aspects of biodiversity, such as *variety* (e.g. number of species (species richness), genetic variability), *abundance* (e.g. number of individuals or populations in a given location), *level of organisation* (e.g. genetic, population, species, or ecosystem diversity or abundance), and *biological interactions* (e.g. between pollinator species and plants, and between predators and prey).

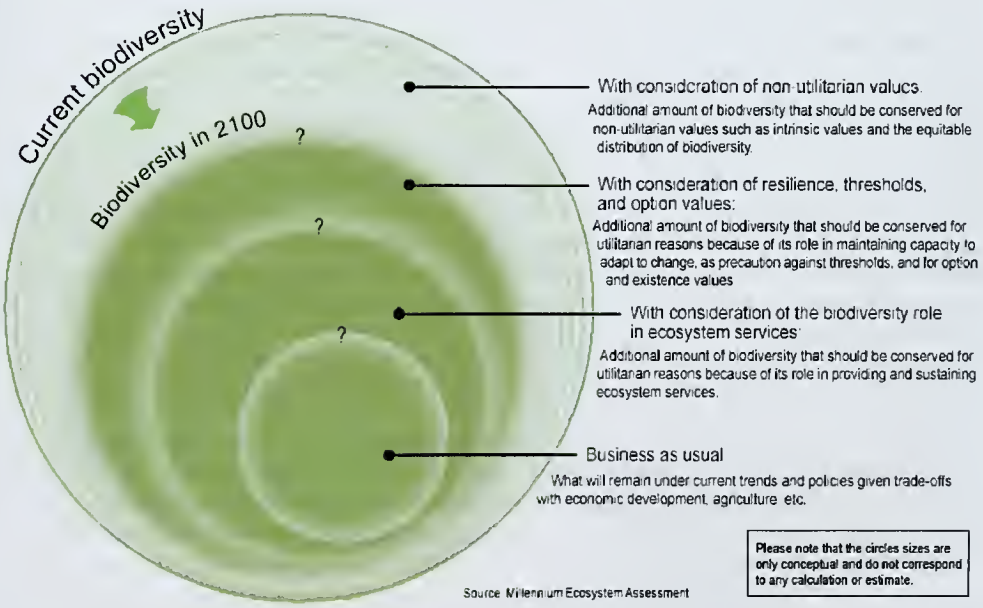

Figure 1. Conservation of biodiversity under different value frameworks – How much biodiversity might we need in the future? This report assesses the current state of knowledge regarding the sizes of these various circles, considering the importance of various attributes of biodiversity for the supply of ecosystem services, both now and into the future. There is little doubt that there will be less biodiversity in the future than at present, but note that the sizes of circles in this graphic are conceptual. Source: Millennium Ecosystem Assessment.

Biodiversity provides benefits to both the rural and urban poor. Although the majority of the world's poor currently live in rural areas, where they are most directly dependent on ecosystem services for their well-being, the rapidly-growing proportion that live in urban and peri-urban areas are also ultimately dependent on ecosystem services, both locally and from a distance. Ecosystem services particularly important to the growing number of urban poor include waste processing and detoxification, regulation of water and air quality, and services supporting small-scale agricultural production.

The issues considered in this report underpin the relationship between the environment and development at all scales, and as such relevant information is contributed here for national, bilateral, and international efforts to sustainably achieve the United Nations Millennium Development Goals and other poverty reduction strategies. The report lends support to, and builds on, previous publications and strategies on biodiversity and development.

1.2 Biodiversity and Ecosystem Services in the International Context

This report comes at a time of rapidly increasing awareness of the importance of biodiversity and ecosystem services. The Millennium Ecosystem Assessment (MA)[1] provided a baseline assessment of the condition of the world's ecosystems in providing benefits to people. It concluded that many of the benefits that people derive from ecosystems are being degraded, largely because their values are not captured in current economic systems. This finding is supported by other recent studies, such as that commissioned by UK Defra, and produced by EFTEC in 2005 on *the Economic, Social and Ecological Value of Ecosystem Services*, and reports of UNDP, the World Bank and others, such as *World Resources 2005; The Wealth of the Poor*.

The role and value of biodiversity and ecosystem services has been recognised at the centre of international efforts to reduce poverty and promote sustainable development, through the framework of the Millennium Development Goals. MDG 7, on environmental sustainability, calls for governments to *reverse the loss of environmental resources*, and although the indicators for monitoring progress towards this goal are not well developed, or comprehensive, the recent incorporation of the "2010 biodiversity target" (see below) into MDG7 has made the connection between biodiversity and the MDGs explicit. The Convention on Biological Diversity (CBD), signed by over 180 governments, manifestly recognises the important role of biodiversity in development, through its overarching objectives of conservation and sustainable use of biodiversity, and the equitable sharing of benefits arising from its use. Government Parties to the CBD, including the UK, have adopted a target, endorsed by the World Summit on Sustainable Development, to *achieve, by 2010, a significant reduction of the current rate of biodiversity loss at global, regional, and national levels as a contribution to poverty alleviation and to the benefit of all life on Earth*. Despite this, there has been a tendency at the national level, and at the international level with development donor agencies, to move away from an explicit focus on biodiversity and ecosystem services in recent years. This may in part be due to a focus on short-term gains for some development targets, many of which come at the expense