3

# Climate Change – Biodiversity and Livelihood Impacts

Hannah Reid, IIED[1]

**Climate change will put international action to eradicate poverty and achieve the MDGs at risk. Responding to this risk is an opportunity to move away from the science and towards action to reduce poor people's vulnerability to the climate.[2]**

## 1. INTRODUCTION

The debate about climate change has reached a stage where most scientists accept that, whatever happens to future greenhouse gas emissions, we are now locked into a future characterised by significant human-induced changes to our climate. There are two types of response to these changes: the first is to try and reduce the extent to which our climate is altered. This is known as climate change mitigation. The second is to learn to live with the inevitable changes. This is known as adaptation to climate change.

1. The author would like to thank Saliem Fakir and Saleemul Huq for their advice and reviews.
2. Hilary Benn, UK Secretary of State for International Development, March 2004.

Biodiversity is inextricably linked to climate – changes in climate affect biodiversity and changes to natural ecosystems affect climate.[3] This chapter considers the linkages between climate change (mitigation and adaptation) and biodiversity, and then relates these linkages to livelihoods, poverty and achieving the Millennium Development Goals. The chapter finishes with some suggestions for actions needed at global, national and local levels in order to support local solutions.

## 2. HOW CLIMATE CHANGE AFFECTS BIODIVERSITY

### 2.1 Direct Impacts

Climate change is likely to have a number of impacts on biodiversity – from ecosystem to species level. The most obvious impact is the effect that flooding, sea level rise and temperature changes will have on ecosystem boundaries, allowing some ecosystems to expand into new areas, while others diminish in size. As well as shifting ecosystem boundaries, these changes will also cause changes in natural habitat – an outcome which will have a knock-on effect on species survival. A growing body of research indicates that, as a result, climate change may lead to a sharp increase in extinction rates. Mid-range predictions from one recent study suggest that 24 per cent of species in the five study regions will be on their way to extinction by 2050 due to climate change. The study indicates that for many species, climate change poses a greater threat to their survival than the destruction of their natural habitat.[4]

**Box 3.1: Climate Change and Protected Areas**

The impact that floods, sea level rise and changes in climate are likely to have on natural habitats means that some protected areas may no longer be appropriate for the species they were designed to conserve. Those planning the proposed Greater Addo National Park in South Africa recognise this and have factored climate change into their planning. The proposed park covers a large area with a range of elevations, latitudes, microclimates, ecosystems and almost an entire watershed. Species can therefore migrate to another safe habitat if climate change adversely affects their present one (http://www.upe.ac.za/zoo/addo/addoprop.htm).

3. Reid, H., B. Pisupati and H. Baulch (2004). 'How Biodiversity and Climate Change Interact' *SciDev.Net* Biodiversity Dossier Policy Brief. http://www.scidev.net/dossiers/index.cfm?fuseaction=policybriefs&dossier=11
4. Thomas, C. D. *et al.* (2004). 'Extinction risk from climate change'. *Nature* 427: 145-148.

Global warming is also causing shifts in the reproductive cycles and growing seasons of certain species. For example, higher temperatures have led to an increase in the number of eggs laid by the spruce budworm, already one of the most devastating pests in North America's boreal forests.[5]

The impacts of climate change on biodiversity will vary from region to region. The most rapid changes in climate are expected in the far north and south of the planet, and in mountainous regions. These are also the regions where species often have no alternative habitats to which they can migrate in order to survive. Other vulnerable ecosystems and species include small populations or those restricted to small areas. Coral reefs have already shown devastating losses as a result of increased water temperatures (Box 3.2).

### Box 3.2: Coral Reefs and Global Climate Change

Coral reefs have the highest biodiversity of any marine ecosystem, and they provide important ecosystem services and direct economic benefits to large and growing human populations in coastal zones. Although the natural habitat of coral reefs can be a stressful environment, recent global increases in reef ecosystem degradation and mortality suggest that the rate and nature of recent environmental changes often exceeds the adaptive capacity of coral reefs. This can lead to the replacement of the coral reef community by non-reef systems. Such ecosystem shifts are well advanced in the Caribbean region, where two major reef-building coral species have been devastated by disease, and in the Indo-Pacific region, where repeated episodes of lethal 'bleaching' have occurred.

This crisis is almost certainly the result of interactions between multiple stresses. These include increased nutrient and sediment loading, direct destruction, contamination, over-harvesting, disease and predation. Rising ocean temperatures have been implicated in chronic stress and disease epidemics, as well mass coral bleaching episodes and reduced calcification. Increasing atmospheric CO2 levels can also inhibit calcification. It is difficult to separate the effects of global climatic and local non-climatic influences when considering reef condition or vulnerability.

Predicting the future of coral reefs is difficult because current environmental changes are causing a combination of surface ocean chemistry and temperature conditions that have not occurred in the evolutionary history of modern coral reef systems. Although climate change has the potential to yield benefits for certain coral species in specific regions, such as the expansion of their geographic ranges, most effects are stressful rather than beneficial. Continued climate change will almost certainly cause further degradation of coral reef communities, which will be even more devastating in combination with the continuing non-climatic stresses.

Source: Robert W. Buddemeier, Joan A. Kleypas and Richard B. Aronson (2004). *Coral Reefs and Global Climate Change. Potential Contributions of Climate Change to Stresses on Coral Reef Ecosystems.* Pew Centre on Global Climate Change.

**5. Gitay, H., A. Suárez, D. J. Dokken and R. T. Watson (2002). *Climate Change and Biodiversity*. Intergovernmental Panel on Climate Change Technical Paper V.**

## 2.2 Impacts of Mitigation Activities

It is not just climate change itself that can have an impact on biodiversity. In some cases, the strategies that are adopted to mitigate climate change can affect biodiversity – both positively and negatively. Investment in renewable energy technology may provide climate change benefits, but outcomes for biodiversity are often poor. For example, some bio-energy plantations replace sites with high biodiversity, introduce alien species and use damaging agrochemicals. Large hydropower schemes can cause loss of terrestrial and aquatic biodiversity, inhibit fish migration and lead to mercury contamination.[6] They can also be net emitters of greenhouse gases if submerged soils and vegetation decay and release $CO_2$ and methane. By contrast, fuelwood conservation measures, such as efficient stoves and biogas use, can conserve carbon reservoirs and reduce pressure on forests.

**Projects designed to sequester carbon, and hence mitigate climate change, present opportunities to incorporate biodiversity considerations**

The concept of becoming 'carbon neutral' is gaining popularity with many businesses that wish to contribute to climate change mitigation activities by offsetting their carbon emissions. Likewise, many nations have committed to reducing their net greenhouse gas emissions under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC). Projects designed to sequester carbon, and hence mitigate climate change, present opportunities to incorporate biodiversity considerations. Afforestation and reforestation activities can restore watershed functions, establish biological corridors and provide considerable biodiversity benefits if a variety of different aged native tree species are planted. Monocultures, however, not only reduce biodiversity, but also increase the chances of pest attacks thus challenging the permanence of carbon stocks. The location of afforestation and reforestation projects is also important. Replacing native grasslands, wetlands, shrublands or heathlands may lead to dramatic

**6. Montgomery S., M. Lucotte and I. Rheault (2000). 'Temporal and spatial influences of flooding on dissolved mercury in boreal reservoirs'. *The Science of the Total Environment* 260(1-3):147-157. Fearnside, P. M. (2001). 'Environmental impacts of Brazil's Tucurui Dam: unlearned lessons for hydroelectric development in Amazonia'. *Environmental Management* 27(3): 377-396. Fu, C. Z., J. H. Wu, J. K. Chen, Q. H. Qu and G. C. Lei (2003). 'Freshwater fish biodiversity in the Yangtze River basin of China: patterns, threats and conservation'. *Biodiversity and Conservation* 12(8): 1649-1685.**

biodiversity losses, and also lower the relative increase in carbon sequestered compared to implementing such projects on degraded land.[7]

## 3. HOW BIODIVERSITY AFFECTS CLIMATE CHANGE

### 3.1 Direct Impacts

Just as climate change affects biodiversity, so changes in biodiversity can also affect the global climate. Land use changes that lead to biodiversity losses can cause increased greenhouse gas emissions. Forests are a major store of carbon, and when forests are cut down or burnt, $CO_2$ is released into the atmosphere. Continuing deforestation, mainly in tropical regions, is currently thought to be responsible for annual emissions of 1.1 to 1.7 billion tonnes of carbon per year, or approximately one-fifth of human $CO_2$ emissions.[8]

**Continuing deforestation, mainly in tropical regions, is currently thought to be responsible for annual emissions of 1.1 to 1.7 billion tonnes of carbon per year, or approximately one-fifth of human $CO_2$ emissions**

Peatlands or mires hold roughly one-third of the carbon contained in soil worldwide, and greenhouse gases are released every time peatlands are burned, drained, converted to agriculture or degraded. Peatland forest fires in Indonesia in 1997 released an amount of $CO_2$ equivalent to 40 per cent of the world's average yearly carbon emissions from fossil fuels.[9] Such peatlands also provide many environmental services, such as improving water quality. Many are important biodiversity reservoirs or stopover points for migratory species.

There are also feedback mechanisms at work between biodiversity and climate change. For example, some species of ocean algae release dimethyl sulfate (DMS) into the atmosphere. Rising ocean temperatures (a product of global warming) mean that more DMS is released from booming

**7. Reid, H. (2003). 'A framework for biodiversity and climate'. *Tiempo, a bulletin on Global Warming and the Third World* 50: 7-10.**
**8. Brown, S., J. Sathaye, M. Cannell and P. E. Kauppi (1996). 'Management of forests for mitigation of greenhouse gas emissions'. In *Climate Change 1995 – Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analysis*. R. T. Watson, M. C. Zinyowera, R. H. Moss and D. J. Dokken (eds) Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK, pp. 773-797.**
**9. Page, S. E., F. Siegert, J. O. Rieley, H. D. Boehm, A. Jaya and S. Limin (2002). 'The amount of carbon released from peat and forest fires in Indonesia during 1997'. *Nature* 420: 61-65.**

algal populations. But DMS is also associated with the formation of clouds, which may actually help reduce the amount of heat reaching the Earth's surface.[10]

### 3.2 Biodiversity as a Tool for Mitigation

**Currently, some 60 per cent of anthropogenic global greenhouse gas emissions originate from the generation and use of energy. Use of renewable energy sources provides an opportunity to reduce emissions from burning fossil fuels**

Effective biodiversity conservation and management can lead to higher levels of carbon sequestration and hence climate change mitigation. For example, forest management activities such as increasing rotation age, low intensity harvesting, reduced impact logging, leaving woody debris, harvesting which emulates natural disturbance regimes, avoiding fragmentation, provision of buffer zones and natural fire regimes, can simultaneously provide biodiversity and climate benefits. This is also true for certain agroforestry, revegetation, grassland management and agricultural practices such as recycling and use of organic materials. Integrated watershed management can conserve watershed biodiversity in addition to increasing water retention and availability in times of drought, decreasing the chance of flash floods and maintaining vegetation as a carbon sink.

Energy production is another key area where biodiversity conservation provides opportunities to help mitigate climate change. Currently, some 60 per cent of anthropogenic

**Box 3.3: Greenhouse Gas Mitigation as a Co-Benefit of the Brazilian Ethanol Programme**

The Brazilian ethanol programme was launched in 1975 and remains the world's largest commercial application of biomass for energy production and use. It demonstrates the technical feasibility of large-scale ethanol production from sugarcane and its use as fuel. Each year more than five million cars have been running on ethanol, with remaining cars running on gasohol (an ethanol gasoline mix). Additionally, sugar cane bagasse (a by-product of ethanol and sugar manufacture) is being increasingly used as an industrial fuel, with surplus electricity entering the national grid. The programme has saved foreign exchange due to surplus gasoline exports and reduced oil imports, and created 720,000 jobs directly and 200,000 more indirectly in rural areas. It has curbed city air pollution and has avoided six to 10 million tons of carbon emissions per year since 1980.

Source: Lèbre La Rovere, E. and A. Ribeiro Romeiro (2003). *The Development and Climate Project phase I: Country Study Brasil.* Centro Clima, COPPE, Federal University of Rio de Janeiro, Brazil.

**10. Sciare, J., N. Mihalopoulos and F. J. Dentener (2000). 'Inter-annual variability of atmospheric dimethylsulfide in the southern Indian Ocean'. *Journal of Geophysical Research* 105: 26,369-26,377.**

global greenhouse gas emissions originate from the generation and use of energy. Use of renewable energy sources provides an opportunity to reduce emissions from burning fossil fuels (Box 3.3).

## 4. BIODIVERSITY, CLIMATE CHANGE AND LIVELIHOODS

Poverty is a complex, multi-dimensional condition that goes beyond a simple lack of financial resources. Equally important are factors such as lack of education and skills, poor health, inadequate access to water and sanitation services, inadequate or risky asset base, poor quality or insecure housing, weak safety nets to ensure basic consumption can be maintained when income falls or crops fail, inadequate protection of poorer groups' rights, and lack of power and voice.[11] Vulnerability to shocks is thus a key component of poverty.

**Climate-induced changes to crop yields, ecosystem boundaries and species' ranges will dramatically affect many poor people's livelihoods. Those most vulnerable to climate change are the poorest groups in the poorest countries of the world**

Poor people generally depend more on ecosystem services and products for their livelihoods than wealthy people. The means by which a poor family gains an income and meets its basic needs are often met by multiple livelihood activities. For example, exploiting common property resources such as fish, grazing land or forests can provide income, food, medicine, tools, fuel, fodder, construction materials, and so on. Poor people are therefore severely affected when the environment is degraded or their access to it restricted. This link between poverty and the environment has been recognised for some time.[12]

As a result of this dependency, any impact that climate change has on natural systems threatens the livelihoods, food intake and health of poor people.[13] Climate change will mean that many semi-arid parts of the developing world will become even hotter and drier, with even less predictable rainfall. Climate-induced changes to crop yields,

11. Satterthwaite, D. (ed.) (2003). *The Millennium Development Goals and Local Processes: Hitting the Target or Missing the Point.* IIED, London.
12. Bass, S., H. Reid, D. Satterthwaite and P. Steele (2004). *Reducing Poverty and Sustaining the Environment: The Politics of Local Engagement.* Earthscan, London.
13. Smith, D. and J. Troni (2004). *Climate Change and Poverty: Making Development Resilient to Climate Change.* DFID, London.

ecosystem boundaries and species' ranges will dramatically affect many poor people's livelihoods. Those most vulnerable to climate change are the poorest groups in the poorest countries of the world. This is because they live in areas more prone to flooding, cyclones, droughts, and so on and because they have little capacity to adapt to such shocks. They are often heavily dependent on climate-sensitive sectors such as fisheries and agriculture, and the countries they live in have limited financial, institutional and human capacity to anticipate and respond to the direct and indirect impacts of climate change.[14]

Conservation of biodiversity and maintenance of ecosystem integrity may be a key objective towards improving the adaptive capacity of such groups to cope with climate change. Functionally diverse systems may be better able to adapt to climate change and climate variability than functionally impoverished systems. A larger gene pool will facilitate the emergence of genotypes that are better adapted to changed climatic conditions. As biodiversity is lost, options for change are diminished and human society becomes more vulnerable.

**Functionally diverse systems may be better able to adapt to climate change and climate variability than functionally impoverished systems. A larger gene pool will facilitate the emergence of genotypes that are better adapted to changed climatic conditions**

Poor people are particularly vulnerable to extreme weather events (Box 3.4). Over 96 per cent of disaster-related deaths in recent years have taken place in developing countries. Extreme weather events are increasing, and during 2001, 170 million people internationally were affected by disasters, 97 per cent of which were climate-related.[15] Women and children are particularly vulnerable. For example, when the 1991 cyclone hit Bangladesh, 90 per cent of victims were women and children. This was due to a number of factors including their capabilities in survival (e.g. swimming), and socio-cultural beliefs that prevented women with their children from congregating in public cyclone shelters.

14. Walter, J. and A. Simms (2002). *The End of Development? Global Warming, Disasters and the Great Reversal of Human Progress*. New Economics Foundation, London. Huq, S., A. Rahman, M. Konate, Y. Sokona and H. Reid (2003). *Mainstreaming Adaptation to Climate Change in Least Developed Countries (LDCs)*. IIED, London. Sperling, F. (2003). *Poverty and Climate Change: Reducing the Vulnerability of the Poor Through Adaptation*. World Bank, Washington DC.
15. Walter, J. (ed.) (2002). *World Disasters Report: Focus on Reducing Risk*. International Federation of Red Cross and Red Crescent Societies, Geneva.

**Box 3.4: The Ecological and Social Devastation of Hurricane Mitch**

In October 1998, Hurricane Mitch brought winds of over 180 km per hour and 127 cm of rain in only a week to Central America. Over 18,000 people were killed and thousands of homes, bridges, roads, water systems, crops and animals were destroyed. Hurricane Mitch impacted about 6.4 million people, with the poorest groups suffering the greatest losses. Among these groups, the most vulnerable were those living and farming on hillsides and near riverbanks. Unequal land tenure policies and skewed resource distribution mean that many of Central America's farmers own small plots of land on ecologically fragile, disaster-prone lands. With little access to credit, land titles and technical assistance, farmers have few incentives to invest in sustainable farming practices, and ranching, farming, burning and forest removal for timber have all contributed to removing protective vegetative cover. During Hurricane Mitch, heavy rainfall led to massive runoff on these degraded hillsides, which carried away tons of topsoil, rocks and vegetation. Debris-choked rivers also overflowed their banks causing extensive damage to human and natural riverside systems.

Farms using agro-ecological practices such as soil and water conservation, cover cropping, organic fertilisers, integrated pest management and reduced or zero grazing, were more resilient to erosion and runoff. They withstood Hurricane Mitch's impacts better than those farms using conventional farming methods. Damage from gullies and landslides was equally severe on both types of farm, perhaps because many gullies and landslides originated uphill or upstream on poorly managed degraded or deforested slopes. This demonstrates the importance of conserving entire hillsides and watershed ecosystems rather than just individual plots.

Source: World Neighbours (2000). *Reasons for Resiliency: Toward a Sustainable Recovery after Hurricane Mitch*. World Neighbours, Tegucigalpa, Honduras.

## 5. PRACTICAL WAYS TO PROVIDE BIODIVERSITY, CLIMATE CHANGE AND LIVELIHOOD BENEFITS

Classic top-down approaches to climate change equate to large infrastructure construction projects. Those designed to support adaptation to climate change are often associated with physical protection, for example large sea walls. Those designed to reduce global greenhouse gas emissions and thus mitigate climate change are often associated with large renewable energy schemes, such as hydropower. Such projects often have significant negative impacts on biodiversity and local livelihoods. For example, plans to build scores of dams with massive hydroelectricity generating potential on the Mekong River will affect the livelihoods of the 52 million people currently using river resources, many of whom live below the poverty line. Dam construction will prevent fish migration, and yet Mekong fish provide 40 – 60 per cent of the animal protein consumed by the population of the lower basin. The nine proposed mainstream dam projects alone would also displace 60,000 rural people.[16]

16. Abramovitz, J. N. (1996). *Imperiled Waters, Impoverished Future: The Decline of Freshwater Ecosystems.* World Watch Paper 128. Worldwatch Institute, Washington, D.C.

While big infrastructure projects can be effective, comparatively little attention has been paid to non-structural alternatives and to 'bottom-up' approaches rooted in existing community-based strategies for managing resources and reducing vulnerability to climatic shocks.[17]

Many of the carbon sequestration projects undertaken by companies and nations to mitigate their greenhouse gas emissions do not incorporate biodiversity issues. Even fewer incorporate livelihood and poverty issues as well. The Clean Development Mechanism (CDM), established under the Kyoto Protocol of the Climate Change Convention, aims to provide developed countries that have accepted targets for reducing greenhouse gas emissions with flexibility for achieving these targets, by allowing them to take credits from emissions reduction projects undertaken in developing nations. Projects are supposed to provide global benefits from carbon sequestration, but also sustainable development benefits to host developing countries.[18] Many projects pay little attention to these sustainable development benefits. However, one project generating electricity from biogas and bio-diesel in Brazil is attempting to provide livelihood, carbon and biodiversity benefits (Box 3.5).

**While big infrastructure projects can be effective, comparatively little attention has been paid to non-structural alternatives and to 'bottom-up' approaches rooted in existing community-based strategies for managing resources and reducing vulnerability to climatic shocks**

Some initiatives succeed in combining biodiversity, livelihood and climate change related benefits. Activities to build the resilience of communities to climate stresses ae continuing in Central America, where following Hurricane Mitch, the charity World Neighbours has been working to increase agro-ecological activities. This is helping vulnerable communities adapt to their changing environments as the incidence and severity of climate change-related disasters increases (Box 3.4). Similarly, since 1992, PASOLAC (Programa para la Agricultura Sostenible en las Laderas de América Central) has been helping communities in Nicaragua, Honduras and El Salvador to increase the agricultural productivity of their

17. Burton, I., J. Soussan and A. Hammill (2003). *Livelihoods and Climate Change: Combining Disaster Risk Reduction, Natural Resource Management and Climate Change Adaptation in a new Approach to the Reduction of Vulnerability and Poverty*. IISD, IUCN and SEI Boston.
18. Huq, S. and H. Reid (forthcoming) 'Benefit sharing under the clean development mechanism'. In D. Freestone and C. Streck *Making Kyoto Work: Legal Aspects of Implementing the Kyoto Protocol Mechanism*. Oxford University Press, Oxford

**Box 3.5: Electricity Generation from Biogas and Bio-diesel in Brazil**

Garbage is a huge problem in Rio de Janeiro, and a recent emissions inventory shows that the Jardim Gramacho Landfill at Duque de Caxias is the main source of greenhouse gas emissions (in the form of methane) emitted by the city. A new project at the Jardim Gramacho Landfill is converting this polluting open dumpsite into a sanitary landfill, and illustrating the potential for generating electricity from renewable energy sources. This project is one of several under the SouthSouthNorth Project, which seeks to help public and private stakeholders develop the necessary confidence for dealing effectively with the CDM.

Biogas, produced from the decomposition of organic solid wastes in landfills, and bio-diesel, produced from used vegetable (cooking) oils, drive a power generator providing partial energy self-sufficiency for landfill site operation. Remaining fuel needs will come from renewable sources. Technological refinements are still required, but the power generation process will convert methane into $CO_2$, thus reducing the greenhouse gas effect by a factor of 21. It is projected that the project will reduce emissions by an equivalent of 35,000 tons of $CO_2$ over a ten-year period. Income from the sale of this carbon will support the project operation.

Electricity generated by the plant is used to clean the water produced at the landfill site, such that only clean water is returned to Guanabara Bay nearby. This has led to the rehabilitation of local mangrove swamps and improvements in associated livelihood opportunities. Employment generation has also occurred through the selective collection of used vegetable oils. However, those who depend on picking through garbage to earn their living have expressed concerns that their livelihood will be threatened. Efforts to provide these people with alternative employment opportunities at recycling plants elsewhere have met with limited success, as people feel they would earn less (they can earn as much as twice the minimum wage picking through waste) and their quality of work would deteriorate (they currently see themselves as freelancers or small entrepreneurs, which would change with employment at a recycling plant). The provision of local social benefits for some low-income groups therefore remains a challenge.

Sources: Orford, M. (2004). *Climate Change and the Kyoto Protocol's Clean Development Mechanism.* ITDG Publishing, London.

hillsides through improved soil and water management. The programme is characterised by participatory demand driven approaches. Such hillsides support tropical forests, key freshwater reservoirs, and several important and diverse ecosystems. They also represent the economic base for the majority of the population in Central America (producing grains, coffee etc.) but are prone to soil and landscape degradation, problems exacerbated by climate change-induced droughts and floods.[19]

'Bottom-up' processes have also met with success in Bangladesh, through the Reducing Vulnerability to Climate Change (RVCC) Project and Vietnam, where the Vietnam National Chapter of the Red Cross has worked with local communities to rehabilitate mangroves (see Case Study 2).

**19. IISD (2003). *Livelihoods and Climate Change: Combining Disaster Risk Reduction, Natural Resources Management and Climate Change Adaptation to Reduce Vulnerability and Poverty*. IISD, SEI, Intercooperation. Information Paper 2, December 2003.**

## 6. MEETING THE MILLENNIUM DEVELOPMENT GOALS

Climate change is dealt with in MDG7 on ensuring environmental sustainability. One target set for reaching this goal to 'integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources'. Indicators for monitoring whether this target is met are as follows:

- Proportion of land area covered by forest
- Ratio of area protected to maintain biological diversity to surface area
- Energy use (kg oil equivalent) per $1 GDP (Purchasing Power Parity)
- Carbon dioxide emissions per capita and consumption of ozone-depleting Chlorofluorocarbons (Ozone Depleting Potential tons)
- Proportion of population using solid fuels

The focus on energy use and $CO_2$ emissions emphasises mitigating climate change and ignores the fact climate change is already a reality, and adaptation needs to be considered. This need for adaptation does not replace the need to mitigate climate change; both adaptation and mitigation are important parts of the solution.[20] The proportion of population using solid fuels is also a poor measure of air quality as it fails to distinguish between the dangers of indoor and external air pollution.

**The indicators relating to energy use and $CO_2$ emissions would be improved if they captured some measure of broader environmental and social benefits emerging from activities undertaken**

The forest indicator would be better if it captured some measure of goods and services coming from forests, such as carbon sequestration, soil protection, biodiversity enhancement and contributions to local livelihoods.[21] Likewise, the indicators relating to energy use and $CO_2$ emissions would be improved if they captured some measure of broader environmental and social benefits

20. Sperling (2003), *op.cit*
21. Roe, D. (2003). 'The Millennium Development Goals and natural resources management: reconciling sustainable livelihoods and resource conservation or fuelling a divide?' In D. Satterthwaite (ed.) *The Millennium Development Goals and Local Processes: Hitting the Target or Missing the Point*. pp. 55-72. IIED, London.

emerging from activities undertaken. If such considerations are taken into account, investment could shift towards projects with multiple livelihood, biodiversity and climate change benefits (or at least projects which do no harm in these additional contexts), as opposed to initiatives (such as large dams), which might meet one indicator, but which have significant negative impacts on ecosystem integrity, biodiversity, climate change mitigation or adaptation, and local livelihoods. Achieving the MDGs is already proving to be a challenge. Ensuring that any progress made towards meeting these targets will benefit the poor depends on the process undertaken.

## 7. THE WAY AHEAD: LINKING CLIMATE CHANGE, BIODIVERSITY CONSERVATION AND POVERTY REDUCTION

The role of local processes in addressing climate change, biodiversity conservation and poverty reduction is often overlooked – or undermined. The biodiversity conservation agenda has, for example, been driven by international priorities – such as preservation of rare and charismatic mammals. This approach has often superseded local values attached to biodiversity such as livelihood support or risk reduction in the face of climate shocks.[22] Likewise, much attention and funding, currently focuses on top-down strategic planning requirements (often stemming from the environmental conventions spawned at the UN Earth Summit in Rio in 1992) such as National Communications, National Adaptation Plans of Action, National Biodiversity Strategies and Action Plans, National Conservation Strategies, National Environmental Action Plans and Poverty Reduction Strategy Papers. Such initiatives typically challenge poor countries by placing considerable strain on already overloaded institutions with limited capacity.[23]

**The role of local processes in addressing climate change, biodiversity conservation and poverty reduction is often overlooked – or undermined**

**22. The relationship between local and global values is explored in detail in Chapter 5**
**23. Dalal-Clayton, B. (2003). 'The MDGs and sustainable development: the need for a strategic approach'. pp73-91 in D. Satterthwaite (ed.) *op.cit.***

**Disaster management plans drawn up to deal with climate-induced disasters could incorporate impacts on local ecosystems in addition to vulnerable human settlements. This would recognise the role that ecosystems play in local livelihoods as well as havens of biodiversity**

Supporting local solutions requires action at several levels. Globally, actions to reduce poverty and inequity will ultimately reduce vulnerability to climate change and may also reduce unsustainable natural resource use. Such actions include curbing the loss of income from trade barriers and subsidies paid to farmers in high income nations; improved market access for processed raw materials; external investment and untied aid (to support accountable local processes); debt relief; and a commitment in high-income nations to change consumption patterns and thus reduce greenhouse gas emissions.

Synergies between the Climate Change Convention and Convention on Biological Diversity need to be explored, alongside links with national development plans such as Poverty Reduction Strategy Papers.[24] This is not easy as the processes have separate constituencies, administration arrangements, negotiators and guiding scientific bodies.[25] Some feel encouraging countries to establish a single body to deal with their obligations under all international environmental agreements would be useful. For example, disaster management plans drawn up to deal with climate-induced disasters could incorporate impacts on local ecosystems in addition to vulnerable human settlements. This would recognise the role that ecosystems play in local livelihoods as well as havens of biodiversity.

Possible tools for integrating biodiversity, livelihood and climate change concerns include the ecosystem approach, which could incorporate climate concerns and environmental assessments which can be adapted to support broad uptake of environmental, social and development priorities. Measuring the value of environmental services to capture the true value of environmental goods and services is needed. Participatory

**24. CBD Ad Hoc Technical Expert Group on Biodiversity and Climate Change (2003). *Interlinkages Between Biological Diversity and Climate Change and Advice on the Integration of Biodiversity Considerations into the Implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and Its Kyoto Protocol.* Draft Report for Experts and Government Review.**
**25. Reid *et al.* (2004). *op.cit***

processes and an holistic approach incorporating all aspects of sustainable development should be promoted.[26]

Nationally, policies that benefit biodiversity, climate change adaptation and mitigation, and poverty reduction need promotion. In particular, development activities should integrate responses to climate risks and thereby minimise the impacts of climate change.[27] Development agencies, national governments and other stakeholders should internalise climate change into their work. However, many adaptation activities are located within the Ministries of Environment, which are traditionally relatively weak and have little influence over line Ministries (such as those responsible for agriculture or water management).

Good governance is very important, but inevitably requires contextualisation within the complexities of local and national political systems.[28] Stronger decentralised government can play an important role, but a well functioning national government with vision and accountability is also critical. Locally, actions that encourage fair and accountable local government, effective land tenure reform and common property resource management in ways that protect rights of poor groups are important.

**Capacity building activities should support local solutions and bottom-up processes accountable to low-income groups**

One key priority in the search for solutions is to build on the considerable body of knowledge already possessed by poor people. Adaptation activities in particular should take account of this knowledge because poor people have had to cope with climate variability for many years. Capacity building activities should support local solutions and bottom-up processes accountable to low-income groups. Rather than categorising poor people as beneficiaries of aid, support should be provided for them to prioritise their own efforts to reduce climate-related vulnerability through ecosystem management and restoration activities that sustain and diversify local livelihoods.

**26.** Reid (2003). ***op.cit***
**27.** Smith and Troni (2004). ***op.cit***
**28.** Bass ***et al.*** (2004). ***op.cit***