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BIODIVERSITY AND ENERGY

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ABSTRACT

This paper highlights the biodiversity and energy. Biodiversity impacting and biodiversity neutral stratigies for power generation are discussed.

Links between biodiversity and energy

Many forms of energy are the result of a service provided by ecosystems, now or laid down in the form of fossil fuels far in the past. Conversely, society's growing requirements for energy are resulting in significant changes in those same ecosystems, both in the search for energy sources, and as a result of energy use patterns. Given that energy is a fundamental requirement for supporting development in all economies, the challenge is to sustainably provide it without driving further loss of biodiversity. It is necessary to define the trade-offs required, and develops appropriate mitigation and adaptation strategies.

Demand for energy is projected to grow at least 53 per cent by 2030. Energy from biomass and waste is projected to supply about 10 per cent of global demand until 2030. However, this assumes that adequate fossil fuels will be available to address the majority of the increase in demand, and some have suggested this may not be realistic. Energy-related carbon dioxide emissions are expected to increase slightly faster than energy use by 2030.

Energy use has impacts at local, national and global levels. Pollution from burning fossil fuels, and the associated effects of acid rain have been a problem for European and North American forests, lakes and soils, although the impacts on biodiversity have not been as significant or widespread as cautioned in the Brundtland Commission report. While emission controls in Europe and North America led to a reversal of acidification trends, there is now a risk of acidification in other areas of the world, particularly Asia.

The impacts noted above are relatively localized and small in comparison to the potential impacts of climate change, which results largely from energy use. As a result of climate change, species ranges and behaviour are changing with consequences for human well-being, including changing patterns of human disease distribution, and increased opportunities for invasive alien species. Species most likely to be affected include those that already are rare or threatened, migratory species, polar species, genetically impoverished species, peripheral populations and specialized species, including those restricted to alpine areas and islands. Some amphibian species extinctions have already been linked with climate

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change, and a recent global study estimated that 15-37 per cent of regional endemic species could be committed to extinction by 2050.

Biodiversity-based energy sources include both traditional biomass and modern biofuels. Ecosystems provide relatively inexpensive and accessible sources of traditional biomass energy, and therefore have a vital role to play in supporting poor populations. If these resources are threatened, as is the case in some countries with extreme deforestation, poverty reduction will be an even greater challenge. Use of fuel wood can cause deforestation, but demand for fuel wood can also encourage tree planting, as occurs, for example, in Kenya, Mali and several other developing countries.

Climate change is also having impacts at ecosystem scales. By 2000, 27 per cent of the world's coral reefs had been degraded in part by increased water temperatures, with the largest single cause being the climate-related coral bleaching event of 1998. For some reefs recovery is already being reported. Mediterranean-type ecosystems found in the Mediterranean basin, California, Chile, South Africa and Western Australia are expected to be strongly affected by climate change.

Managing energy demand and biodiversity impacts

Few energy sources are completely biodiversity neutral, and energy choices need to be made with an understanding of the trade-offs involved in any specific situation, and the subsequent impacts on biodiversity and human well-being. Biodiversity management is emerging as a key tool for the mitigation of and adaptation to the impacts of climate change – from avoided deforestation to biodiversity offsets – while contributing to the conservation of a wide range of ecosystem services.

There are a number of management and policy responses to the increasing demand for energy and the impacts on biodiversity. One important response to the rising price of oil is increasing interest in other energy sources. Prime among these are biofuels, with several countries investing significant resources in this field. The world output of biofuels, assuming current practice and policy, is projected to increase almost fivefold, from 20 million tonnes of oil equivalent (Mtoe) in 2005 to 92 Mtoe in 2030. Biofuels, which are produced on 1 per cent of the world's arable land, support 1 per cent of road transport demand, but that is projected to increase to 4 per cent by 2030, with the biggest increases in United States and Europe. Without significant improvement in productivity of biofuel crops, along with similar progress in food crop agricultural productivity, achieving 100 per cent of transport fuel demand from biofuels is clearly impossible. In addition, large-scale biofuel production will also create vast areas of biodiversity-poor monocultures, replacing ecosystems such as low-productivity agricultural areas, which are currently of high biodiversity value.

Current actions to address the impacts of climate change can be both beneficial and harmful to biodiversity. For example, some carbon sequestration programmes, designed to mitigate impacts of greenhouse gases, can lead to adverse impacts on biodiversity through the establishment of monoculture forestry on areas of otherwise high biodiversity value. Avoiding deforestation, primarily through forest conservation projects, is an adaptation strategy that may be beneficial, with multiple benefits for climate change mitigation, forest biodiversity conservation, reducing desertification and enhancing livelihoods. It must be recognized that some "leakage" in the form of emissions resulting from those conservation efforts can occur .Climate change will also affect current biodiversity conservation strategies. For example, shifts from one climate zone to another could occur in about half of the world's protected areas, with the effects more pronounced in those at higher latitudes and altitudes. Some protected area boundaries will need to be flexible if they are to continue to achieve their conservation goals.

The impacts of energy production and use on biodiversity have been addressed as a by-product of several policy responses in the past few decades. Examples include Germany's effort to reduce subsidies in the energy and transport sectors, promoting increases in the proportion of organic farming and reducing nitrogen use in agriculture. However, responses have not been comprehensive, coordinated or universal. Commitments, including shared plans of action, have been made in various floras, but implementation has proved to be extremely challenging, due both to problems of securing required finance and lack of political will or vision.

CONCLUSION

There are also attempts to address this issue through impact management within the private sector, and especially in the energy industry. The private sector is increasingly accepting its responsibilities as a

Energy Sources and their impacts on biodiversity

Energy source *	Impacts on biodiversity	Subsequent impact on human well-being
Fossil fuels Crude oil	• Global climate change and associated disturbances, particularly Coal Natural gas when coupled with human population growth and accelerating rates of resource use, will bring losses in biological diversity. • Air pollution (including acid rain) has led to US$ damage to forests in southern China amounting to 14 billion/year. Losses from air pollution impacts on agriculture are also substantial, amounting to US$ 4.7 billion in Germany, US$ 2.7 billion in Poland and US$ 1.5 billion in Sweden. • The direct impact of oil spills on aquatic and marine ecosystems are widely reported. The most infamous case is the Exxon Valdez, which ran aground in 1989, spilling 37 000 tonnes of crude oil into Alaska's Prince William Sound. Impacts also come through the development of oil fields and their associated infrastructure & human activities in remote areas that are valuable for conserving biodiversity (such as Alaska's Article National Wildlife Refuge that may be threatened by proposed oil development).	• Changes in distribution of and loss of natural resources that support livelihoods. • Respiratory disease due to poor air quality.
Biomass Combustibles, renewables and waste	• Decreased amount of land available for food crops or other needs due to greatly expanded use of land to produce biofuels, such as sugar cane or fast-growing trees, resulting in possible natural habitat conversion to agriculture and intensification of formerly extensively developed or fallow land. • Can contribute chemical pollutants into the atmosphere that affect biodiversity. Burning crop residues as a fuel also removes essential soil nutrients, reducing soil organic matter and the water-holding capacity of the soil. • Intensively managing a biofuel plantation may require additional inputs of fossil fuel for machinery, fertilizers and pesticides, with subsequent fossil fuel related impacts. • Monoculture of biomass fuel plants can increase soil and water pollution from fertilizer and pesticide use, soil erosion and water run-off, with subsequent loss of biodiversity.	• Cardiovascular and respiratory disease from reduced indoor air quality, due to wood-burning stoves, especially among poor women and children.
Nuclear energy	• Water used to cool reactors is released to environment at significantly above ambient temperatures, and accentuates ecological impacts of climatic extremes, such as heat waves, on riverine fauna. • Produces relatively small amounts of greenhouse gases during construction. • Because of the potential risks posed by nuclear energy, some nuclear plants are surrounded by protected areas. For example, the Hanford Site occupies 145 000 ha in	• Health impacts of ionising radiation include deaths and diseases due to genetic damage (including cancersand reproductive abnormalities).

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	south eastern Washington State. It encompasses several protected areas and sites of long-term research, and provides an important sanctuary for plant and animal populations. • A nuclear accident would have grave implications for people and biodiversity.	
Hydroelectricity	• Building large dams leads to loss of forests, wildlife habitat and species populations, disruption of natural river cycles and the degradation of upstream catchment areas due to inundation of the reservoir area. • Dam reservoirs also emit greenhouse gases due to the rotting of vegetation and carbon inflows from the basin. ® On the positive side, some dam reservoirs provide productive fringing wetland ecosystems with fish and waterfowl habitat opportunities.	• Building large dams can result in displacement of people. • Alterations in availability of freshwater resources (both improved and declining, depending on the situation) for human use.
Alternative energy sources Geothermal Solar, wind, tidal and wave	• Ecosystem disruption in terms of desiccation, habitat losses at large wind farm sites and undersea noise pollution. • Tidal power plants may disrupt migratory patterns of fish, reduce feeding areas for waterflow, disrupt flows of suspended sediments and result in in various other changes at the ecosystem level. •Large photovoltaic farms compete for land with agriculture forestry and protected areas. •Use of toxic chemicals in the manufacture of solar energy cells presents a problem both during use and disposal. • Disposal of water and wastewater from geothermal plants may cause significant pollution of surface waters and groundwater supplies. • Rotors for wind and tidal power can cause some mortality for migratory species, both terrestrial and marine. • Strong visual impact of wind farms.	•Decreased species populations to provide basic materials of life. •Toxins released to the environment may cause public health problems. •Decreased economic value of lands near wind farms, due to strong visual impacts.

steward of the environment. It is collaborating with non-governmental organizations, through flora such as the Energy and Biodiversity Initiative, to better understand impacts and possible mitigation and adaptation strategies that make business sense. Beyond legislation and regulation, the use of payments for ecosystem services, as exemplified by the emerging carbon market, represents an innovative though somewhat controversial approach to addressing the impacts of energy use on the environment. Ensuring access to energy while maintaining biodiversity and vital ecosystem services will require an integrated multi-sectoral approach that includes:

- An ecosystem approach to management of biodiversity and natural resources that ensures inclusion of lessons learned in on-going management of natural resources affected by energy production and use;
- A major shift in environmental governance to incorporate policies and incentives promoting energy production and use that mainstreams action to address biodiversity concerns, especially with respect to climate change; and
- Increasing partnership with the private sector, including extractive industries and the financial sector, to promote energy programmes that internalize the full costs on biodiversity and livelihoods.