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The Economics of Global Environmental Change

INTERNATIONAL COOPERATION FOR SUSTAINABILITY

Edited by **Mario Cogoy** *and* **Karl W. Steininger**

NEW HORIZONS IN ENVIRONMENTAL ECONOMICS

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Contents

Figures

Tables

PART I

Overview

1. The Economics of Global Environmental Change: International Cooperation for Sustainability

Mario Cogoy and Karl W. Steininger

1. INTRODUCTION

Worldwide, substantial changes in environmental and social indicators have been observed over the most recent decades. For example, in a few generations, humankind has embarked upon the process of exhausting fossil fuel reserves that it took several hundred million years to generate. As a result the carbon dioxide concentration in the atmosphere has increased by more than 30 per cent since the beginning of the Industrial Revolution and that of methane has increased by 100 per cent (IPCC, 2001a). Nearly half the land surface has been transformed by direct human action so far, with significant consequences for biodiversity, nutrient cycling, soil structure and biology, and climate. More than one-fifth of terrestrial ecosystems have been converted into permanent croplands; most of the temperate, old-growth forest has been cut (GLP, 2005). In terms of another crucial resource, water, more than 50 per cent of all accessible freshwater is used directly or indirectly by humankind; our underground water resources are being depleted rapidly (GWSP, 2005).

Nevertheless, some 300 million people worldwide still live on less than US$1 a day, with the largest concentration occurring in Africa's poorest countries, where two-thirds of the population belong to this group, and nine out of ten people live on less than $2 a day (in purchasing-power terms in both cases). But the share of people in poverty has significantly declined since 1970. Even the absolute numbers have too, by some 400 million over the last three decades (using the poverty specification just mentioned). Within-country inequality has most likely gone up during recent decades, as has across-country inequality, at least on average. In 1960 the incomes of the richest 20 per cent were 11 times bigger than the incomes of the poorest 20 per cent (in terms of purchasing power), while they were 15 times bigger in 1997. Often the market exchange rates are used for this comparison, which do not take account of the lower cost of living in poor countries. The corresponding ratios are then 30 and 74. Yet, mainly due to two large and so

far poor countries having improved their situation substantially – primarily China, and to some degree India – when the country variance reported above is weighted by population, we find that recently inequality has been declining worldwide (Sala-i-Martin, 2002). Assuming India and China escape poverty, and that no similar escape can be triggered in Africa, worldwide inequality is likely to return to its long-term trend in future, and that is rising.

We may look at some further social information across countries, for example life expectancy and health data as indicators of well-being. The extremes range from a current (2006) more than 80 years of life expectancy in Japan or Switzerland to less than 40 years in Botswana, Lesotho, Swaziland, Zambia or Zimbabwe. In medical service we find one doctor for 170 people in Italy, while at the other extreme some 50 000 people in Chad or Eritrea are served by one doctor only.

Both issues, global environmental change and poverty, are clearly interdependent by their economic dimension. For example, there are substantial potential benefits of economic growth, especially for the poor and disadvantaged, but such growth in turn may destroy the very basis for long-term development, for example in terms of natural resource depletion, biodiversity loss or climate change.

In response to global environmental change and poverty challenges, sustainable development is broadly defined so as to encompass the needs both of the poor and of posterity. Sustainability is inherently transnational and depends for its materialization on international cooperation. Current activities in any one country may have concurrent impact on other countries or on the future options available in other countries or even worldwide. In the present volume we supply an analytical structure to aid understanding of such interlinkages and we draw specific conclusions on what international cooperation can achieve and how it can be triggered.

Sustainability itself has been defined as a state in which any of the following conditions (or any combination thereof) are met (Perman et al., 2003):

- utility or consumption of humankind is non-declining through time;
- resource management is undertaken so as to maintain production opportunities for the future;
- the natural capital stock is non-declining through time;
- resource management is undertaken so as to maintain a sustainable yield of resource services;
- minimum conditions of ecosystem stability and resilience through time are satisfied.

The term 'sustainable development', then, is consequently used to describe a path of development where criteria such as the above are fulfilled. In addition, some authors also use the term 'sustainable development' to refer to a path of development that – starting from any current non-sustainable state – brings us closer to a sustainable one. The latter definition, for example, includes a view of sustainable development which is necessarily process-oriented, with the primary focus being not on defining a sustainable state but on social capacity and consensus-building.

The international interlinkage in global environmental change (and in processes of consensus-building and cooperation) to bring us closer to a sustainable state may arise out of one of two transnational interlinkages, one environmental and one economic.

The international environmental interlinkage is given as emissions and natural resource use in general in any one country may affect a specific (group of other) country(ies), such as sulphur emissions from UK thermal power plants causing acid rain in Scandinavia (transboundary environmental impact). Impacts may even be global, such as the climate change consequences of greenhouse gas emissions or loss of biodiversity (see Eyckmans, Chapter 7, this volume and Friedl et al., Chapter 4, this volume).

The international economic interlinkage is at least as complex. The production and consumption systems of nations are connected: (1) by international trade in goods and intermediate products; and (2) by flows of production factors, most importantly capital (for example foreign direct investment), but also labour (for example migration). Thus, economic actions or economic policy undertaken in any one country often trigger consequences for the production and/or consumption system in other countries, resulting in social and environmental impacts in these countries (or beyond) (see van Beers, Chapter 2, this volume). For example, take a country implementing a fossil fuel tax which makes aluminium production within that country uncompetitive. Production shifts to another country, where different production technology and/or labour standards may be used. If the technology in the new production location is less energy efficient, we may observe an increase in global greenhouse gas emissions, basically as a consequence of the unilateral greenhouse policy implementation in the first country (that is, a very significant unilateral policy leakage effect).

The structure of this chapter, introductory to this book, is as follows. We start with an overview of important global environmental change issues and their basic economic analysis in section 2. Section 3 then focuses on the distribution of environmental and economic burdens of global environmental change, and compares these with the distribution of benefits stemming from the underlying production and consumption systems. In section 4 we analyse the international economic interlinkage with respect to its environmental

consequences. To supply more detailed guidance on the further chapters of this book analysing the economic dimensions in the specific fields of global environmental change and international options for cooperation, section 5 gives an overview of the issues, structure and conclusions of each of these chapters. The final section comments on general policy implications arising out of this book's analysis.

2. GLOBAL ENVIRONMENTAL CHANGE

> Humans are altering the ecology of the planet, the chemistry of the planet, and the climate of the planet; moreover, these changes are coupled in an exceedingly complex manner. Multiple, concurrent interactions among the biota and their environment, and between the environment and our social institutions may produce unpredictable results with cascading feedbacks. (Moore, 2001, p. 2)

It is not only the altering of our planet's cycles per se, but also the speed of this altering, which is of relevance. Moreover, with science progressing, repeatedly human induced changes to the earth system have been found to happen much faster than thought when initially researched. The ice sheet response to greenhouse warming, for example, was thought to be in the order of millennia according to the IPCC (2001a), and has since been found to be in the order of centuries (Hansen, 2005). In this case the new knowledge only emerged after shelf ice had broken away in response to initial warming, and science only thereafter could find out that the speed of the ice stream floating downward towards the ocean did react to the vanishing of shelf ice. This speed had been thought to be stable, but was found to have increased by a factor of eight as a response. The time frame of ice shield melting matters. For example, the total Greenland ice shield melting (2.8×10^{15} m^3) would imply a 7-metre sea level rise.

While climate change is one of the most prominent global change issues, it is by far not the only one:

> Human activities are significantly influencing Earth's environment in many ways in addition to greenhouse gas emissions and climate change. Anthropogenic changes to Earth's land surface, oceans, coasts and atmosphere and to biological diversity, the water cycle and biogeochemical cycles are clearly identifiable beyond natural variability. They are equal to some of the great forces of nature in their extent and impact. Many are accelerating. Global change is real and is happening now. (Moore et al., 2001, p. 1)

This volume focuses on the economics of these transformations, denoted as global environmental change. Economic analysis of the specific environmental issues in global environmental change rests on a toolbox developed for so-called 'global and transboundary environmental problems',