ECONOMICS OF SUSTAINABLE DEVELOPMENT: INTERNATIONAL PERSPECTIVES

Mario Cogoy  
*Department of Economics, University of Trieste, Italy*

Karl W. Steininger  
*Department of Economics, University of Graz, Austria*

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Summary

Sustainable development encompasses concern for the poor and for future posterity. In both cases it has significant international dimensions. Current activities in any one country may influence various other concurrent impacts or determine future options available in other countries or even worldwide. In the present collection, we supply an analytical structure to aid understanding of such interlinkages and we draw specific conclusions on the basis of economic analysis.

The international dimensions of sustainable development basically arise out of one of two transnational interlinkages. First, environmental media may mix across boundaries or even globally, and thus actions in any one location may have an impact on other cross-border locations via the environmental medium. Second, the economic systems of different nations are interlinked by flows in traded goods and services, and in production factors (migration, foreign direct investment). Also here, individual action and policy (not only environmental) usually has a transboundary or even global impact on livelihood in other locations (in economic, social and environmental terms).

In this article we first review some transboundary and global environmental problems, which are currently seen to be crucial. We then present an economic analysis of their structure and discuss the related policy measures which have so far been taken.

We then show that the responsibility for global environmental damages is shared differently among nations, and that the burden deriving from such damages (vulnerability) is unevenly distributed among countries, and among different social groups within countries.

For future development paths the following becomes evident. By assuming that all nations have the right to comparable levels of prosperity and social development, it does not follow that future paths of development must necessarily replicate the patterns of the past. Nevertheless evidence that industrialising nations are currently following paths of development similar to those of industrialised countries is available, at least for some environmentally sensitive areas. Thus, an intensification of future disputes on the distribution of scarce emission rights is likely to be the consequence.

Regarding issues arising out of the economic interlinkages among nations, we find that environmental and natural resource scarcity may render traditional paradigms of the benefits of economic liberalisation invalid in their pure form. When a policy shortcoming is present for any one trading partner (e.g. insufficiently stringent environmental policy, too low labor standards), we can no longer assert that an overall welfare gain is achieved from economic integration, at least not for all trading partners. Rather, opening up to trade in this case might ‘magnify’ the pre-existing welfare loss. There are also certain incentives at work which lead to less strict levels of regulation than would be optimal. In empirical terms, however, not many of these links have so far been proven noteworthy at significant levels, possibly a consequence of the fact that environmental regulation does not yet differ sufficiently across the major trading partner countries.
Finally, the relevant institutional issues arising from the international perspectives of sustainable development are discussed in some depth both here and in the more specific related articles. The diffusion of pollutants and of polluting technologies are expanding at a breathtaking pace. Unfortunately, the parallel growth of an international institutional framework, capable of coping with the long-run aspects of international pollution is rather slow. We analyze some of the difficulties in the construction of such a framework and offer suggestions on how they might be overcome.

Also in order to gain momentum for political initiatives in this direction, education in environmental problem-awareness and its promotion appear crucial. They are seen as a fundamental requirement enabling modern societies to respond to the international challenges of sustainability. This overview and the individual articles on this topic are an attempt to move in this direction.

1. Introduction

Worldwide, substantial changes in environmental and social indicators have been observed over recent decades. For example, in a few generations, humankind has embarked upon the process of exhausting fossil fuel reserves that has taken several hundred million years to generate. As a result the carbon dioxide concentration in the atmosphere has increased by more than 30% since the beginning of the Industrial Revolution and that of methane, has increased by 100%. Nearly half the land surface has been transformed by direct human endeavour so far, with significant consequences for biodiversity, nutrient cycling, soil structure, 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. In terms of another crucial resource—water—more than 50% of all accessible freshwater is used directly or indirectly by humankind; our underground water resources are being depleted rapidly.

Nevertheless, some 300 million people worldwide still live on less than 1 US$ a day, with the largest concentration occurring in Africa’s poorest countries, where two-thirds of the figure belong to this group, and nine out of ten people live on less than $2 a day (in terms of purchasing power 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 3 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% were 11 times larger than the incomes of the poorest 20% (in terms of purchasing power), while they were 15 times greater in 1997. Often the market exchange rates are used for this comparison, which do not take account of the lower cost of living in poorer countries. The corresponding ratios are then 30 and 74. Yet, mainly due to two particularly large and presently, poor countries who have 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. Assuming India and China escape poverty, and that no similar escape can be engineered in Africa, worldwide inequality is likely to return to its long-term trend in future, and that will be a rising trend.
We may look at some further social information across countries, e.g. life expectancy and health data as indicators of well-being. The extremes range from a current (2002) 80 years of life expectancy in Japan or Sweden to less than 40 years in Botswana, Mozambique or Malawi. With regard to medical services, 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. There are clearly significant 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 or climate change.

In response to such challenges, sustainable development is broadly defined to encompass the needs of both the poor and that of posterity. Significant international dimensions are implied in both cases. 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 contribution we supply an analytical structure to aid understanding of such interlinkages and we draw specific conclusions on the basis of economic analysis.

Sustainability itself has been defined as a state in which any of the following conditions (or any combination thereof) are met:

- 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, and/or
- 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 not on defining a sustainable state but on social capacity and consensus building (for a detailed discussion of sustainable development see Welfare Economics and Sustainable Development and Economics of Sustainable Development: Intertemporal Perspectives).

The international dimension of sustainable development may arise out of one of two transnational interlinkages: one environmental and one economic.
1 **International environmental interlinkage**: Emissions in any one country may effect a specific (group of other) country(ies), such as sulfur 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 (global environmental impact).

2 **International economic interlinkage**: The production and consumption systems of nations are connected (a) by international trade in goods and intermediate products and (b) by flows of production factors, most importantly capital (e.g. foreign direct investment), but also labor (e.g. migration). Thus, economic actions or economic policies 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). 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 labor 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 (i.e. a very significant unilateral policy leakage effect).

The structure of this paper is as follows. We start with an overview of important transboundary and global environmental issues and their basic economic analysis in section 2. Section 3 then focuses on the distribution of environmental and economic burdens of transboundary and global environmental problems, 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 articles analysing selected and specific subjects dealing with the topic of international perspectives of the economics of sustainable development, section 5 gives an overview of the issues, structure and conclusions of each of these articles. The final section summarizes the main conclusions.

2. Global and Transboundary Environmental Problems

2.1. Economic Analysis of Global and Transboundary Environmental Problems

Two main methods of analysis have normally been used to depict the structure of, and derive economic policy conclusions for, the problem of global and transboundary pollution: (a) optimization analysis and (b) game theory analysis.

2.1.1. Optimization analysis

This line of analysis is based on the construction of an objective function for each country under consideration (usually referred to as a national utility function). There are two ways of optimizing a single country’s behaviour. First, each country can set its environmental policy such as to maximize its own objective function only, assuming that the environmental policy in each of the other countries is given (fixed). This is known as non-cooperative optimization. Second, countries may seek to maximise the
collective overall benefit, and set their own policy while considering the potential damages of domestic pollution abroad. There will usually be benefits choosing collective optimization, and these can be shared among the countries, on the basis of negotiation (cooperative optimization).

This type of analysis shows the direction and magnitude of additional environmental policy necessary to cope with transboundary and global pollution. When comparing the resulting emission levels of non-cooperative and cooperative optimization, we can determine the amount by which an individual country’s emissions would need to be reduced to compensate for the impact of its domestic emissions on other countries. The baseline result is a quantification of the benefits of joint regulation and coordinated environmental policy. Furthermore, conclusions on the policy stringency level can be derived. For example, if the policy instrument is a pollution tax, the analysis indicates the amount by which a pollution tax correcting only for the intra-national pollution problem would need to be raised to guarantee the international overall best outcome (i.e. the international overall minimization of environmental damages and abatement costs). For one application of this method presented in some detail see *International Environmental Agreements and the Case of Global Warming*.

### 2.1.2. Game theory analysis

For many transboundary environmental problems the number of (relevant) actors (i.e. actors within the affected number of countries) is relatively small: i.e. governments of each country, the business sector and consumers (i.e. a representative firm and consumer for each country). Further, the consequences of one country’s decision significantly depend on all the other countries’ decisions. In this situation matters of strategic choice may become relevant. Such mutual dependency is analysed in game theory. For example, if any one country reduces greenhouse gas emissions, this might lead it to incur economic costs. However, the corresponding benefits arising from the country’s greenhouse gas reduction are dependent on both said country’s own emission reduction and on any consequent reductions in the other countries, especially those accounting for substantial emission shares.

Conversely, the benefits of one’s own greenhouse emission reduction accrue to all countries worldwide. If a country chooses not to reduce its own emissions, it will still obtain benefits from others doing so. There is thus an incentive to free-ride on global pollutant emission reduction.

The core characteristic of such decision problems is that in your own decision-making you do not know in advance how the other player(s) will decide. Each player can, however, seek to find out whether there is a best strategy for any of the players, including himself. To do so, the pay-offs for each player under each combination of their own choice/other’s choices needs to be determined (or estimated). Then, as in optimization analysis above, there are two basic approaches to the game. First, each player can seek to maximize his own benefit only, without cooperating with the other player(s) (non-cooperative game). Second, a joint best strategy can be sought (cooperative game). For the more complete exploration of the differences in these strategies see *International Cooperation to Resolve International Pollution Problems*.
One baseline result here is similar to the above, in that it indicates that cooperation may involve benefits. That is, each country can do at least as well from cooperation and subsequent sharing of the cooperation benefits as it can do with non-cooperative behaviour. Game theory analysis places particular emphasis on the decision and incentive structure upon which each country is acting. For example, it provides us with two of the main reasons why cooperation (and thus a collective benefit) often does not materialize:

- first, at the hierarchical level above nation states, there is no supranational institution with enough authority to impose a cooperative solution,
- second, in the absence of this supranational institution, a cooperative solution necessitates bargaining and negotiations between individual countries. To organize such a process successfully is all the more difficult and complex, (a) the more parties are involved, (b) the more diverse the weight of these parties are, (c) the more expected gains and losses differ, and (d) the larger the costs of bargaining relative to the overall and individual benefits of cooperation.

For an analysis of the obstacles to and potential for international cooperation in environmental issues, both theoretically and empirically, see *International Cooperation to Resolve International Pollution Problems*. On the specific issues surrounding one of the most crucial global environmental problems, global warming, see *International Environmental Agreements and the Case of Global Warming*.

In the remainder of this subsection we develop a general starting base by reviewing three of the more important global and transboundary environmental problems and their economic characteristics.

### 2.2. Stratospheric Ozone Depletion

Ozone builds up in the upper layers of the atmosphere in a chemical process involving oxygen molecules, various catalysts and ultraviolet light. There are many significant variations of ozone concentration in time, location and altitude which occur naturally. Humans also have an impact on the stratospheric ozone concentration in many ways. The dominant impact is ozone depletion triggered by chlorofluorocarbon (CFC) emissions. CFCs drift for years in the environment until they eventually reach the stratosphere, where intense UV solar radiation severs chlorines off the CFCs. These chlorines are able to catalytically break up ozone molecules (i.e. convert them into oxygen molecules). Acting as a catalyst, it is estimated that one chlorine atom can convert 100,000 molecules of ozone into oxygen before that chlorine becomes part of a less reactive compound, such as HCl, and eventually is precipitated out of the stratosphere by water vapor.

While stratospheric ozone depletion has been predicted since the early 1970s, the discovery of the so-called ozone-hole over Antarctica (a decline in ozone concentration of some 60%), reported in 1985, placed the issue high on the political agenda. Translated to one average number for the whole globe, the loss of stratospheric ozone by the year 2000 due to human impact has been about 5% of the levels existing in the late 1960s. A higher decrease is occurring in winter and spring, and towards the poles.
Stratospheric ozone absorbs ultraviolet (UV) radiation. A reduction in concentration thus exposes living organisms to higher doses of harmful UV radiation. For example, a 1% depletion in the ozone concentration is estimated to increase some types of skin cancers by more than 3%. Other potential impacts currently discussed include effects on the human immune system, genetic damage to crops, and other damage to plants and animals, with the decline triggered in marine plankton growth being particularly relevant as the latter represents an important element in many food chains. CFCs not only reduce stratospheric ozone, they also act as greenhouse gases, and contribute to global warming (more on this below).

Side by side with the international diplomatic efforts to agree on a reduction and phasing out of CFC production, it became evident that even unilateral reductions in CFCs—even from substantial levels—involve overwhelming net benefit to cost ratios, even for individual countries (see Table 1) The consumer benefits due to reduced UV radiation strongly exceed potential production and export losses. Thus, international cooperative action can be seen foremost as an indicator that the problem was acknowledged, and action by the then main CFC producers would have been almost certain to take place even without any international agreement. From the Vienna Convention in 1985, up to the Montreal Protocol in 1988 and, finally, to the London Amendments in 1990, it was ultimately agreed upon by the industrial world to phase out CFCs by 2000. Furthermore, financial support was made available for developing countries to assist them in replacing ozone-depleting substances. For developing countries the agreed freezing of CFC emissions by the year 2000, the 50% cut by 2005, and the complete phase-out by 2010, to date, seems to be generally on track. Nevertheless, the very long life of these molecules implies that the ozone layer will continue to be damaged for about another century, with even further decrease in protection from ultraviolet radiation over the next few decades.

<table>
<thead>
<tr>
<th>Level of control</th>
<th>Discounted benefits [$ bill.]</th>
<th>Discounted costs [$ bill.]</th>
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<tbody>
<tr>
<td>80% cut</td>
<td>3533</td>
<td>22</td>
</tr>
<tr>
<td>50% cut</td>
<td>3488</td>
<td>13</td>
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<tr>
<td>20% cut</td>
<td>3396</td>
<td>12</td>
</tr>
<tr>
<td>Freeze</td>
<td>3314</td>
<td>7</td>
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Table 1. Costs and benefits of CFC control estimated for the United States in 1989 by the EPA

2.3. Climate Change

Solar energy reaching our planet is to a large degree absorbed by land mass and the oceans and partially radiated back into the atmosphere as infrared radiation. This infrared radiation in turn is largely reflected back to the land mass and oceans by the so-called greenhouse gases in the atmosphere (e.g. carbon dioxide) and by water vapour. This natural greenhouse effect keeps the earth some 33 degrees Celsius warmer than it would otherwise be, a temperature giving rise to the complex interplay in current climate and to which current forms of life have adjusted. Human emissions of
greenhouse gases since the late eighteenth century have increased the concentration of these greenhouse gases in the atmosphere, and thus the warming effect. For the most important greenhouse gas, carbon dioxide, the pre-industrial atmospheric concentration of 275 parts per million (ppm) has increased to a current 380 ppm. As it is concentration that is relevant (i.e. a stock measure), emissions (i.e. a flow measure) would need to decline substantially to really reduce concentration—albeit this would happen only with some time lag. For example, in order to ultimately stabilize carbon dioxide concentration at 450 ppm, emissions would need to be reduced by some 90% by 2300 relative to current levels. Most people in fact would argue for larger reductions in the industrial North in order to allow the South to catch up.

The impacts of climate change are manifold and current knowledge is becoming increasingly available even on a regional scale. The Intergovernmental Panel on Climate Change (IPCC), formed under the auspices of the UN, reports regularly on findings in this area, and is the largest body to do so. The most recent (Third) IPCC Assessment Report states that “these changes in atmospheric composition are likely to alter temperatures, precipitation patterns, sea level, extreme events, and other aspects of climate on which the natural environment and human systems depend.” Following the structure of this report, climate change influences the hydrological cycle and water resources; ecosystems and their goods and services; coastal zones and marine ecosystems; human settlements, energy and industrial systems; and human health. For example, on climate extremes it is concluded that “vulnerability of human societies and natural systems to climate extremes is demonstrated by the damage, hardship, and death caused by events such as droughts, floods, heat waves, avalanches, and windstorms. While there are uncertainties attached to estimates of such changes, some extreme events are projected to increase in frequency and/or severity during the 21st century due to changes in the mean and/or variability of climate, so it can be expected that the severity of their impacts will also increase in concert with global warming.”

For more information concerning the empirical results of evaluations of economic costs and benefits with respect to climate change mitigation and adaptation, and their national differences, see International Environmental Agreements and the Case of Global Warming. One result is that the benefit to cost ratio for substantial unilateral emission reduction is significantly lower for greenhouse policy than it is for stratospheric ozone policy reviewed above. In many cases it is not certain whether the necessary significant reductions even result in benefit to cost ratios above 1 for the individual country, if they are undertaken unilaterally. International agreement and action would thus be much more important in this field, but due to the cost-benefit structure for individual countries international agreement is in fact much slower. The first broad international agreement, the United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992, calls for the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”. Binding quantitative emission reductions for signatories were agreed upon in the 1997 Kyoto Protocol. Here, an average target reduction of about 5% of the 1990 emission level for six greenhouse gases by 2008 to 2012 was set, and this was to take place basically in OECD countries and Eastern Europe. In the often cumbersome political process devised to achieve a framework of legal security thereafter, a set of political compromises was finally adopted in 2001 in the Bonn Agreement of the
Kyoto Protocol. Here, the greenhouse gas emission reduction objective—relative to Kyoto was again cut by half, and set at about 2 to 2.5% of the 1990 level by the end of the first decade of the twenty-first century. After ratification by the European Union and Japan in mid 2002, the Protocol still requires ratification by other major emitter countries for it to take effect.

2.4. Biodiversity Loss

Biological diversity refers to both the number of biological organisms in existence and their variability. It can be considered on different levels: at the level of the population (genetic diversity within the populations comprising a species), at the level of the species (number and diversity of distinct species in particular locations) and at the level of ecosystems. The currently ongoing rate of extinction is thought to be unprecedented in history. A further increase in this rate is expected in the future. For example, the United Nations Environment Programme assumes an expected overall loss in all biological species (of which most are still unknown to date) of between 1% and 10% in the next 25 years. Up to a quarter of tropical forest species may be lost in this time period. For higher animal species extinction rates are lower, yet half of all bird and mammal species could be lost within the next 200 to 500 years.

The importance of biodiversity again is manifold. For example, it facilitates ecosystem functions such as carbon cycling, soil fertility maintenance, climate and surface temperature regulation, and watershed flows. Of greatest long-term relevance is probably the genetic and evolutionary potential granted by biodiversity. A diverse gene pool can serve to protect against challenges not yet known. International action manifested itself in 1992 at the Earth Summit in Rio de Janeiro with the Convention on Biodiversity. Again, this document is largely a mere indication of future political will and of problem recognition, because—while being a binding agreement—it contained hardly any specific commitments from individual nations.

3. International Distribution of Environmental Burdens

The responsibility for global environmental damage is shared differently among nations, and the burden deriving from such damage is unevenly distributed among countries, and among different social groups within countries. Activities directed at redressing the environmental degradation and redirecting the socio-economic system towards a sustainable path therefore face a problem of equity: the effort of redressing global environmental impacts will have to be shared in different proportions among nations and among social groups within nations, depending on the extent to which they cause the problem, and on their degree of vulnerability. For these reasons, the politics of global sustainability is a more complex and challenging task, than the task of redressing local conflicts arising from the transboundary diffusion of pollution from local sources.

In the case of distributional problems deriving from local pollution sources (e.g. downstream pollution from an upstream source, or transboundary transfer of pollutants among countries in a well-defined geographic area) the conflicts arising among the actors involved can be adequately described in a well-defined framework and negotiations can help to implement a cooperative solution to the distributional conflicts.
involved. Global environmental impacts related to the use of our global commons tend to produce a much more complex pattern of conflicts and conflict dimensions, since the deterioration of basic resources (such as water, air, climate) has profound long-term effects on the future development of human societies, and the conflicts arising are influenced by attitudes and expectations of the parties involved concerning their future development. It is not surprising therefore, that issues related to the unequal distribution of costs and benefits from the use of the global commons have developed into conflicts over social justice, international equity, and the right of all nations to comparable levels of welfare and of socio-economic development.

3.1. Climate Change

Climatic changes (see also International Environmental Agreements and the Case of Global Warming) affect different countries in different ways, via changes in temperature, sea-level rise, and other climatic impacts. In the words of an IPCC Report: “Some nations are particularly vulnerable. Eight to ten million people live within one metre of high tide in each of the unprotected river deltas of Bangladesh, Egypt and Vietnam. Half a million people live in archipelagos and coral atoll nations that lie almost entirely within three metres of sea level, such as the Maldives, the Marshall Islands, Tuvalu, Kiribati and Tokelau. Other archipelagos and island nations in the Pacific, Indian Ocean and Caribbean could lose much of their beaches and arable lands, which would cause severe economic and social disruption.”

In a recent IPCC report vulnerability is assessed in great detail across regions. One conclusion of the report is: “Most less-developed regions are especially vulnerable because a large share of their economies are in climate-sensitive sectors and their adaptive capacity is low due to levels of human, financial, and natural resources, as well as limited institutional and technological capability.”

The responsibility for actual and past emissions of GHG is also unevenly distributed among countries. Regional CO₂ emission data from fossil-fuel burning, cement manufacture and gas flaring, published by the Carbon Dioxide Information Analysis Center (CDIAC) at the Oak Ridge National Laboratory, show that the group of developed countries (Western Europe, Germany, North-America, Oceania (including Japan), and Eastern Europe) were responsible for 60% of the emissions in 1998, while they accounted for only 21% of the world population (see Figure 1).
On a per-capita basis, emissions in North-America (5.3 t C) in 1998 were 17 times higher than per-capita emissions in Africa (0.3 t C). Emissions at a single point in time, however, only give a partial view of different responsibilities of countries, since the long term persistence of CO₂ in the atmosphere suggests that the historical time profile of emissions must be taken into account, if the historical role of countries in affecting the global commons is to be assessed (Brazil proposal, submitted in May 1997 to UNFCCC).

3.2. Local impacts of global problems

Not only are the impacts of emissions from fossil fuel burning unevenly distributed, the direct environmental impacts from fossil fuel extraction are too. Local pollution caused by prospecting and extraction activities have led, for example, in the Niger Delta, and in the Peruvian Amazonas, to conflicts between extraction companies and local communities. The patterns of such conflicts are rather complex, since more than two parties are usually involved: e.g. extraction companies, governments of the developing countries, and one or more local communities that may be affected by prospecting and extraction activities. Local communities may have views on development different to those of their governments, and may support conflict strategies that are at variance with the official politics of their governments. In addition, local communities may be severely affected not only by negative impacts from extractive activities, such as oil spills, but also from other influences related to fossil fuel extraction, such as, for instance, the diffusion of diseases, to which local populations may be particularly vulnerable, owing to their lack of immunity. Prospecting activities in the Camisea natural gas development area in Peru for example, are reported to have caused severe loss of life among the local Nahua population as a consequence of the diffusion of a whooping cough epidemic. This example shows that government development projects may contradict the legitimate interests of local populations, and that acceptable...
management of potential conflicts is only possible in a participatory framework, in which all stakeholders are adequately represented.

Such conflicts point to the complexity of distributional issues, arising from the global impacts of fossil fuel burning, since not only have nations profited differently from the use of the global commons, but also local communities within nations may have been affected differently. Equity requires therefore, that local communities take part in decisions concerning local environments and obtain an adequate share of the proceeds deriving from local projects.

3.3. Emission reductions and equity

If the global atmospheric commons have been so unevenly used in the past, and if the consequences of this use have been so unevenly distributed, the question naturally arises, as to how they will have to be used in the future. Although it is very easy to argue that equal per-capita emissions of GHG are not feasible in the very short run, it is also very difficult to dispute that some form of equitable distribution of future emissions will have to be agreed upon, if severe conflicts between developed and developing nations are to be avoided.

Of course, opinions may differ on what a design for an equitable use of the global commons might look like. Equal per-capita distribution of emission rights may appeal to some as a result of its straightforward simplicity. Others may argue, that equal per-capita distribution should be corrected for allowances to be granted to countries with particularly hot or particularly cold climates. A more radical view is that historical cumulative responsibility for climate change should be adopted as a criterion for allocating future emissions, and that countries that were responsible for more emissions in the past, should repay their “ecological debt” accumulated through their overuse of the atmospheric commons (a Brazilian proposal).

No doubt one can raise objections to all such brands of egalitarianism e.g. by saying that the past overuse of the atmospheric commons by industrialising countries not only benefited rich countries, since industrialisation not only implies the accumulation of physical capital and infrastructures in developed nations, but also the accumulation of knowledge and technology (i.e. of human capital), which can benefit, at least potentially, the whole of humankind. Even on this basis, however, credible programs of scientific and technological empowerment of developing nations should still be implemented by developed nations, as compensation for the past overuse of the global commons.

Not only is the type of egalitarian solution to be adopted subject to controversy, but also its timing, since, even if “equitable” access for all nations to the services of the global commons were agreed upon, the appropriate timing for convergence to such an “equitable” access would still be open to debate.

3.4. Western lifestyles
Assuming there is agreement on the principle that all nations have the right to comparable levels of prosperity and social development, it does not follow that future paths of development must necessarily replicate the patterns of the past. There is evidence, however, that industrialising nations do follow paths of development similar to those of industrialised countries, at least in some areas of high environmental sensitivity. An intensification of future disputes on the distribution of scarce rights of emission is therefore likely to be the consequence.

As far as motorization is concerned for example, projections estimated in an IEA study, indicate that the number of cars per 1000 inhabitants in developing countries will rise as a function of GDP per capita, similar to the pattern followed in past years in industrialised countries (see Figure 2).

![Figure 2. Car ownership and income level, selected countries](image)

Although motorization only represents one aspect of the western pattern of growth, this example shows that the real issue behind debates on the use of the atmospheric commons will increasingly coincide with the issue of a sustainable restructuring of developed economies, and the diffusion of sustainable patterns of development among developing nations.

### 3.5. Biodiversity

Another example of how generalised threats to the global environment can lead to political conflicts on distributional issues, and on the choice of development patterns, is the issue of biodiversity. The rapid loss of biodiversity is caused by a multiplicity of factors: economic overexploitation of fisheries, mangrove destruction, tourism, urban sprawl in biologically valuable areas, land degradation as a consequence of poverty and overpopulation, deforestation, dam projects, damage to coral reefs due to water pollution and temperature rise, etc. Threats to biodiversity are also enhanced by the generalised deterioration of the global commons, since global warming and increased
UV-radiation, as stated above (a consequence of ozone depletion), can put an additional stress on ecosystems.

The loss of biodiversity imposes two very different kinds of damage on human activities: on the one hand, it impairs the functioning of local ecosystems and damages in this way natural life support systems for the local population, on the other hand it impovershes the pool of genetic resources available for high-tech industrial use (pharmaceuticals, bioengineering, agrotechnology, etc.). Biodiversity loss affects, therefore, both the poor and the rich, but in very different ways, and the question arises, whether the interests of all parties can be harmonised in a satisfactory way. Given the difficulty of harmonising such different interests, it comes as no surprise, however, that conflicts on biodiversity issues between rich and poor continue to hold the stage, and that some critics feel that the interests of poor local communities are not sufficiently protected against economic exploitation by the rich.

Conflicts between rich and poor on the “equitable” shares of biodiversity use are difficult to resolve, since historical rights on biodiversity may be claimed on the ground that the richness of the genetic pool existing in the south is due to the sustainable and bio-protective practices of local indigenous communities in the past. For this reason, if one argues that the abundance of woman-and-man-made capital in the North is due to the “thriftiness” of past generations, and that the rights on the rents from such capital accrues therefore to their heirs, using the same argument one could conclude that local indigenous communities should become full recipients of the rents arising from biodiversity, as this was preserved by the ecological “thriftiness” of their ancestors.

The Convention on Biological Diversity, adopted at the 1992 Earth Summit in Rio, provides financial and technical instruments, such as the Global Environment Facility, which are designed to support the sharing of benefits from commercial biodiversity use. The Convention also explicitly recognises the dependence of indigenous and local communities on the use of local biological resources, and protects traditional knowledge applied to the use of these resources. Following these principles, the Convention on Biological Diversity reaffirms “that States have sovereign right over their own biological resources” (Preamble), and favours the transfer of technology making use of biological diversity to developing countries “under fair and most favourable terms” and in such a way, that is “consistent with the adequate and effective protection of intellectual property rights” (Art.16.2).

Under these circumstances, the protection of biological diversity is made compatible with the existence of a market with well defined property rights: such as rights to biological resources, and the intellectual property rights for technological developments based on such resources.

An example of an agreement based on a clear definition of property rights is the much quoted deal between a big pharmaceutical company, and a private organisation in Costa Rica, which is active in the field of biodiversity protection. Under this deal, the pharmaceutical firm is granted the use of samples of plants, insects and microorganisms collected in Costa Rica’s rich forest environment. The government of Costa Rica, and the private scientific organisation receive payments for the collection of samples, and,
more important, royalties on the commercialisation of the pharmaceutical products developed under the agreement. Payments to Costa Rica under this deal are earmarked for activities directed at biodiversity and environmental preservation.

The deal is a good example of how the clear definition of property rights induces the formation of a market for biodiversity. As on every market however, also on biodiversity markets, the more powerful party is likely to strike the better deal, and the more powerful party is the party controlling know-how, capital, technology, and intellectual property rights. The question is therefore, whether the growth of biodiversity markets can help developing countries to acquire appropriate technology of their own, and to establish themselves as equal partners in a process of development, benefiting their own population, and in particular the local communities, who are naturally interested in the protection and sustainable use of biological diversity.

3.6. The role of scientific institutions

The future dynamics of global environmental impacts are by their very nature complex, and characterized by a high degree of uncertainty. Projections and evaluations of alternative possible choices therefore require well-equipped, and adequately funded research institutions. Well-informed reports of research results in the media are also important, so that public awareness of the problems involved in distributional environmental conflicts may develop, and be employed to support solutions negotiated. It is therefore important, that developing countries are endowed with research and scientific institutions, which empower them to argue their case in the international political arena.

4. International Trade and Foreign Direct Investment

Following on from the above review of the international distribution of environmental services and burdens let us now move on to the international distribution of production and the resulting trade flows and foreign direct investment flows. The difference in endowments in natural resources across countries, in available technologies and skills, and even in preferences (the French and Australians, for example, tend to like different food) supplies an ample basis for gaining mutual benefits by trading goods, services, and production factors across countries. This is the basic premise of international trade analysis. For a so-called first-best world it shows that exchange among countries is necessarily to the benefit of both, otherwise by definition countries would not trade. We may compare this to an ecological system, in which the individual component can hardly live on its own, but relies upon exchange with other components of the ecosystem. The crucial questions that arise, especially in the long term, are concerned with the types of goods which one economic unit should exchange with another economic unit, as well as the volume of these trade flows. Exchange in the ‘wrong’ items or excessive exchange may deprive the country of its production base and thus may well erode the very basis of the economic systems upon which these trade flows depend. Such exchange may also conflict with one or more of the conditions for sustainable development indicated in the introduction to this article.
Several aspects of this basic question have been distinguished in the past, both in terms of analysis of the positive and normative state of affairs and in terms of policy analysis on how to foster sustainable development in an internationally economically interlinked world. We shall look at some of these crucial issues below.

4.1. The opening up to trade (economic integration) and its environmental implications

For a country that has its environmental and social policies well in place and at a sufficient level of stringency, allowing for exchange with trading partners (or lowering existing barriers to trade) unambiguously increases welfare. Basically a new division of labor takes effect, with production tending to shift to that country that has the lowest opportunity costs of production, thus producing an overall increase in available goods and services. However, in the presence of a policy shortcoming (e.g. no environmental policy in place, or too low labor standards), we find a welfare loss even when there is no international trade. The opening up to trade in such a situation will magnify this welfare loss. Looking at economic integration, we find that the net effect of the welfare gains from trade and the increased welfare loss from the policy failure may or may not be positive (see *International Trade, the Environment and Sustainable Development* for a more detailed analysis). It is no longer tenable to simply assert that there will be an overall welfare gain resulting from economic integration, at least not for all trading partners.

4.2. Environmental policy in an open economy

The introduction of a well founded environmental, natural resource, and social policy in order to avoid the trade magnification of policy shortcomings might be a solution. This, however, raises the question: how well is the introduction of increased policy stringency likely to succeed in the face of an internationally open competitive economic environment? In such a situation, governments may trade off the potential losses in production and employment against losses in environmental quality and go for the latter (a race-to-the-bottom in environmental quality may occur).

4.3. International regulation

Introducing regulation at the supra-national level may well avoid such a race to the bottom. This is particularly relevant for transboundary and global pollutants, where there is a clear incentive for such supra-national regulation (see *International Cooperation to Resolve International Pollution Problems*). Considering a country undertaking unilateral abatement of global pollutants, in addition to a potential competitive disadvantage in the economic arena, we also observe a leakage effect in the environmental domain, i.e. other countries potentially emitting more in a now less damaged world. This leakage effect may simply be due to other countries rationally deciding in their own self interest to emit more in what has in effect become a cleaner world, but it may also work via market effects (for unilateral greenhouse policy the lower demand for fossil fuels may reduce their price and thus induce other countries to consume (and emit) more). While, as is shown in *International Cooperation to Resolve International Pollution Problems*, international cooperation is often slow to arise for
transboundary and global pollutants, it will not be present at all for strictly local pollutants, which is why in this case the race-to-the-bottom argumentation only appears to be solvable by domestic effort.

4.4. The Environmental Kuznets Curve and international trade

In the preparation of the 1992 World Development Report on Development and the Environment an empirical relationship between economic per capita growth and environmental pollution per capita was emphasized, which indicated that for a range of pollutants their pollution levels increase at low income levels, but once a certain level of per capita income has been achieved, further growth lowers the pollution intensity. This relationship, known as the Environmental Kuznets Curve (EKC), has since been the focus of ample discussion and empirical analysis. If it holds, international trade, in fostering economic growth, may well contribute to environmental improvement. This rather extensive discussion has resulted in several empirical conclusions: first, the EKC relationship appears to be present primarily for local pollutants, while global pollutants (such as greenhouse gases) do not seem (yet?) to follow this pattern. Second, it has been concluded, that there is nothing automatic about this relationship, and thus growth policy cannot substitute for environmental policy itself. Third, it needs to be noted that even for those cases of pollutants where the EKC-relationship is valid, this is true on a per capita-basis, which—given population growth—does not necessarily translate to a decline in absolute emission levels (and, even less so, to a decline in pollutant stock levels).

4.5. International trade versus foreign direct investment

From the perspective of theoretical analysis, the conclusions concerning the impacts of environmental policy on international trade and foreign direct investment are very similar. Basically, international divergences in environmental policies will first trigger trade flow changes. If these divergences are strong enough and/or are expected to last for a sufficiently long period in time, a relocation of production (including foreign direct investment) may occur, feeding back on trade flow changes again. From a policy perspective, obviously, the two areas are different, with trade policy being negotiated within the World Trade Organisation (see International Trade, the Environment and Sustainable Development) and foreign direct investment policy being discussed in the Multilateral Agreement on Investment (so far without success).

For trade flows, and to some degree foreign direct investment, however, it is not only trade and investment policy in the narrow sense, but also the respective financing and insurance options available for such flows, that strongly determine whether and which trade and investment will occur from North to South. Industrial country officially guaranteed export financing and investment insurance (managed by the respective national export credit and investment insurance agencies) is used particularly to enable exports to the South and, more recently, to emerging markets. Such exports and investments regularly concern investment goods, which are crucial for projects with significant environmental and social implications (such as large hydropower or chemical industry investments). Acknowledging these impacts 70 nationally responsible export credit agencies in late 2001 gathered under the auspices of the United Nations
Environment Programme. UNEPs Executive director Klaus Töpfer summarised the effort:

“The financial services sector has the power to direct financial resources towards projects or companies that have demonstrated good environmental performance. A growing number of managers in the sector have become aware of the need to better evaluate the environmental risks associated with their decisions, as well as the market opportunities provided by sustainable development initiatives.”

A first (non-binding) code of conduct on environmental impact assessments for environmentally sensitive exports has been agreed upon, to which many national agencies are currently in the process of adjusting their practices to, mainly so in Europe.

4.5.1. Empirical findings

While there has been ample empirical analysis of both the impact of liberalized trade on the environment and of strict environmental policy on trade flows, most of these studies were not able to identify significant impacts. This may be due to the fact that in the past countries did not diverge too much in environmental policy, and that environmental control costs most often represent only a very small cost component. Both explanations need not hold in future. However, in some specific areas mutual dependence has been proven empirically, particularly with respect to the relocation reaction of footloose industries (industries that do not depend on specific local resources) in circumstances of economic liberalization where countries differ in the stringency of their environmental policies (see International Trade, the Environment and Sustainable Development).

5. Overview of Topic-Related Articles

The further in-depth discussion of international perspectives in the economics of sustainable development are provided in the five Articles within this Topic. We provide a short summary here.

5.1. International trade, the environment and sustainable development

The central focus of this article by Cees van Beers is the relationship between trade, environment and sustainable development. Four relationships are considered as important in this respect:

- The impact of international trade and trade policies on the existing state of environmental quality;
- The impact of the state of the environment on international trade;
- The impact of international trade on environmental policies;
- The impact of environmental policies on international trade.

In the first part of his article van Beers examines the impact of trade on economic welfare, without taking environmental issues into account. The workhorse of international trade, the Heckscher-Ohlin model or factor endowment approach, is explained. This is followed by a graphical exposition of welfare analysis in a partial equilibrium model. The conclusion is that international trade increases welfare, although this can change where
environmental externalities are introduced. Particularly where environmental externalities are large and not incorporated into prices by appropriate environmental policies, a country may export pollution-intensive commodities, when in fact its economic welfare would be maximized by importing such goods. The impact of the state of environmental quality on international trade is dealt with theoretically. Environmental services can be a production factor and therefore a source of comparative advantage and thus international trade. If a country is relatively well endowed with environmental resources, e.g. forests, its exports will to a large extent consist of environmentally intensive goods like timber.

The impact of environmental policy on international trade is currently a ‘hot’ issue. More stringent environmental policies increase production costs for pollution-intensive firms. This is in fact what environmental policies are all about. However, policy makers and businessmen fear that such firms can go bankrupt resulting in losses of employment. From the point of view of welfare economics the value of employment loss should be weighed against the value of a less polluted environment. More interesting is the suggestion that more stringent environmental policies negatively affect the international competitiveness of pollution-intensive firms, especially when other countries have relatively lax or even non-existent environmental policies. Empirical studies do not provide evidence in support of this argument. The Porter hypothesis, that relatively stringent environmental policies remove slack (‘low-hanging fruit’), stimulate firm innovation and thus result in improved competitiveness represents the opposite point of view. At the moment, however, there is insufficient empirical evidence to allow a definite judgment on this hypothesis.

Alternative economic approaches to the trade and environment issue come from ecological economists. They argue that GDP is not a good measure for economic welfare because environmental depreciation is not taken into account. Moreover, they argue that even if all countries in the world managed to consider internalization of environmental externalities, international trade would still provide an incentive for a race-to-the-bottom. This means that countries would loosen environmental regulations in order to remain competitive. In order to avoid such a race-to-the-bottom it is necessary—in this alternative view—to reduce trade flows by placing impediments on imports from countries that have less stringent or non-existent environmental policies.

Although environmental policies aim at correcting for market failures, many government policies introduce government failures such as environmentally damaging subsidies. These are aimed at achieving specific (often non-environmental) goals. Apart from failing to realize their primary aim they also contribute strongly to environmental damage. This issue is relatively new and thorough investigation is needed before the main question can be answered—how can such subsidies best be reduced or eliminated?

5.2. North-South trade, capital flows, and the environment

This article by Partha Sen discusses the relationship between environment and development. This relationship represents a major challenge for future generations, i.e. the need to avert potential conflict between two top-level imperatives, protecting the environment and raising the living standards of the poor. The basic reason for such potential conflict is that past development of the North has made lavish use of
environmental resource, and that ensuing environmental scarcity is likely to constrain the future development of the South. Elementary equity considerations suggest therefore, that the North and the South must cooperate in promoting a pattern of economic development, which is more in line with the environmental constraints of our age.

Sen also reviews trade and foreign direct investment as important vehicles for the distribution of environmental burdens between the North and the South. In particular, where property rights are inadequately defined a tendency to over-harvesting of environmental resources arises, and natural resources can be over-exploited, leading to extinction of species and irreversible destruction of natural habitats. This is often a major problem in the South.

The article further discusses foreign direct investment models. Mobile capital combines with absorptive capacities of the environment (a factor of production), and, if technology is similar across countries, capital-pollution ratios tend to equalize, and therefore capital moves to regions where less stringent environmental standards allow a more extensive diffusion of pollutants from productive activities. As the author shows, however, the empirical evidence on investment issues is not decisive, since other factors may blur the picture.

Similar conclusions can be drawn for trade patterns, since the pollution intensity of exports in some countries (e.g. Korea, Indonesia) seem to be related to specific aspects of these economies, which may not lend themselves to generalization.

Finally, the removal of agricultural subsidies on energy- and fertilizer-intensive processes in the North, would help develop labor intensive and more sustainable agricultural practices in the South.

5.3. International cooperation to resolve international pollution problems

This article by Michael Finus provides an overview of important results of the game theory literature on the formation and stability of international environmental agreements (IEAs) on transboundary pollution control. To provide insight into the method of analysis used the article first gives an informal introduction to coalition models.

Due to the lack of a supranational enforcement authority it is difficult in reality to implement first or second best solutions for international pollution problems. The article identifies three main obstacles. First, cooperation may not be profitable for all countries if participants to an IEA face different costs and benefits from abatement. Second, even if an IEA would be profitable for all participants, individual countries can gain from two types of free-rider incentives. The first type is to remain a non-signatory (non-participation) and the second type is to violate the spirit of an IEA (non-compliance). The reason for this is that nobody can be excluded from the public good, clean environment, which is provided by those countries that participate in IEA and comply with its terms. Paradoxically, under those conditions where cooperation would generate large global welfare gains, free-riding is particularly pronounced. Unfortunately, there
are no straightforward countermeasures to neutralize free-rider incentives. Since accession to an IEA is voluntary, only ‘carrots’ can be used to increase participation, and the provision of ‘carrots’ is itself subject to free-riding. In addition, ‘sticks’ cannot always be used to punish non-compliance since the threat of sanctions often lacks credibility. Thus, there is no universal instrument that can solve all problems. Therefore, a mix of instruments has to be used in order to narrow the gap between actual IEAs and first and second best solutions. Some of the most promising steps in this direction are discussed in this article. They include the following:

- Transfers may be used to provide developing countries and countries in transition with an incentive to join an IEA. If those countries do not fulfill their treaty obligations, a credible punishment is to suspend transfer payments for some time.
- Non-compliance of industrialized countries can be punished by other participants by them reducing abatement efforts and by enforcing the violator to increase its abatement efforts for some time. However, this punishment will only work if the violator accepts his additional duties. Therefore, punishment obligations must be flexible and the punished country must be rewarded with the prospect that cooperation is to be resumed soon.
- Governmental and non-governmental organizations should regularly publish the status of treaty ratification, the overall success of a treaty as well as the related compliance records and abatement obligations of individual countries. This puts environmentally conscious voters in a position to put pressure on their governments and encourages reputation effects.
- Cooperation on research and development may create economies of scale effects. This can reduce abatement costs and may thus encourage participation in IEAs.
- Abatement obligations may be embodied in national law making it more difficult for governments to violate the terms of IEAs.
- For regional environmental problems, issue linkage may be a successful strategy to balance asymmetries between countries in order to raise participation and compliance.
- For global environmental problems several regional agreements among relatively homogenous countries may be superior to a global agreement since the individual interests of participants can be better accounted for.
- Small IEAs may be superior to large IEAs since more ambitious abatement targets can be implemented and compliance can be better enforced. However, if leakage effects are strong, this relation may be reversed and initiators should strive for large participation.

5.4. International environmental agreements and the case of global warming

The article by Johan Eyckmans focuses on the issues of equity and international distribution of income and their crucial role in multilateral negotiations on environmental agreements. In the first part of his article he uses the maximization framework discussed above to illustrate the differences between the non-cooperative (or laissez-faire) outcome and socially desirable solutions for transboundary pollution problems. Within this framework, bargaining power interpretations of multilateral
agreements, such as the Kyoto agreement on greenhouse gas emissions can also be given. He shows that, if one cares about world income distribution, the traditional cost-efficient burden sharing need not be socially optimal. Further, the requirement to maintain current levels of living standards are shown to result in severe participation constraints for any international agreements and thus have an important impact on the set of achievable outcomes in social improvement.

In the second part of the article the 1992 UNFCCC and the 1997 Kyoto Protocol are interpreted in the light of the earlier theoretical model. Eyckmans explains many of the features of the actual burden-sharing agreement in terms of power or ethically inspired arguments.

His conclusions are foremost twofold. First, talking about equity in the distribution of emission reduction targets in an international environmental agreement is found to be misleading (i.e. a mirage of partial justice), if the starting position of unequal world income distribution in the background is neglected. Second, due to the lack of a world authority with sufficient coercive power, individual countries have strong veto power in international environmental agreements. A solution is only feasible if it is voluntarily acceptable for all its signatories. The fact that there exists for every country some reservation utility level that it might obtain using a credibly free-riding strategy, can be used to derive so called participation constraints, which matter a lot, and which should be included as constraints in the burden sharing negotiations. Analyzing recent climate negotiations, this is confirmed, as it can be seen that countries with strong bargaining power managed to negotiate relatively low emission reduction obligations whereas others, that felt that they could do better by not respecting the Protocol, simply left the room (the USA). Therefore for the negotiations on the burden-sharing in subsequent commitment periods of the Kyoto Protocol, the article sees the prime objective to be that of ensuring that participation constraints for voluntary commitment of the major emitters are satisfied first, and that equity considerations come second.

5.5. Environmental Conflicts and Regional Conflict Management

This article by Simon Mason and Kurt Spillmann discusses environmental scarcity as a potential source of violent conflicts. Environmental scarcity can lead to violent conflicts, if combined with other socio-economic factors. It is also possible, that the environmental origin of such conflicts becomes blurred, as conflicts develop, and that violent escalations make increasing use of ideological factors. In this way, other mechanisms of conflict definition, such as e.g. ethnicity divert attention from the environmental origin of the conflict. With reference to the work of M. Suliman, this phenomenon is termed by the authors, conflict inversion. Environmental problems can lead to direct open conflicts, but also create a secondary source of conflicts and social problems, as in the case of environmental refugees, whose number, as the authors report, can exceed the number of war refugees.

The authors report extensively on environmental conflict management, and list freshwater conflicts going back several decades. Some were successfully solved, others not. Third-party assisted negotiations seem to be more effective than self-managed
negotiations. Also, conflicts over the use of a resource are easier to solve than conflicts relating to its property, and the difference in power between parties plays a major role.

The authors apply their theoretical insights to a case-study of the Nile-Basin. The geographical power relations are very unequal in this area, since 86% of the flow of the Nile to Egypt originates from the Ethiopian highlands. Nevertheless, the example shows how cooperation patterns can develop, if the focus is shifted from the control of the resource (water) to its use (irrigation, hydropower).

Another interesting feature of this example is that cooperation can be significantly enhanced, if the real cause of the conflict, i.e. water use, is tackled directly—in this case by increasing the efficiency of irrigation systems and by reducing losses due to evaporation.

The positive role of international organizations is also underlined in the paper, since involved parties are often much too entrenched in conflicting positions, and are only able to move toward cooperation if a third party assists them. The paper shows that there are good opportunities for successful intervention of the international community in environmental conflicts, and that past experience serves as an important aid in improving the chances of conflict mitigation in the future.

6. Conclusions

The above Articles describe in great detail some of the challenges surrounding the issue of international aspects of sustainability policy. Sustainability is an international challenge, because emissions of pollutants and sources of pollution tend to diffuse across international borders, and also because local environmental damage often has international implications.

Ozone depletion and global warming have confronted the international community with the problem of controlling pollutants. These are potentially harmful for everybody, irrespective of one’s distance from the source of emission. Pollution sources also tend to diffuse internationally with the diffusion of technology. Although air pollution in Mexico City for example does not affect the lungs of an inhabitant of Paris, the latter is nevertheless affected by an analogous type of source, namely traffic emissions, since transport technology, based on private cars with internal combustion engines has become the globally dominant technology in transportation. Even local damage can have worldwide implications, as in the case of species extinction due to local pollution, since the loss of local biodiversity represents a loss in terms of the biological heritage of mankind.

The diffusion of pollutants and of polluting technologies is expanding apace. Unfortunately, the parallel growth of an international institutional framework, capable of coping with the long-run aspects of international pollution is rather slow, and some of the difficulties in the construction of such a framework are analyzed in several of the contributions in this Topic.
It needs to be added however, that the construction of international institutions capable of dealing with global issues is not only a technical, but also a political task. Unfortunately, for the majority of nations, international sustainability policy does not rank very highly on the political agenda, and many do not have a clear perception of the negative effects on everyday life resulting from a lack of concerted action in this area. Education in environmental problem awareness needs to be promoted, and must be recognized as a fundamental requirement in enabling modern societies to respond to the international challenges of sustainability.

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and detailed introduction to the economics of sustainable development, including separate chapters on international environmental problems, sustainability concepts, welfare economics, and ethics.]


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Biographical Sketches

Mario Cogoy studied philosophy, sociology, and economics at the Universities of Pisa, Freiburg, and Frankfurt. Previously Professor for Sociology at the University of Frankfurt. Since 1988 Professor for International Economics at the University of Trieste. Visiting Professor in Leuven and Graz. Research activities for ENEA (Rome) on rational energy use and energy conservation. Research interests in Environmental and Resource Economics, in the Economics of Consumption and in Materials Flow Analysis.

Karl Steininger received his education in Economics and Computer Science at the University of Vienna and UC Berkeley. In research he specialized in environmental, and ecological economics, and in international trade. Since 1999 he has been Associate Professor of Economics at the University of Graz, Austria. Further he is a member of the Austrian National Global Change Committee and chairs the Human Dimensions Programme for Austria. He is a lecturer at the Vienna based University of Life Sciences. Previously he held positions in the World Bank (Environment Department) and at the University of Trieste, Italy (Guest Professor on Trade and Environment).