



Climate Change and Sustainable Development

**New Challenges for
Poverty Reduction**

Edited by M.A. Mohamed Salih

Climate Change and Sustainable Development

Liber Amicorum in Honour of J.B. (Hans) Opschoor

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New Challenges for Poverty Reduction

Edited by

M.A. Mohamed Salih

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Contents

<i>List of figures</i>	vii
<i>List of tables and box</i>	viii
<i>List of contributors</i>	ix
<i>Foreword</i> Jacqueline Cramer, The Netherlands Minister for Spatial Planning and the Environment	xvii
<i>Preface</i> Louk Box, Rector, Institute of Social Studies, The Netherlands	xix
<i>List of acronyms and abbreviations</i>	xxii
Introduction	1
<i>M.A. Mohamed Salih</i>	
1. Polycentric systems as one approach to solving collective- action problems	17
<i>Elinor Ostrom</i>	
2. An ecosystems services approach: Income, inequality and poverty	36
<i>Kerry Turner and Brendan Fisher</i>	
3. Ecospace, humanspace and climate change	47
<i>Ton Dietz</i>	
4. After us, the deluge? The position of future generations of humankind in international environmental law	59
<i>Nico Schrijver</i>	
5. A child rights perspective on climate change	79
<i>Karin Arts</i>	
6. Climate change and development (cooperation)	94
<i>Joyeeta Gupta</i>	
7. Environmental security, politics and markets	109
<i>Bas de Gaay Fortman</i>	
8. Humans are the measure of all things: Resource conflicts versus cooperation	126
<i>Syed Mansoob Murshed</i>	
9. From climate refugees to climate conflict: Who is taking the heat for global warming?	142
<i>Betsy Hartmann</i>	

10.	Rural poverty, cotton production and environmental degradation in Central Eurasia <i>Max Spoor</i>	156
11.	Spatializing development and environmental discourses: The case of sustainable development and globalization <i>Michael Bernard Kwesi Darkoh and Meleckidzedeck Khayesi</i>	179
12.	Digital dematerialization: Economic mechanisms behind the net impact of ICT on materials use <i>Jeroen C.J.M. van den Bergh, Harmen Verbruggen and Vincent G.M. Linderhof</i>	192
13.	Ecological cities, illustrated by Chinese examples <i>Meine Pieter van Dijk</i>	214
14.	Green or mean: Is biofuel production undermining food security? <i>Rob Vos</i>	233
	<i>Appendix</i>	251
	<i>Bibliography</i>	255
	<i>Index</i>	303

Figures

2.1	The value of the world exports, gross world product and USD 2/ day poverty line as indices (1990 = 100)	39
2.2	The mean incomes of the poorest 60 per cent of countries and the richest 10 per cent for the years 1820 and 1992	41
2.3	A simplified ESapp Framework starting at understanding changes in the physical environment through to post-policy appraisal	46
7.1	Environmental security strategies of two countries A and B	113
7.2	Achieving the sustainable energy goal	124
10.1	Poverty and vulnerability rates	158
10.2	Rural and national poverty (2003)	159
10.3	House connections to piped water (2002)	162
10.4	Under-5 mortality rate (1990–2003)	163
10.5	Child poverty (USD <2.15)	165
10.6a	Real GDP (1989–2006)	166
10.6b	Real GDP (1989–2006)	166
10.7	Spatial differences in poverty incidence (1999–2003)	167
12.1	Micro level impact of ICT on materials use	209
13.1	A picture of the water cycle, showing where costs and revenues can be expected	218
13.2	Water recycling in the Taiyue-Jinhe project	228
13.3	The wetland	229
14.1	Nominal and real world market price of agricultural food products	234
14.2	Fuel ethanol prices in Brazil, United States and Europe and international crude oil price, 2002–2007	237

Tables and box

TABLES

6.1	Changing discourses in policy arenas	105
6.2	Major aid uses by individual DAC donors	106
8.1	Conflict years, growth, polity and economic typology in selected countries	138
10.1	Poverty incidence in the USSR	160
10.2	Agrarian profile of CEA countries (2004)	161
10.3	Malnourishment in Central Eurasia, 1993–2004 (%)	163
10.4	Stunting (chronic malnutrition), 2000 (%)	164
10.5	Population affected by water and air pollution in Uzbekistan (1998)	176
12.1	Typologies of ICT in the literature	195
12.2	Summary of the factor X debate	207
12.3	Typology of indirect impacts of ICT on material use	210
12.4	Economic analysis of ICT impacts on dematerialization	211
13.1	Space distribution in the considered housing project	227
13.2	Information on the wastewater treatment plant	228
13.3	Investment funding distribution (million yuan)	229
14.1	Global biofuels production by country, 2007	236
14.2	Most rural poor are not net sellers of tradable food staples	243
14.3	Impact on global poverty of surge in agricultural commodity prices	246

BOX

13.1	Research under Switch by working package 6.4	219
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Foreword

Sustainable development, climate change and poverty are urgent tasks requiring efforts that span countries, regions and communities. In this interdependent world, a shared vision and common effort are vital to sustaining the life support system that humanity relies on for its water, clean air, energy, food and raw materials.

Since creating a sustainable world begins at home, the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM), which I am honoured to lead, works to balance the needs of society with preserving the environment for present and future generations. In The Netherlands, we work closely with many partners as we pursue the holy grail of sustainability: other ministries, local and regional authorities, civil society, businesses and interest groups, as well as other national governments. Dutch environmental policy and practice are integral parts of the global sustainability effort. We do not merely pay lip service to international treaties, conventions and laws; we *implement* them. Our vision and our promise to work for a liveable environment underpins our belief in diversity and social justice; in freedom with responsibility: giving citizens the freedom to make decisions in a socially responsible way; and in managing the living environment in a manner that guarantees its preservation for future generations.

It is difficult, if not impossible, to formulate and implement sustainability policy without first understanding the dynamic relationships between nature, society, economics and technology; research also plays a pivotal role in this regard. In my capacity as educator, researcher and policy advisor, I have come to know Professor Hans Opschoor as a man of true dedication and great personal integrity. He shares our common vision of improving and sustaining the environment and quality of life not only for the people of The Netherlands but also for the whole world.

In both academia and policymaking, Professor Opschoor has long been a world class contributor to sustainable development and environmental economics. In fact, I would go so far as to call him an academic environmental activist, fully committed to the ethos and values of sustainability. The contributors to this volume have collaborated or copublished with Professor Opschoor on sustainable development and environmental and resource economics, or served with him in advisory committees and research boards or on the editorial staff of globally renowned journals.

Although not all the contributors directly reference Professor Opschoor's work, this volume contains pieces by academics at the cutting edge of sustainability and sustainable development research and addresses five major themes:

1. principles and practice of resource/environmental economics and sustainable development;
2. globalization, liberalization, policy and politics of sustainable development in developing countries;
3. structural socioeconomic change, growth and dematerialization;
4. national and international economic instruments for climate change policy;
5. market forces, institutions and environmental degradation.

The majority of subthemes and chapters articulate the dynamic relationship between two central global concerns: poverty and climate change. If ignored, the relationship between the two will have unprecedented impact, undermining the welfare of both present and future generations of the world's most vulnerable citizens. This is one of the reasons I am pleased to have been able to contribute to this endeavour, both in a personal capacity and as someone who understands the extent of Professor Hans Opschoor's contribution to the science of sustainability. The dedication of this book to his work is a fitting and respectful tribute.

Jacqueline Cramer
Minister for Spatial Planning and the Environment
The Netherlands
September 2008

Preface

How do we make the climate change? We now know so much about climate change that even the staunchest sceptics have had to acknowledge that it does change; that the change is in all likelihood largely manmade and that the changes move faster than foreseen.

Yet how did the climate change about climate-change? How did those who warned about the dangers of climate change convince public opinion that this needed to be a prime concern? How did political parties respond to the need for setting public priorities differently? How did religious leaders come to include the notion in their moral set of values? How did intellectuals convince academics that their research priorities needed urgent review? How did academics convince the upcoming generation that sustainable development was more than just another fad, particularly since it concerned that very same generation's life chances?

Hans Opschoor's professional life touches each of the foregoing questions, from his doctoral dissertation on *The Economic Valuation of Environmental Pollution* (Amsterdam, 1971) until the granting of the Nobel Peace Prize to the Intergovernmental Panel on Climate Change (IPCC) in which he participated (Oslo, 2007). After 1987, Opschoor was committed to applying economic analysis to environmental issues in the context of sustainable development; first and foremost as an academic, but as I will argue, just as much as a committed social democrat working in the Dutch Labour party to change political priorities. Opschoor is also the concerned (post-) Christian ecumenicalist, contributing to the reformulation of moral priorities. He is the intellectual, convincing fellow members of The Netherlands Royal Academy of Arts and Sciences of the need to take a new look at climate change. All the while, working as a teacher, translating research results for the next generation of national and international students, be they in The Netherlands, Botswana or China. Last but not least, he practises what he preaches on the Board of Royal Haskoning, a company engaged in sustainable development.

In a way, Opschoor's academic career between 1971 and 2009 coincides with the sea change associated with the original benign neglect of the 1970s, until the conversion of climate change negationists some 40 years later. Opschoor's biography reads like a case study in 'making climate change' as he sought to change public perceptions, problem formulations

and political priority setting, for it took a concerted effort spanning very different realms of life to make that change.

Hans Opschoor first became aware of the limits to industrial growth as a research assistant in 1966 to Prof. Harm Booij at the then Rotterdam School of Economics, and soon became concerned with welfare theory and health economics. By 1971, he had moved to the Institute for Environmental Studies at the Vrije Universiteit van Amsterdam, where he stayed until 1978, when he left to go to Botswana. During his three-year stay there, he became acquainted with African environmental and rural development realities; at the same time, he got the taste for international education. His appointment as Director of the Institute for Environmental Studies brought him back to Amsterdam for eight years. In 1990, he took up the prestigious post as Chairman of the Netherlands Council for Environment and Nature Research through which he came into close contact with politicians and policymakers. In 1996, his love for international education brought him to the position of Rector at the Institute of Social Studies in The Hague, where he revamped the research programme and remained involved in teaching and research. In 1998, he became a member of the prestigious Netherlands Royal Academy of Arts and Sciences, which allowed him to engage fellow academics on the urgency of environmental research and policymaking. As an Honorary Professor of the Chinese Academy of Sciences, and at Nanjing University, Opschoor formed a link between European and Asian academics.

In The Netherlands, Hans Opschoor was, between 2002 and 2007, chair of The Netherlands Research School for Resource Studies and Development (CERES). He saw the importance of an international agency for doctoral training, for research coordination and for stimulating a more active science–policy–society interface. He made the Institute for Social Studies into a core member of CERES and supported attempts to develop a valuation tool for assessing quantity and quality of scientific production.

His academic work resulted in (contributions to) 13 books and more than 175 scientific articles. Some of these, such as the ones on *GNP and Sustainable Income Measures* and *Chain Management in Environmental Policy* have received wide academic acclaim and are cited in this volume as well. Still his intellectual interests are much broader. They include essays on traffic noise; capacity development; social justice; knowledge sharing; biodiversity; economic, social and cultural rights; North–South research cooperation; the ecological footprint; ecumenism and ecology; disarmament; and, of course, the intricacies of the Botswana range cattle system. See appendix for a sample of Hans' many publications on sustainable development and climate change.

Yet, Hans Opschoor is not just the successful academic; he is a public intellectual who engages in debate, who raises his voice in passionate disagreement and who carefully tests a moral stance against his commitment to Christian values and social-democratic principles of equity and justice. If his friends have prepared this *Liber Amicorum* for him, it is in recognition of his work in Rio de Janeiro and in Johannesburg, for his contributions to international peace and justice movements and for his inspiring lectures as a teacher and committed colleague.

How do we make change happen? Only by continued engagement. Through 40 years of professional and personal commitment to environmental economics, Hans Opschoor contributed to changes in public opinion from benign neglect to general concern. He is one of those thousands of IPCC members honoured with the Nobel Peace Prize. He will remain the respected public intellectual who is not swayed by new ideas, but who generates them. His friends all over the world and at the Institute of Social Studies prepared this volume for him as another contribution to making climate change.

Louk Box
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Acronyms and abbreviations

AIJ	Activities Implemented Jointly
AMIS	Agency-Managed Irrigation Systems
ASEAN	Association of Southeast Asian Nations
B2B	Business-To-Business
B2C	Business-To-Consumer
BOT	Build, Operate And Transfer
BTL	Biomass-To-Liquid
C2C	Consumer-To-Consumer
CAM	Computer Aided Manufacturing
CBS	Central Bureau For Statistics
CDM	Clean Development Mechanism
CEA	Central Eurasia
CERES	The Netherlands Research School for Resource Studies and Development
CERs	Certified Emission Reductions
CFP	Common Fisheries Policy
CIM	Computer Integrated Manufacturing
CIS	Commonwealth of Independent States
CNC	Computer Numerical Control
CRC	United Nations Convention on the Rights of the Child
CSGA	Consortium for Self-Governance in Africa
CVM	Contingent Valuation Methods
DHS	Demographic and Health Surveys
DNC	Direct Numerical Control
DOE	Designated Operational Entity
DRE	EU Directive on Renewable Energy
EKC	Environmental Kuznets Curve
ESapp	Ecosystem Approach
ECOSOC	Economic and Social Council of the United Nations
EU	European Union
EU-ACP	European Union and the African, Caribbean and Pacific states
FCCC	United Nations Framework Convention on Climate Change
FMIS	Farmer-Managed Irrigation Systems

FMS	Flexible Manufacturing Systems
GAO	Gross Agricultural Output
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GNI	Gross National Income
GPS	Global Positioning System
GSP	Generalized System of Preferences
GWP	Gross World Product
HDI	Human Development Indicators
HDR	Human Development Report
HVA	High Value Agriculture
ICE	Immigration And Customs Enforcement
ICJ	International Court Of Justice
ICSU	International Council of Scientific Union
ICT	Information and Communication Technology
IFPRI	International Food Policy Research Institute
IFRI	International Forestry Resources And Institutions
ITQ	Individual Transferable Quota
IPCC	Intergovernmental Panel On Climate Change
ISIC	Industrial Standard Industrial Classification
ITQ	Individual Transferable Quota
IUWM	Integrated Urban Water Management
KNMI	Royal Netherlands Meteorological Institute (Koninklijk Nederlands Meteorologisch Instituut in Dutch).
LCA	Life Cycle Analysis
MaGW	Social and Behavioral Science Council (Maatschappijen Gedragwetenschappen in Dutch)
MBR	Membrane Bio-Reactor
MDGs	Millennium Development Goals
M-P chain	Material-Product Chain
NEAP	National Environmental Action Plan
NGETs	New Generation Environmental Technologies
NIIS	Nepal Irrigation Institutions And Systems Database
NOW	Netherland Organization For Science
ODA	Official Development Assistance
OECD	Organization For Economic Cooperation And Development
PPP	Purchasing Power Parity
PES	Payments For Ecosystem Services

RDS-TMC	Radio Data Signal–Traffic Message Channel
RIVM	The Netherlands National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu, in Dutch).
SEPA	State Environmental Protection Agency
SMEs	Small and Medium Enterprises
SMSAs	Standard Metropolitan Statistical Areas
SPA	Statistical Classification Of Products By Activity
Switch	Switch Sustainable Water Improves Tomorrow's Cities' Health
TPF	Total Productivity Factor
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO-IHE	United Nations Educational, Scientific And Cultural Organization-Institute For Water Education
UNFCCC	United Nations Framework Convention On Climate Change
VAM	Vulnerability, Adaptation And Mitigation
WCED	United Nations' World Commission On Environment And Development
WMO	World Meteorological Organization
WTO	World Trade Organization

Introduction

M.A. Mohamed Salih

Progress towards sustainable development has been agonizingly slow, raising questions as to whether the struggle for sustainability of the environment and its life support capacity are destined to be lost.¹ Ominously, negative environmental trends have not reversed in any satisfactory manner and in some cases the trends are worsening rather than improving. Climate change typifies these growing negative trends owing to its integrative nature and the intractable problems it is most likely to generate without adoption of prudent adaptation and mitigation measures. In this respect, the evidence available suggests that climate change is contrived to pose formidable challenges to two mutually reinforcing global agendas: sustainable development and poverty reduction.

Obviously, climate change impacts would have discernable consequences for states and people's ability to pursue long term environmentally sustainable development, including the quest for social justice and equity among and between generations. Several publications also reveal that climate change is most likely to make the poor poorer and the more vulnerable less capable of coping with the consequences of environmental degradation. Should bleak scenarios of rising global temperatures beyond tolerable capacities occur, the poor will become less capable of pursuing long term sustainable livelihood strategies in favour of immediate short term survival tactics, thus jeopardizing sustainable development. Likewise an increase in energy consumption for industry, residential areas and the transport sector will be significant as population, urbanization and industrialization grow in both the advanced industrial and the developing countries. Moreover it is likely that climate change will influence the pattern of change in energy consumption, which could have significant effects on CO₂ emissions (IPCC 2007a, pp. 488–9).

In this volume, there is a general realization that the global context of sustainable development has changed significantly since its inception during the late 1970s. As a result, the structural relationship linking climate change, sustainable development and poverty reduction has changed and should be explained and analysed within the new global context dominated

by an ascendant globalization. At least five factors distinguish the present global context of sustainable development from the time of its initial conception.

1. Increase in environmental consciousness and the consolidation of the multilateral sustainable development institutions, public and movements. This has ushered in a dramatic increase in the numbers, diversity and quality of environmental actors and institutions as major players in environment and development efforts at the local, regional, national and global levels.
2. Mutually reinforcing and structurally linked fate of climate change, sustainable development and poverty reduction, whereby failure in one is most likely to undermine the other two
3. Climate change policies are also part of sustainable development, with its linkages to poverty reduction interventions presently conceived and implemented under a new global context of development dominated by considerable reliance on fossil fuels, increased demand for materials and commodities, the information and communication technology (ICT) revolution, economic liberalization and free trade accompanied by significant progress in the triple heritage of democratic governance, human rights and the rule of law.
4. Unprecedented global economic growth during the last two decades, which witnessed India and China rise, along with the reemergence of other Asian and Latin American countries, from the economic crisis of the late 1990s with considerable contribution to the global economy.
5. Emergent economies' formidable demand for commodities, raw materials, food, minerals and energy in order to sustain their accelerated industrialization and a fast growing population, with altered consumption habits and patterns. There are also increasing demands and efforts to harness alternative energy sources, dematerialization and contemplation of innovative concepts such as ecological cities and new generation environmental technologies.

The post 1990s global context of sustainable development is also the context of a renewed poverty reduction effort under the aegis of the Millennium Development Goals (MDGs). Notably, the Johannesburg (2002) World Summit on Sustainable Development mandate was to develop policy-instruments for implementing already agreed upon global commitments, particularly those made in Rio in 1992 and the more recent MDGs. In other words, the Johannesburg Conference was not an attempt to revisit sustainable development's original objectives as envisaged a few decades

ago, but to serve as a contributor to the MDGs. In a sense, an explicit linkage with poverty reduction added an extra dimension to the complex relationships involving climate, among other environmental problems. Below are four examples of MDG goals:

1. Integrate the principles of sustainable development into country policies and programmes and reverse loss of environmental resources;
2. Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss;
3. Reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation; and
4. Achieve significant improvement in the lives of at least 100 million slum dwellers, by 2020 (UN Millennium Declaration 2000).

The Johannesburg Declaration (2002) was conceived within the confines of the new context of sustainable development as influenced by globalization, the liberalization of trade and the triple heritage of democratic governance, human rights and the rule of law. More than any other global environmental problems, climate change has taken centre stage in global public policy, traversing many environmental, developmental and trade issues pertaining to economic growth and the quality of life of the rich and the poor. In other words, one can view climate change and its consequences as metaphors for development failure coupled with the slow pace in implementing a sustainable development agenda during the last 30 years.²

Reflecting on the current democratic dispensation, command and control environmental policies reminiscent of the nondemocratic policy development and implementation during the Cold War was replaced by more democratic and largely participatory processes involving states and an array of nonstate actors.³ Elinor Ostrom offers, in this volume, federal systems of common-pool resource governance as an alternative to centralized and individualized command and control blueprints. Ostrom, after reviewing studies of polycentric governance systems in metropolitan areas and on the management of common-pool resources, argues that providing and producing public goods and common-pool resources require different institutions to open, competitive markets or highly centralized governmental institutions. Ameliorating Opschoor's (2004) work in this field, Ostrom recognizes that for such an understanding to prevail there is need for analytical approaches consistent with a public sector that encourages human development at multiple institutional levels: local, regional, national and international. Ostrom explored a number of research themes – creativity in producing collectively, public goods and common-pool resources. Various actors, both in the rural and urban

environments and at multilayer levels and governance arrangements, adopted some of these innovative approaches. In case study after case study, Ostrom challenges the universal relevance of the view that local actors are individualistic self-interest seekers and blind to the interests of the collective. Ostrom laments that in thinking about the production of public goods and common-pool resources, researchers and policymakers alike should design principles (that define the boundaries of a resource system; proportional equivalence, collective choice arrangements, endogenous monitoring, graduate sanctions; minimal recognition of rights; and nested enterprises) rather than blueprints. Principles rather than blueprints have proven to offer genuinely innovative methods for engaging this enduring aspect of human behaviour linking environmental resources and collective welfare.

Turner and Fisher (in this volume) propose alternative ecosystem service approaches sensitive to social capital, collective-action capacity and the environmental, social and material needs of the most vulnerable in society. Turner and Fisher reorient ecosystem service approaches, originally developed to strengthen the link between well functioning ecosystems and the flow of economic benefits these systems generate, on a long term basis, and their use for poverty alleviation and human well being. The authors critically and creatively assessed and articulated the role of ecosystem approach (ESapp) for the achievement of the twin objectives of conservation and human development and its apparent relevance to the current debate on how to achieve the MDGs. Turner and Fisher have succinctly examined three key research issues that an ESapp must accommodate: 1. marginal changes in landscapes or seascapes; 2. apply the precautionary principle; and 3. capture ecosystem service benefits such that realizable welfare gains flow to people. With these caveats in mind, the implications of ESapp as a tool for informing policy implementation as to whether the poor really do gain in PES schemes. There is also the need to recognize that if PES programmes proliferate, there will be a macroeconomic impact on a national scale in the form of higher food prices, labour and land costs, indirectly conditioning the livelihoods of the poor. However some other caveats are important, including land to be set aside to ensure service provisions are only likely to benefit the poor if they themselves own the land and if the land is characterized as low grade agricultural land but not high grade ecosystem services land. There are also possibilities for tapping into social stocks as an alternative or supplementary approach to ecosystem service maintenance. Institutional arrangements and transaction costs will play a significant role in whether poor people gain from PES schemes. On the whole, conclude Turner and Fisher, ESapp would serve

as a policy instrument for analysing and synthesizing relevant knowledge and provide mechanisms for capturing the benefits that flow from healthy ecosystems and their services. However the challenges that an ESapp approach can overcome remain formidable. It requires a careful consideration of time, space and context, the need to *set* for the least advantaged groups in the current generations, and the long run *opportunities set* across generational time. Not to underestimate the potency of collective-action both within PES schemes and as an alternative approach, acknowledging that the incorporation of ecosystem service assessments into policy and development contexts should go some way towards internalizing costs.

Clearly resource management systems and approaches to ecosystem service generation and distribution, according to Ostrom, and Turner and Fisher are influenced by the institutional instruments devised to ensure that they enhance the well being of the many and not the few. This is more so under democratic conditions that respect polycentricity and cultivate people's inner strength and capabilities.

CLIMATE CHANGE, DEVELOPMENT AND POVERTY REDUCTION

The current state of knowledge about climate change and its consequences tells us that:

observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate change, particularly temperature rise; a global assessment of data since 1970 has shown that it is likely that anthropogenic warming has had a discernible influence on many physical and biological systems; impacts due to climate change will vary regionally but aggregated and discounted to the present, they are very likely to impose net annual costs which will increase over time as global temperatures increase (IPCC 2007a, p. 25).

Beyond changes in temperature, which impact physical and biological systems, are the social costs of climate change superimposed on the present vulnerabilities that therefore affect the poor and vulnerable most. Climate change means severely reduced precipitation in some regions thus further reducing access to drinking water, health and nutrition by threatening food security and in countries whose economies are dependent on agriculture, the macroeconomic cost of climate change will certainly be high. It is important to understand the intensity of the negative human development impacts of climate change on the poor, in conjunction with the 2007

Human Development Report (HDR) of the United Nations Development Programme (UNDP). It reports that, 'there are around 1 billion people in the World living on less than USD 1 a day, with the number increasing to 2.6 billion (or 40 per cent of the World population) people living on less than USD 2 a day' (UNDP 2007, pp. V, 25). Noting that the majority of the poor live in rural areas and depend on natural capital for their livelihood, apparently, the environment and development agendas in developing countries are not separable from the negative impacts of climate change.

In this volume, a number of chapters address the thorny relationship linking climate change, development and poverty reduction. For example, Fortman attempts to connect the economics of sustainability with the politics of security by examining these relationships in respect to major reconceptualization of the meaning and applications of environmental security in a multilayered framework that explores the local, regional and global processes that contrived to contribute to the environmental crisis. An important element of Fortman's chapter is his concern with the distribution of risk, which is, by necessity, about the distribution of justice, involving the major contention that markets are rational and could, therefore, be expected to ensure justice without state intervention or that free trade behind closed borders works equally for the poor and the rich? The challenge to global public provisioning projects such as the MDGs is how to combine the noble endeavour of feeding the poor and vulnerable populations, while preserving the natural resource base and the environment, responding to environmental crises, global poverty and exclusion.

Gupta's commentary on the relationship between climate change, development policies in the industrially and affluent North and the impoverished South bears the hallmark of the challenges climate change poses for development policy and practice. Gupta's chapter offers an expansive and substantive commentary on these issues. She commences with the following pertinent questions: How logical is it to link climate change to development aid? And, what can climate change assistance learn from the history of development aid? Gupta approaches these two questions as follows: First, she provides the reader with very useful background information on the evolution of climate change, funding and aid discourses, before moving to address the two questions. Gupta's conclusion is startling. Although it makes good practical sense to link climate change policy-instruments with existing development aid measures, it will remain politically sensitive, as the South will view this as retracting from the original commitment the developed countries made to them. She purports, until and unless new and additional resources from the North are available to the South, the packaging and evaluation of development aid needs should be substantially increased.

Three contributions (Spoor, Darkoh and Khayesi, and Murshed) are illustrative of Gupta's thesis on the synergetic effects linking spatializing development and environmental discourses in the context of global restructuring. Darkoh and Khayesi's chapter, for example, finds inspiration in recent geographic research on spatializing development and environment discourses. They focus on sustainable development and globalization and show that spaces (connoting the broader definition of environment as our surroundings) are central to understanding the consequences of development and globalization on sustainable development. Darkoh and Khayesi's concern is primarily with development and globalization where environmental resources and their respective goods and services are very limited. Examining the dialectical relationships between environment, sustainable development and globalization in a space sensitive analysis, they offer an integrated assessment. Their chapter yields profound insights into how different societal forces operate to produce and oppose the production of spaces along with related socioeconomic configurations. The chapter provides a few examples of how the complex interaction and processes lead to sustainable development and globalization may be spatialized, thus projecting a real life synthesis of their consequences on human existence. The implications of this chapter for the pertinent findings of Turner and Fisher, Dietz and Gupta are far reaching. Compounding sustainability challenges are factors not immediately obvious in a linear or singular explanation of the environmental crisis and its potential remedies and policy subscriptions.

Spoor's contribution articulates the role of cotton production in Central Eurasia, which contributes to the already harsh livelihood conditions, rural poverty and environmental degradation. Spoor argues that despite robust overall economic growth in this region, poverty in rural areas has not declined as rapidly as in urban areas. This has created an imbalance emanating from extensive state intervention in agricultural production, marketing and processing, as well as a lack of palpable support for individual agriculture. However, despite dire conditions for the poor and negative environmental impacts, Spoor observes that cotton is particularly profitable for the processing and trading sector in the supply chain. It benefits state officials involved in the regulatory framework, rather than the producers. Spoor notes that sustainable management of environmental resources such as land, water and forest does not have the priority. Inadequate irrigation and drainage practices and decaying infrastructure contribute to environmental degradation, begging for urgent action to modernize the institutional frameworks of cotton production, marketing, as well as irrigation and drainage infrastructure among other better environmental management measures.

Even if the policy context of sustainable development is ripe and implementation is relatively successful, environmental resources have often been arenas for conflict. In most cases, conflicts herald two processes that undermine livelihood and environmental sustainability: poverty and underdevelopment. Murshed critically explores two phenomena that have recently been utilized by political economists, political scientists and others to explain conflict onset – greed and grievance – over valuable natural resource rents, relative deprivation and the grievance it generates. Each within its own internal dynamics and the external environment, separately or combined, greed and grievance are potential explanations for the factors that fuel conflict. However, Murshed argues that the mere presence of greed or grievance alone is insufficient explanation for the outbreak of violent conflict, without, for instance, institutional breakdown such as the failure of the social contract between citizens and the state. It is ominous that environmental degradation and exploitation by corrupt governance and greedy elites enhances the degradation of the social contract – most likely in the context of poverty and growth failure.

Hartmann questions the efficacy of the current debate on what is framed as climate change security by arguing that whether violent conflict and mass migrations occur depends on so many other factors that it is far too simplistic to see climate change as a major cause or trigger. Moreover, she argues that such threat scenarios ignore the way many poorly resourced communities manage their affairs, without recourse to violence, and that violent conflict in the Global South is much more connected to resource abundance (rich oil and mineral reserves, valuable timber and diamonds, to name a few) than resource scarcity as such. Power structures, that determine whether conflict over resources turns violent or not, motivate any relationship between climate change and conflict, according to Hartmann. In her view, the linkage between environment and security is reminiscent of the neoMalthusian environmental security discourses of the 1980s and 1990s. This line of reasoning, laments Hartmann, not only profoundly naturalizes political conflicts, but also casts poor people as victims-turned-villains.

The contribution to explaining the onset of resource conflicts (Murshed) and the critique of climate change as a natural cause of security (Hartmann) are in the environment development nexus and are illustrative of the stark contrasts of the sustainability questions posed under abject poverty and affluence. The struggle for sustainability is being waged under various governance arrangements and processes: democratic or authoritarian. The worst of these are violent conflicts, the subject matter of Murshed's theoretical and empirical contribution, which undermine long term sustainability and progress towards poverty reduction.

Ecological Cities

Environmental transformations due to urbanization and industrialization imply environmental health related to or because of exposure to large scale change of the scale and nature of biological pathogens, chemical and physical hazards and psychosocial stressors. According to Satterthwaite, this change can be positive for human health (such as water and sanitation systems that greatly reduce human contact with biological pathogens) or negative (such as inadequate drainage in settlements providing new breeding grounds for disease vectors); for instance, in many tropical areas, mosquitoes are the vectors for malaria or dengue fever (Satterthwaite 1997). Another aspect of large urban environments is their ecological footprints, meaning that they place higher demands on nature, not only from their surroundings and from national natural capital, but also globally, which includes air pollution and greenhouse effects (Wackernagel *et al.* 2006; McManus and Haughton 2006; Newman 2006; Satterthwaite 1997).

Increasingly the alternative sought to negative elements of urban environmental change is the establishment of ecological cities, a concept popularized by environmentalists and policymakers as a potential solution to urban environmental hazards.

Interpreting Kenworthy's (2006) ten dimensions for sustainable city development in developing countries, van Dijk develops an analytical framework that can possibly be used to meet the challenges of determining whether certain such initiatives qualify for the ecological city praxis (or theory of practice). He engages ecological city initiatives developed by the Chinese government in response to the myriad of environmental problems emanating from rapid rural–urban migration, urbanization and industrialization. These initiatives include alternative building techniques and materials, drinking water treatment and sanitation methods. The chapter is inspired by the Switch project (Sustainable Water Improves Tomorrow's Cities' Health) that aims at a paradigm shift in urban water management, with the main purpose of making water treatment more sustainable, reducing risks such as water related diseases, droughts and flooding. It explores whether the Chinese Government's efforts will contribute to a broader thinking, building the ecological city of the future. While at the city level, the emergence of ecological neighbourhoods is leading to individual initiatives capable of triggering new markets and incentives. The chapter grapples with the question of whether the Chinese (and others) ecological cities' initiatives are precursors of future developments inspired by more ecological urban water systems or a very different, more integrated approach to a number of related environmental issues. Conservation and sustainable use of environmental resources in ecological cities can benefit from the debate

on dematerialization and efficient use of materials necessary for the production and reproduction of urban life and modern human settlements, as van den Bergh and associates illustrate as depicted in the following section of this introduction.

Digital Dematerialization

Dematerialization is the shift in consumption and production in favour of less material-intensive products and services, using advanced technology and recycling to boost efficiency in material use. The emphasis on consumption and production patterns underlines the intricate relationship between economic growth, consumption, poverty, inequality and the environment. Dematerialization also implies the need for new and more efficient technologies put in service for sustainable development through New Generation Environmental Technologies (NGETs). NGETs support a new approach to environmental protection, which raises important questions for both private industry and government policymakers. Can such technologies enable widespread decoupling of environmental impact from economic growth? Or will they remain confined to isolated pockets of success? If the former is indeed possible, what steps must government and the private sector take to bring NGETs to their full potential? Over the past decade, the governments have pursued a variety of programmes to explore the development of these new approaches (Lempert *et al.* 2003, p. 3).

Van den Bergh and associates take up this theme in respect to digital dematerialization asking similar questions and building on their earlier work. For example, Ayres and van den Bergh proposed an alternative approach to modelling growth with the environment that meets the needs of information for current debates, involving at least two modifications of conventional growth theory.

First, to explain the growth of output, be it in monetary (income) or physical terms, it must reflect the existence of self-reinforcing feedback mechanisms or growth engines apart from population growth and the traditional savings–investment–capital accumulation mechanism. Second, a modified growth theory should explicitly reflect the fact that important (i.e. scarce) factors of production in economics can and do change over time. When non-renewable natural resources were perceived as available without limit (i.e. not scarce), they could be formally regarded as intermediate products of scarce labor and scarce produced capital (Ayres and van den Bergh 2005, p. 97).

Ayres and associates underpin the major challenges confronting alternative development from a digital dematerialization that could assist social and natural scientists and policymakers' efforts to to have a better

understanding of sustainable economic growth that uses materials efficiently.⁴ Van Dijk's assessment of ecological cities development is followed by van den Bergh and associates chapter on 'Digital dematerialization'. Clearly, their chapter is inspired by Professor Hans Opschoor's research on material-product chains. Their aim is to develop a framework for understanding the total, direct and indirect, impact of ICT on materials use. After identifying the economic mechanisms involved (price, income and information effects; substitution, sectoral change, changing preferences and economic growth), van den Bergh and associates take into account the material and energy intensive production of ICT equipment. The questions they raise are important. If the implementation of ICT technology can contribute to increases in the productivity of production factors, such as labour, capital and natural resources, the logical question in the context of environmental studies, then, is whether improved resource productivity implies beneficial impacts on material and energy use, and indirectly a reduced pressure of economic activities on the environment. The overall assessment here is that while ICT contributes to dematerialization at the micro level, this does not necessarily lead to absolute dematerialization at the macro level of the economy. The authors offer at least two compelling factors to explain this anomaly: 1. Various economic mechanisms come into play when changes associated with implementation of ICT occur at the micro level thus neglecting the production of ICT itself, which apparently also uses many diverse materials and energy sources. 2. Efficiency gains, in terms of material and energy use in production and consumption, incorporate ICT production costs and, consequently, contribute to the decline of commodities. Together with information technology, according to the authors, effects and interaction between related markets may stimulate consumption, new preferences, activities and consumption patterns.

Whether digital dematerialization is a panacea for material conservation or not, van den Bergh and associates' overall assessment is sombre as there is no reason for optimism about the material saving net effects of widespread use of ICT in economic production, goods and services. However, they also provide sufficient evidence to suggest that there is potentially a guarded optimism for a better understanding of environmental challenges and benefits associated with NGETs.

Biofuels Versus Food

Among the challenges confronting the sustainable development and environment agenda is the current increasing interest in biofuels; described by Mol as 'fuels that are directly derived from biological sources'. According to Mol, sources that lead to specific products in biofuel production are

classified into four groups; of these, the first two are in common use while the latter two are still experimental.

1. Cereals, grains, sugar crops and other starches that can be fermented fairly easily to produce bioethanol, and can be used in their pure state or blended with fuels;
2. Oilseed crops, such as sunflower, rapeseeds, soya, palm and *Jatropha* that can be converted into methyl esters (biodiesel) and blended with conventional diesel or burnt as pure biodiesel;
3. Cellulosic materials, including grasses, trees and various waste products from crops and wood processing facilities as well as municipal solid waste that can be converted into a newer generation of bioethanol (via enzymatic breakdown or acid hydrolysis, followed by fermentation); and
4. New biodiesel technologies, such as the Fischer-Tropsch process that synthesizes diesel fuels from different biomasses (such as organic waste material) via gasification (Mol 2007, p. 298).

Biofuels such as bioethanol and methyl esters are renewable, considered environmentally friendly, potentially less hazardous and can, therefore, provide cleaner energy.⁵ These fuels entered the climate change debate as potential alternatives to fossil fuels and as an important energy source at a time of high food and energy prices. However, the volatility of the World Economy, blamed partly on high oil prices overshadows the polemic between climate and food security, epistemic communities, policymakers and activists.⁶ On the other hand, Plieninger and Bens lament, first generation biofuels (such as grain ethanol or rapeseed-based biodiesel) overwhelmingly take the form of energy crops. In most cases these are grown on fertile soils, where direct competition between food and fuel production arises (2008, p. 273). Conservationists are also worried about the prospect that the production of biofuels could undermine conservation efforts by claiming lands originally set aside for conservation. Biofuels challenge ideas preoccupied with conservation such as tree planting as an antideforestation, soil and water conservation measure as well as for the promotion of sustainable fuel-wood production and energy saving stoves for rural households in developing countries.

Rob Vos, recognizing that food prices surged in recent years, food security is under threat in many poor countries and more than 100 million people may have fallen into extreme poverty because of the recent food price hikes alone, articulates the debate on the biofuel versus food subtheme. Rising food prices coincided with rising energy prices and a growing sense of energy insecurity. The rising food prices have resulted

from a number of factors enacted on both the supply and demand side of food markets. There has been a relative neglect of agriculture, especially in developing countries, over several decades and productivity growth has fallen well short of demand for food. More recently weakening financial markets, rising oil prices and concerns about energy security in developed countries caused further upward pressure on food prices, especially for basic grains. It is amid these agricultural policy deficits, argues Vos, that biofuel production (from basic grains, sugar and oil seed crops) expanded strongly, thanks to generous subsidies in developed countries. However this has occurred at the cost of land use for food production for human consumption and with very limited impact on improving energy security or mitigating climate change through the use of this source of *clean* energy. Vos purports that, under the prevailing technologies, biofuel subsidies are not cost effective, from an economic or environmental perspective. Because of the impact on food prices, they are also undesirable from a humanitarian perspective and hence require reconsideration, along with a new approach towards food production in developing countries.

CONCLUSIONS

The overall structure of the book consists of at least five subthemes directly or indirectly addressing the challenges of sustainable development failure and subsequent escalation of climate change as it pertains to poverty reduction. Emergent issues such as digital dematerialization, ecological cities and concrete proposals for ecological services and distribution explicit in climate change form a substantive crosscutting issue within the new global context of sustainable development.

1. *Analyse common-pool resource management and ecological service principles and policies within the current debate on democratic governance, with an added emphasis on the need to include the poor.* The contributors, situated within the debate on environmental democratic governance, articulate the need for respect of diversity in environmental management and ecoservice approaches and policies. These contributions offer alternative approaches for natural environmental resource management based on polyarchy, the recognition of multiplicity and context-based democratic governance.
2. *Repositioning the debate on climate change injustice to one of sustainable development's most enduring legacies (that is justice between and among generations).* Some contributions to this volume are concerned with climate change injustices resulting from the prevailing international

political economy and law of environmental management, articulating the current debate on right-based approaches from a climate change perspective. In particular, the contributors delineate the normative and practical dilemmas of unequal distribution of impacts, unequal responsibility for the cause of climate change, unequal costs incurred by poor and rich, and for mitigation and adaptation between and among generations.

3. *Revisiting, elaborating and deepening the environment and development debate.* The approach of this subtheme makes reference to a range of perspectives from: (a) Environment and development policymaking in the North in respect to climate change. (b) Comparing and contrasting development and environmental policy approaches and emphasis, within a rapidly changing context of development. (c) The need to identify what parts of nature are sustainable and what parts could be forsaken in the bid to balance developmental and climate change effects on humanspace and ecospace. (d) Conflicts over environmental resources and distributional justice cannot be explained by greed and grievance alone or in isolation from other social justice concerns. A synthesis of the greed and grievance hypothesis along with its relationship to a failing social contract, provide a complete and more comprehensive understanding of the causes of the onset of resource conflicts or cooperation among diverse resource users. (e) An explanation and analysis of climate change and the conflicts surrounding it not as natural phenomena but as a social problem that generates conflicts of interests far beyond the simple fulfilment of the neoMalthusian prophecy.
4. *Exploring the most recent sustainable development alternatives, their pros and cons, particularly, digital dematerialization, ecological cities and the controversy surrounding the debate on biofuels versus food.* Although digital dematerialization may (or may not) contribute to efficient production or ecological cities, it may (or may not) provide better-built living environments. The real challenge is, how to create conditions where such new responses to environmental degradation also benefit the poor and duly contribute to poverty reduction. Do the ecological footprints of ecological cities differ from any other cities, knowing that, generally, cities are densely populated and consumption is concentrated thus generating impacts that traverse the cities and their nation's geographic boundaries? Cities are also spaces that magnify the digital divide. Hence uneven benefits of digital dematerialization together with possible unequal distribution of potential negative environmental change impact climate change.
5. *Examining the complex relations involving climate change and its implications for two major global agendas: sustainable development*

and poverty reduction This is a major subtheme running throughout the book; dealing with climate change, sustainable development and poverty reduction simultaneously; climate change and sustainable development, or the contribution of climate change to processes that could possibly undermine poverty reduction.

Climate change challenges to sustainable development and poverty reduction are different from those prevalent during the 1980s and 1990s. While during the 1980s and 1990s, research on sustainable development tended to negate economic growth under the limits to the growth hypothesis or to treat it as a poverty reduction misfit has given way to a new dominant paradigm, it considers economic growth a prerequisite for poverty reduction and a positive contributor to better standards of living. Others, of course, continue to treat economic growth as an instrument for wealth generation, accumulation and concentration that can hardly benefit the poor even if better environmental conditions are maintained and higher growth rates are achieved.

In a sense, the contributors to this volume maintain some continuity and build on the accumulated knowledge and major concerns that prompted the call for sustainable development more than 30 years ago. Collectively, we ask whether a balance between economic growth (or the quality of growth) and the increase (or decrease) in the social and environmental cost of production, including, for example, trade offs between consumption and pollution, is possible. As the contributors have illustrated, the answers to these questions and their consequences for society are not only economic, but also social (poverty, inter and intragenerational equity) and political (resource competition, conflicts and a shrinking environmental space).

The question that the contributors to this volume have not dealt with, due to limited space available in this volume, is the evidence of how climate change impacts would look should the alternative proposals provided here, such as better ecological services delivery, decentralization, polycentricity, ecological distribution justice, ecological cities and digital dematerialization, pose indirect contingent limits on global environmental sustainability? An important allied question is whether these alternatives provide sufficient trade offs to justify their efficacy and subsequent adoption as policy measures towards sustainability. Certainly, this requires another volume specifically devoted to answering the question, under what specific global economic and environmental policy conditions and instruments will the alternative policy responses articulated in this volume suited to climate change abatement, sustainable development achievement and poverty reduction be possible?

NOTES

1. Beckerman 2003; IPCC 2007; Brown 2007; UNDP 2007; among others.
2. World Summit on Sustainable Development 2002. Johannesburg Plan of Implementation and Johannesburg Declaration on Sustainable Development
3. WTO 1999 Report prepared by International Institute for Sustainable Development on the WTO, trade and environment.
4. For example, Wernick *et al.* (2001) and UNDP (1998) Human Development Report on Consumption in the case of developing countries or the philosophical debate between Feigl (1962) and Hansen (1962) and its contemporary relevance for most of the major literature on industrially advanced countries.
5. McLaughlin and Walsh 1998; Pimentel and Patzek 2005, 2006; Mol 2007; Crutzen *et al.* 2007; Plieninger and Bens 2008, among others.
6. According to IMF Chief Economist Simon Johnson, the slowdown in the world economy can be attributed to the slow growth of the US economy, volatile oil, high food prices, fluctuating financial markets and continued inflation.

1. Polycentric systems as one approach to solving collective-action problems

Elinor Ostrom¹

Providing and producing public goods and common-pool resources at local, regional, national and international levels require different institutions than open, competitive markets or highly centralized governmental institutions. If we are to solve collective-action problems effectively, we must rethink the way we approach market and governmental institutions. We need analytical approaches that are consistent with a public sector that encourages human development at multiple levels (Opschoor 2004b). This chapter reviews studies of polycentric governance systems in metropolitan areas and managing common-pool resources.

Hans Opschoor has devoted his academic career to the study of economic instruments and institutions related to the development of and to coping with environmental problems. A fundamental set of problems facing individuals in all developed and developing societies are collective-action problems. The size and shape of these problems, however, differ dramatically. Polycentricity may help solve collective-action problems by developing systems of governmental and nongovernmental organizations at multiple scales.

After an introduction to the problem, this chapter will review the extensive research that demonstrates the capabilities of many citizens to design imaginative and productive ways of producing public goods and common-pool resources. Successful systems tend to be polycentric with small units nested in larger systems. Not all such systems are successful and we need to understand factors associated with failure as well as success. The last section of the chapter will discuss design principles that can help guide the design, adaptation and reform of governance systems to achieve robust and effective systems over time.

MATCHING SCALES OF GOVERNANCE SYSTEMS TO SOLVE COLLECTIVE-ACTION PROBLEMS

Collective-action problems occur when it takes the inputs and efforts of multiple individuals in order to achieve joint outcomes – and it is difficult to exclude beneficiaries of these actions from benefiting even if they do not contribute (Ostrom 1998). Collective-action problems vary in scale from very small problems involving only a few individuals to extremely large problems involving global resources, such as the atmosphere and the oceans. Solving collective-action problems requires opening public and private spheres of activities ranging from the small to the very large so as to encourage effective problem solving (Hess and Ostrom 2007).

Regarding the provision and production of private goods – goods that are relatively easy to package and lack major externalities – creating open, competitive markets is conducive to increased levels of investment, innovation and lower prices to consumers. Entrepreneurship plays a key role in the private sector, since entrepreneurs are the ones who must discover strategies to put heterogeneous factors of production together in new and complementary ways given the availability of resources and technology. In the private sector, the profit motive is the driving force for private entrepreneurs.

Providing and producing public goods and common-pool resources – including public safety; conflict resolution at international, national, regional and local levels; public education; and public health; as well as sustaining natural resource systems – require different institutions than an open, competitive market. Even the market itself is not a viable, independent institution without the presence of effective public property arrangements, courts of law and police (Opschoor *et al.* 1999).

The language used by many analysts divides the rich world of institutions into a barren dichotomy of the market versus the state. While most consider markets to be open, public realms where many individuals and firms of diverse sizes and assets compete, the depiction of the public sector is as a top down hierarchy with little room for problem solving except by top level, government officials. Whether a system is federal or not, some scholars prefer to think about governance occurring primarily at the national level. Even federal countries may need to think about expanding some of their problem solving capabilities to an international level with respect to specific functions larger than any units within their federal systems thus far (Frey 2005).

If we are to solve collective-action problems effectively, we must rethink the way we approach market and governmental institutions (Ostrom 2006, 2007). Analytical approaches that are consistent with a public sector that

encourages human development at local, regional, national and international levels are required (Opschoor 2004b). Diverse interests motivate public entrepreneurs including improving services to their own communities, sharing the burden for increasing benefits, the stimulus of innovation, the respect they receive from others, as well as the income they derive from their positions in public service for those who are not entirely volunteer workers (Mintrom 2000; Kuhnert 2001).

Extensive studies of urban service delivery (for overview see McGinnis 1999b) and of common-pool resources (E. Ostrom *et al.* 1994; Gibson *et al.* 2000), conducted in association with the Workshop in Political Theory and Policy Analysis at Indiana University, found numerous communities in both urban and rural areas self organized to provide and coproduce quality local services, despite the constraints that they face. Many policy analysts presume that without major external resources and top down planning by national officials, there can be no provision of public goods and sustainable common-pool resources. This presumption is wrong.

The opposite prescription that local communities will always solve collective-action problems is also wrong. It is a struggle to find effective ways of providing these services, but public entrepreneurs working closely with citizens frequently do find new ways of putting services together using a mixture of local talent and resources (Dietz *et al.* 2003). If governance systems are arranged polycentrically, from small to very large, collective-action problems are solvable on multiple scales. The costs of effective self organization are lower when authority exists to create institutions whose boundaries match the problems faced. External financial resources may increase the options available to a local community. External resources are not the essential ingredient for building an effective public sector to provide local public goods and protect smaller scale common-pool resources. The results achieved have been grossly disappointing, for example, solving local problems with the allocation of massive amounts of donor funds (Gibson *et al.* 2005).

The presumption that locals cannot take care of public sector problems has led to legislation throughout the world that places responsibility for local public services on units of government that are very large, frequently lack the resources to carry out and are overwhelmed with their assignment. Contemporary assignment of regional, national or international governments with exclusive responsibility for providing local public goods and common-pool resources removes authority from local officials and citizens to solve local problems that differ from one location to the next. Doug Wilson, Research Director for the Institute for Fisheries Management and Coastal Community Development in Denmark, recently reflected on the evolution of fisheries policies in the European Union.

The Common Fisheries Policy (CFP) as it is called is an *exclusive competence* of the European Union (EU) meaning that all decisions are taken at the level of the Union . . . The CFP is not only politically important within the overall effort to build a new kind of polity in Europe; it is also failing to do a very good job of maintaining sustainable fish stocks. Fisheries scientists tell us that, in 2003, 22% of the fish caught from stocks managed by the CFP came from stocks that were smaller than they should have been for sustainable fishing. Scientists, fishers, government agencies and marine conservation groups are all unhappy with the CFP and there are myriad attempts to reform it. The reforms include better policy, better data gathering, a reduction in perverse subsidies to the fishing industry and, finally, 30 years after most other fisheries management agencies had moved beyond top-down management, some serious attempts at stakeholder involvement (Wilson 2006, p. 7).

This emphasis on top down planning is certainly not the way Europe developed. Since the eleventh century, in the Rhine River delta, thousands of independent water boards with their own rules and physical structures, drained the swampy land and protected it from flooding, except during extreme storms (Toonen 1996; Andersen 2001). In Switzerland, alpine peasants devised a variety of private and common property systems to gain profitable income from an extreme and diverse ecology (Netting 1981). More than 1000 free cities with their own charters and legal traditions flourished in Europe during the Middle Ages and were the foundation for modern constitutional democracies (Berman 1983). Drawing on the rich tradition of European public sector development, we need to think of the public sector as a polycentric system (V. Ostrom 1999), rather than a monocentric hierarchy.

Research has repeatedly demonstrated that order and high performance are more likely to be achieved in effective, local public economies established within broader national systems where large, medium, and small governmental and nongovernmental enterprises engage in diverse cooperative as well as competitive relationships (see Frey and Eichenberger 1996). Local public economies are not markets, nor are they simple hierarchies. Households in a local public economy are not able to engage in a wide diversity of independent *quid pro quo* relationships with any producer they choose. Decisions are made for collective consumption units – including a wide diversity of self organized associations as well as governments at multiple levels – that are then held responsible for providing tax revenue and user charges to pay for the provision of public goods and services. Local organizations also enhance the level of citizen coproduction of public safety, education and health. Entities in a public economy engage in extensive horizontal as well as vertical interrelationships. The structure and performance of a public economy at an interorganizational level as well as at the level of a single unit requires examination. We have

repeatedly found that polycentric public economies outperform highly centralized ones (McGinnis 1999a, 1999b, 2000).

POLYCENTRIC PUBLIC ECONOMIES IN URBAN AREAS

The basic assumptions of a polycentric theory, when applied to the study of urban areas, are:

1. Public goods and services differ substantially regarding their production functions and their scale of effects.
2. Individuals with relatively similar preferences for public goods and services tend to cluster in neighbourhoods. Preferences will tend to be more homogeneous within neighbourhoods than across an entire metropolitan area.
3. Citizens who live in multiple jurisdictions learn more about the performance of any one jurisdiction by seeing or hearing about how other jurisdictions handle problems.
4. Multiple jurisdictions with different scopes and scales of organization allow citizens more effective choice in selecting packages of services most important to them, in articulating their preferences and concerns and, if necessary, in moving to other jurisdictions.
5. The presence of large numbers of potential producers of urban goods and services in a metropolitan area allow elected officials more effective producer choices.
6. Producers who must compete for contracts are more likely to search for innovative technologies, to encourage effective team production, as well as citizen coproduction, to enhance their own performance (V. Ostrom 2008a, 2008b; E. Ostrom *et al.* 1978).

This modified form of competition – of vying for citizens to resolve problems and procure services in an urban neighbourhood – is one method for reducing opportunistic behaviour even though no institutional arrangement can eliminate opportunism with respect to the provision and production of collective goods. Allowing citizens to form neighbourhood level collective consumption units encourages face-to-face discussion and the achievement of common understanding. Creating larger collective consumption units reduces the strategic behaviour of the wealthy trying to escape into tax havens where they gain a free ride on the tax contributions of citizens in other jurisdictions. Larger units also can cope more effectively with urban goods and services that have large scale effects.

POLICE IN US METROPOLITAN AREAS

To illustrate the polycentric approach, the following is a short overview of extensive research conducted in US metropolitan areas. The findings from the research are broadly relevant to urban areas of developed and developing countries elsewhere. Regarding the study of local economies in developing countries, colleagues associated with the Consortium for Self-Governance in Africa (CSGA) are currently studying the almost invisible, self organized systems that many citizens in Africa have devised given the lack of public goods produced by formal governments (Sawyer 2006).

During the 1970s and 1980s in response to concerns about police effectiveness in the face of increasing crime rates, proposals to slash the number of police departments serving urban and rural areas of the US gained prominence on the national agenda. Underlying these proposals was the assumption that bigger is always better. Some proposals recommended reducing the more than 40 000 police departments that then existed in the US to less than 500 police departments for the entire country. No systematic empirical evidence supported these reform proposals.

Small and Medium Sized Police Agencies are More Effective at Producing Direct Services

The first important thing to report on here is a series of studies that measured the performance of diversely sized police agencies serving similar communities in the Indianapolis, Indiana; Chicago, Illinois; St. Louis, Missouri; Rochester, New York; and Tampa-St. Petersburg, Florida metropolitan areas. Interviews with a random sample of households served by small, medium and large departments provided data for a police performance measurement. Information obtained was on victimization, willingness to call the police, speed of police response, amount of police follow up, satisfaction levels with police contacts and general evaluations of the quality of policing in a neighbourhood. By studying matched neighbourhoods with similar service conditions, the researchers controlled for many of the other factors expected to affect performance.

The consistent finding from this series of studies was that small to medium sized police departments perform more effectively and frequently at lower costs than large police departments serving similar neighbourhoods (see McGinnis 1999b): victimization rates tend to be lower, police response tends to be faster, citizens tend to be more willing to call police, citizens tend to evaluate specific contacts with police more favourably and to rate police higher across multiple indicators.

Small Police Agencies Arrange for Indirect Services from Large Police Agencies

In a major study of police organization in 80 metropolitan areas (E. Ostrom, Parks and Whitaker 1978), 1159 direct service producers produced services directly for the residents in the areas. Most of these agencies produced general area patrol, traffic patrol, accident investigation and burglary investigation services. Regarding indirect services, the study found that 70 per cent of the direct service producers also produced their own radio communications, but only a small proportion of any of the direct service producers produced other indirect services such as crime labs or entry level training. In all 80 Standard Metropolitan Statistical Areas (SMSAs), indirect services were available to all direct service producers.

Enhanced Police Performance in Metropolitan Areas with Larger Numbers of Police Agencies

In order to examine the effect of interorganizational arrangements on police performance, the researchers relied on measures of performance such as the allocation of police personnel to on-the-street assignments and the relative efficiency of agencies in producing response capacity and solving crime. For each of the 80 metropolitan areas, the researchers calculated the number of producers of each type of service (multiplicity) and the proportion of the population served by the largest producer of each type of service (dominance). Metropolitan areas with low scores in multiplicity and high scores in dominance come closest to approximating the consolidated model. Metropolitan areas with high scores in multiplicity and low scores in dominance come closest to approximating the fragmented metropolitan area model criticized by these same proponents.

There was a distinct difference in the availability of sworn officers to conduct patrols in the metropolitan areas, depending upon the structure of interorganizational arrangements. While more officers per capita were in the most consolidated areas, a lower percentage of these officers were to patrol divisions in these SMSAs. One-third more officers were required in the most consolidated SMSAs to place the same number of officers on patrol as compared to the least consolidated SMSAs. Citizens living in the most fragmented metropolitan areas received more police presence on the streets for their tax expenditures than did citizens living in the most consolidated areas (Parks 1985).

THERE IS NO ONE BEST SYSTEM FOR ALL LOCAL PUBLIC ECONOMIES

In addition to the research on police, scholars conducted rigorous empirical research challenging the presumption that larger public school districts achieve higher performance (Hanushek 1986; Teske *et al.* 1993). Also challenged was the presumption that fragmentation of governments leads to higher costs (Dilorenzo 1983; Schneider 1986; Boyne 1992). Scholars have provided further insights into the construction of local governance (Oakerson and Parks 1989; Stephens and Wikstrom 2000). As a result of extensive empirical and theoretical research, the presumed self evident truth that constructing one government for each metropolitan area is the best way to achieve efficiency and equity, has slowly been replaced with recognition that judging 'structure directly on the single criterion of uniformity contributes little to the advancement of research or reform' (Oakerson 1999, p. 117). Instead of a single best design that would have to cope with the wide variety of problems faced in different localities, a polycentric theory generates core principles that can be used in the design of effective local institutions when used by informed and interested citizens and public officials.

In his conclusion to an in-depth study of urban consolidation efforts in the United States and Canada during the last century, Andrew Sancton reflected:

Municipalities are more than just providers of services. They are the democratic mechanisms through which territorially based communities of people govern themselves at a local level . . . Those who would force municipalities to amalgamate with each other invariably claim that their motive is to make municipalities stronger. Such an approach – however well intentioned – erodes the foundations of our liberal democracies because it undermines the notion that there can be forms of self-government that exist outside the institutions of the central government (Sancton 2000, p. 167).

Those scholars, public officials and citizens who are concerned with solving collective-action problems effectively, equitably and efficiently, recognize the importance of authorizing citizens to constitute their own local jurisdictions and associations using the knowledge and experience they have concerning the public problems they face.

POLYCENTRICITY AND COMMON-POOL RESOURCES

The time has come to examine local institutional arrangements for common-pool resources. Common-pool resources are systems that

generate finite quantities of resource units so that one person's use subtracts from the quantity of resource units available to others (E. Ostrom *et al.* 1994). The use of forests, pastures and irrigation systems are among the most important types of common-pool resources present in most countries of the world. Most common-pool resources are sufficiently large that multiple actors can simultaneously use the resource system and efforts to exclude potential beneficiaries are costly. When the resource units (for example, water, fish, trees) are highly valued and many actors benefit from harvesting them for consumption, exchange, or as a factor in a production process, the harvests withdrawn by one individual are likely to create negative externalities for others.

The phenomenon known as *tragedy of the commons* will occur in highly valued, open-access commons where those involved and/or external authorities do not establish an effective governance regime. Scholars have regularly recommended that private property regimes be imposed on local users since it has been assumed that local fishers, forest users and irrigators could not design their own systems. Clark (2006) has shown that simply imposing an Individual Transferable Quota (ITQ) on those fishing from a coastal fishery is not a sufficient solution to the challenging problem of achieving sustainable harvests. Instead of presuming that there is one ideal governance regime, it is important to recognize that a variety of regimes may achieve sustainability. Instead of focusing on whether a regime is a government, private property or community property regime, it is necessary to look at the specifics of how a regime matches (or does not match) some of the ecological conditions prevalent in a region (Costanza *et al.* 2001).

A more general way of thinking about governance regimes are as sets of rules that regulate one or more of the following:

1. Who is allowed to appropriate resource units;
2. The timing, quantity, location and technology of appropriation;
3. Who is obligated to contribute resources to provide or maintain the resource system itself;
4. How appropriation and obligation activities are monitored and enforced;
5. How conflicts over appropriation and obligation activities are to be resolved; and
6. How the rules affecting the above will change over time with changes in the performance of the resource system and the strategies of participants.

A self governed common-pool resource is one where actors, who are major users of the resource, are involved over time in making and adapting rules

within collective choice arenas regarding the inclusion or exclusion of participants, appropriation strategies, obligations of participants, monitoring, sanctioning and conflict resolution. Some extremely remote common-pool resources are entirely user governed. Thus was the case for Swiss alpine meadows for many centuries (Netting 1981). In most modern political economies however, it is rare to find any resource systems governed entirely by participants without rules made by local, regional, national and international authorities also affecting key decisions (V. Ostrom 1997, 2008b). Thus in a self governed, polycentric system, participants make many, but not necessarily all, rules that affect the sustainability of the resource system and its use.

CONVENTIONAL THEORY OF COMMON-POOL RESOURCES

Since the important early studies of open access fisheries by Gordon (1954) and Scott (1955), and the much-cited work of Hardin (1968), many theoretical studies by political economists have analysed simple common-pool resource systems using relatively similar assumptions. In such systems the assumption is that the resource generates a highly predictable, finite supply of one type of resource unit (one species, for example) in each relevant period. Further, the assumption is that users are homogeneous in terms of their assets, skills, discount rates, cultural views and that they are short term, profit maximizing actors who possess complete information. In this theory, anyone can access the resource and harvest resource units. Users gain property rights only to what they harvest, which they then sell in an open, competitive market. The open access condition is a given and it is assumed that those involved cannot make any effort to change it. Harvesters act independently and do not communicate or coordinate their activities in any way.

Many textbooks in resource economics and law present this conventional theory as the only theory needed to understand common-pool resources in general. Field research challenges the universality of this theory.

COMMON-POOL RESOURCES IN THE FIELD

A sufficient number of empirical examples exist where the absence of property rights and the independence of actors capture the essence of the problems facing users. Until the mid-1980s field researchers had not challenged the broad empirical applicability of the conventional theory effectively. Until the work of the National Academy of Sciences' Panel on

Common Property (National Research Council 1986), the basic theory discussed above applied to all common-pool resources, regardless of the capacity of appropriators. The growing evidence from many field studies called for a serious rethinking of the theoretical foundations for the analysis of common-pool resources (see Berkes 1989; Berkes *et al.* 1989; Bromley *et al.* 1992; McCay and Acheson 1987). The consequence of these empirical studies is not to challenge the empirical validity of the conventional theory, where it is relevant, but rather its generality.

James Acheson, James Wilson and colleagues (Acheson 2003; Acheson *et al.* 1998; Wilson *et al.* 1994; Wilson *et al.* 2007) documented how the lobster fishermen of Maine recovered from a major crash of the lobster stock in their coastal waters during the 1920s and 1930s by experimenting with a diversity of ingenious rules well fitted to important attributes of the relevant resource units – the lobsters – and how fishermen were organized within the harbours where they lived and berthed their boats. The lobster fishermen of Maine have lived in shoreline communities for multiple generations and have deep roots in their communities. They have been able to organize locally and develop norms of trustworthiness and reciprocity. Given their long history they gained effective knowledge about their local resource system to build an ever more valuable local fishery – with sales of lobster from the State of Maine totalling \$186.1 million in 2000 (Acheson 2003, p. 13).

In the field, many attributes different from those in the basic theory of an open access resource, presented in some textbooks, characterize common-pool resources. Local farmers often build small to medium sized irrigation systems and they develop complex governance systems that specify who can use the resource, when and how much water can be withdrawn, how rules will be monitored and when sanctions will be imposed. Thus, irrigation systems are one setting in which to examine how diverse types of governance systems perform in the field (Tang 1992; Shivakoti and Ostrom 2001; Meinzen-Dick 2007).

Recent research on small to medium sized irrigation systems in Nepal has found a substantial difference in performance between those systems owned and governed by the farmers themselves and those systems owned and operated by a national governmental agency. Colleagues associated with the Asian Institute of Technology in Bangkok have been working with colleagues at Indiana University since the early 1990s (Benjamin *et al.* 1994; Lam *et al.* 1994) to develop an extensive database on the performance of irrigation systems in Nepal.

Farmers in Nepal have long taken on the responsibility to create their own water associations, construct and maintain their own systems, and monitor and enforce conformance to their rules. The irrigation systems constructed and maintained by farmers tend to rely on low tech construction techniques

including building impermanent head works from mud, trees and stones. International aid agencies have provided considerable funding to government agencies in an effort to upgrade engineering standards.

In a detailed analysis of data from 150 farmer governed and national government irrigation systems in Nepal, Lam (1998) developed three performance measures: the physical condition of irrigation systems; the quantity of water available to farmers at different seasons of the year; and the agricultural productivity of the systems. Using multiple regression analysis techniques to control for environmental differences among systems, Lam found several variables strongly related to these dependent variables. One is the form of governance of the system. Holding other variables constant, irrigation systems governed by the farmers themselves perform significantly better on all three performance measures. This variable has the largest explanatory power of any variable in Lam's analysis, including the physical size of the system, terrain characteristics and the number of farmers.

We have continued to develop the Nepal Irrigation Institutions and Systems (NIIS) database, which now has information on about 231 irrigation systems located in 29 of the 75 districts in Nepal (Joshi *et al.* 2000).² Our consistent finding and that of other scholars doing research on irrigation in Nepal (Gautam *et al.* 1992), backs up Lam's earlier study and finds that on average, farmer managed irrigation systems (FMIS) outperform agency managed irrigation systems (AMIS) on multiple dimensions. Below is a brief overview of findings from the NIIS database.³

Focusing on three measurements of the physical condition of the irrigation system at the time of data collection, a larger proportion of FMIS is able to maintain the overall system in excellent or moderately good condition, as well as achieve higher technical and economic efficiency as contrasted with AMIS (see Lam 1998 for definitions of these concepts). The better physical condition of the canals enables FMIS to achieve increased levels of cropping intensity (the number of crops grown during a year) at both the head and tail ends of the canal. Thus, farmers' investment in keeping their systems in good physical condition pays off with significantly more agricultural productivity.

About two-thirds of both FMIS and AMIS have formal written rules that include provisions for imposing fines on farmers for not contributing resources to operate and manage the systems (Joshi *et al.* 2000, p. 75). On the other hand, eight out of ten AMIS hire an official guard, while only six out of ten FMIS rely on an official guard (*ibid.*). The presence of an official guard however does not translate into an increased likelihood of the imposition of fines. On 75 per cent of the FMIS, fines actually are imposed when farmers are observed to break a rule while fines are actually imposed on only 38 per cent of the AMIS (*ibid.* p. 76). Farmers follow the rules

of their system more on FMIS than on AMIS and they tend to achieve a higher level of mutual trust (*ibid.*).

The specific rules that the farmers use in governing their systems on a day-to-day basis vary substantially from one system to another since each FMIS has been self organized. The official guard on many of these systems is actually one of the farmers who rotate into this position on a regular basis. The rules specifying allocation, responsibilities for monitoring and punishment, however, are not consistent from one system to the next. Thus monitoring of water allocation and contributions to maintenance performed, almost exclusively, by farmers who have participated in the design of specific rules garnering their own system, have a strong interest in seeing their system perform well and ensure that others in the system are not taking more water than their official share.

Thus farmers with long term ownership claims, who can communicate, develop their own agreements, establish positions of monitors and sanction those who do not conform to their own rules, are more likely to grow more rice, distribute water more equitably and keep their systems in better repair than on government systems. While there is variance in the performance of these Nepali systems, few perform as poorly as government systems holding other relevant variables constant. Since many of the government systems rely on high tech engineering, the capability of farmers to increase agricultural production on their primitive systems, while providing the labour to maintain and operate the system, is particularly noteworthy.⁴

In the last decade, many have studied diversely organized institutions for managing forests around the world. Instead of one model that works well in all types of forests, there are national government owned forests that work well and are associated with sustainable forests and government forests that are rife with illegal harvesting and are unable to stop poachers (Dietz *et al.* 2003; Ostrom and Nagendra 2006). There are same diverse patterns for community managed forests and privately owned forests. To sustain forests over time requires much more than simply imposing a particular blueprint on a forested area. The capacity and incentives of those in a forest governance organization have to fit the collective-action problems faced in sustaining forests over time (Moran and Ostrom 2005; Hayes and Ostrom 2005).

DESIGN PRINCIPLES RATHER THAN BLUEPRINTS

In an effort to speculate on why some locally developed regimes for regulating the use of common-pool resources survived for long periods and others failed (E. Ostrom 1990), a set of design principles was developed that

underlay the robust, long lasting systems and were rarely observed in the systems that failed. When first writing about these design principles, there was concern over speculation based on reading a large number of individual case studies and earlier empirical work. As such, Ostrom urged others to test out these tentative conclusions through further empirical research that would help ascertain if these principles distinguished between robust and failed systems. Since publishing *Governing the Commons*, other scholars have responded to the challenge. As discussed below and in Ostrom (2005), many scholars have examined the relevance of these principles for helping to explain the performance of resource governance systems (such as fisheries, irrigation systems, pastures and forests) throughout the world.⁵

For example, Weinstein (2000) examined indigenous inshore fishery institutions in Canada and Japan. He found that the design principles earlier proposed by Ostrom were largely what characterized these long lived institutions. Abernathy and Sally (2000) studied nine small, but long surviving, irrigation systems in the dry areas of Burkina Faso and Niger. They measured system performance using both physical and nonphysical factors and found that an average measure of performance based on six indicators was highly correlated with governance arrangements conforming to the design principles (see Crook and Jones 1999; Merrey 1996, who found supporting evidence). In light of positive support by other scholars for the validity of the design principles, it is appropriate to review some of the research that focused specifically on these principles.

WELL DEFINED BOUNDARIES

The first design principle is to define the boundaries of the resource system clearly, as well as the individuals or households with rights to harvest resource units. If a group of users can determine their own membership – including those who agree to use the resource according to their agreed upon rules and excluding those who do not agree to these rules – the group has made an important first step towards limiting access and developing greater trust and reciprocity. Using this principle enables participants to know who is in and who is out of a defined set of relationships. Thus, they know with whom to cooperate. Smaller resource governance systems do not always have extensively developed rule systems, but those that are robust do tend to always demark their boundaries (see Schlager 1994; Berkes 2007; Berkes *et al.* 2001).

Group boundaries frequently possess well understood attributes, such as residing in a particular community or joining a specific local cooperative. Membership may be marked by various tags (symbolic boundaries)

and involve complex rituals and beliefs that help solidify individual beliefs about the trustworthiness of others. Contemporary developments in evolutionary theory applied to cultural systems and processes of adaptation help to explain how these design principles work to help groups sustain and build their cooperation over long periods.

Just the process of defining the boundaries carefully, however, may not be sufficient in and of itself. In his study of irrigation systems in Nepal, Shukla (2002) found that almost all of the systems he studied had well demarked boundaries. A substantial difference existed between the FMIS discussed above as contrasted with the AMIS. On the FMIS, the farmers themselves determine the size of the areas served. The farmers who demark the boundary will also have to participate in the construction of the system and its maintenance by contributing time, materials and, potentially, some funds. Thus, the boundaries of irrigation systems developed by farmers tend to be conservative so that those who make the system work have more surety of getting water.

By contrast the demarcation of boundaries in AMIS tends to take place through donor funded projects. Irrigation engineers are strongly motivated to show a positive benefit–cost ratio. The more farmers placed within the service boundary of a system, the higher the benefits reported in the plans submitted to donors for funding. After initial funding, few efforts to check the reliability of earlier estimates occur. In fact, despite promises to the contrary, farmers may not receive a reliable supply. Moreover farmers on these systems are more likely to steal water and less likely to contribute resources to maintenance.

PROPORTIONAL EQUIVALENCE BETWEEN BENEFITS AND COSTS

The second design principle is that the rules in use allocate benefits proportional to the inputs required. Devising rules related to how much, when and how to harvest different products and how costs for operating a system are to be assessed is essential if a group of users wants to harvest from a resource over the long run. When the rules related to the distribution of benefits are consistent with the distribution of costs, participants are more willing to contribute to keep a resource well maintained and sustainable. Relating user inputs to the benefits they obtain is a crucial element of establishing a fair system (Trawick 2001). If some users get all the benefits and pay few of the costs, others will not be willing to follow rules over time (Ensminger 2000).

With different rules in place in long surviving irrigation systems, for

assessing water fees used to pay for maintenance activities, water allocation tends to be proportional to monetary fees or required labour inputs (Bardhan 2000; Bardhan and Dayton-Johnson 2002). Sometimes distribution of water and responsibilities for resource inputs relate to the shares owned by farmers, the amount of land owned and irrigated and the order taken (Tang 1992; Lam 1998).

COLLECTIVE CHOICE ARRANGEMENTS

The third design principle is that most of the individuals affected by a resource regime may participate in enacting their rules. This enables regimes to tailor rules to local circumstances and to devise rules considered fair by participants. As environments change over time, being able to construct local rules is particularly important, as officials located far away do not know of any changes. When local elites are empowered at the collective choice level, policies that primarily benefit them can be expected (Platteau 2003, 2004; Ensminger 1990).

In a study of 48 irrigation systems in India, Bardhan (2000) finds that the maintenance quality of irrigation canals is significantly lower on those systems where farmers perceive rules made by local elite. On the other hand those farmers (of the 480 interviewed) who responded that the rules for their system have been crafted by most of the farmers, as contrasted with the elites or the government, have a more positive attitude about water allocation rules and rule compliance of other farmers. In all of the villages where a government agency decides the allocation and distribution of water, farmers report frequent rule violations and tend to contribute less to the local village fund.

MONITORING

Relying only on endogenous levels of trust and reciprocity among harvesters is not associated with long term regime survival. Rule enforcement must occur in some manner to achieve sustainable systems. Too often, when a reform is proposed, it ignores the question of rule enforcement. Too many *comanaged paper parks* were drafted in the home office of an overseas donor or even in a country's capital city only to be destroyed by illegal harvesting in the specified territory. While many agree that rule enforcement is necessary to create a sustainable resource over time, considerable disagreement exists about who should monitor (see Bruner *et al.* 2001; Wells and Brandon 1992).

Most long surviving resource regimes do select their own monitors, who are accountable to the appropriators or are appropriators themselves and who keep an eye on resource conditions as well as on harvesting activities. By creating official positions for local monitors, a resource regime does not have to rely only on local community norms to sanction a rule breaker. The community creates an official position. In some systems, users rotate into this position so everyone has monitor duty. In other systems, all participants contribute resources and they jointly hire monitors.

In a study of the forest conditions used by 178 forest user groups located in 12 countries studied by the International Forestry Resources and Institutions (IFRI) research program, Gibson *et al.* (2005) found that the level of local monitoring varies substantially across groups. One of the measures obtained in this study is the frequency with which a local group monitors and sanctions rule breaking behaviour in the forest.⁶ We examined the impact of this variable on appropriators' assessment of forest conditions (as well as on a forester's assessment). We also examined the impact of group social capital, group dependence on forest resources and the degree of formal group organization. The result of the analysis is that regular monitoring by a local group is more important than the other three variables in enhancing forest conditions. Regardless of the levels of social capital, forest dependence and formal organization, regular monitoring and sanctioning are strongly and statistically associated with better forest conditions.

GRADUATED SANCTIONS

The fourth design principle is the use of graduated sanctions by robust governance arrangements. In many self organized systems, the initial sanction imposed by a local monitor is small. The initial sanction needs to be considered more as information to the person who is caught as well as to others in the community. Everyone can make an error or can face difficult problems leading them to break a rule. In a regime that uses graduated punishments, a person who purposely or by error breaks a rule is notified that others noticed the infraction (thereby increasing confidence that others would also be caught). Further the individual learns that others continue to extend their trust and want only a small token to convey recognition that the mishap occurred. The capability to escalate sanctions enables a regime to warn members that if they do not conform they will have to pay higher sanctions.

CONFLICT RESOLUTION MECHANISMS

The fifth principle bolsters the operation of the above principles, which point to the importance of access to rapid, low cost, local arenas to resolve conflict among users or between users and officials. Unlike physical constraints, rules require understanding in order to be effective. Situations always exist in which participants can interpret a rule differently. By devising simple mechanisms to get conflicts aired immediately and resolutions that are generally known in a community, the number of trust reducing conflicts can go down. If individuals are going to follow rules over a long period, they must institute some mechanism for discussing and resolving what is or is not a rule infraction.

MINIMAL RECOGNITION OF RIGHTS

The sixth design principle affects the capability of local users to develop an effective regime over time. While some resource regimes have operated for relatively long periods without such rights (see Ghate 2000), participants have had to rely almost entirely on unanimity as the dictate used to change rules. Otherwise any temporarily disgruntled participant who voted against a rule change could go to external authorities to threaten the regime itself. Unanimity in order to change rules imposes high transaction costs and prevents a group from searching for better rules at relatively lower costs.

Some users do devise their own rules without creating formal, governmental jurisdictions for this purpose. In many inshore fisheries, for example, local fishers devise extensive rules defining who can use a fishing ground and what kind of equipment can be used (Schlager 2004). So long as external government officials give at least minimal recognition to the legitimacy of such rules, the fishers themselves may be effective enforcers of these rules when government agencies do not have the staff to enforce them. When external governmental officials presume that only they can make authoritative rules, then it is difficult, but not impossible, for local users to sustain a self organized regime (Johnson and Libecap 1982).

NESTED ENTERPRISES

When common-pool resources are larger, a seventh design principle tends to characterize robust systems – the presence of governance activities organized in multiple layers of nested enterprises. The rules appropriate

for allocating water among major branches of an irrigation system, for example, may not be appropriate for allocating water among farmers along a single distributory channel (Yoder 1994). Consequently among long enduring self governed regimes, smaller scale organizations tend to be nested in ever larger organizations.

COLLECTIVE-ACTION SUMMARY

Thus these and other scholars' consistent finding across empirical studies is that, while there are general design principles, there are no magic formulae for solving collective-action problems. Collective-action problems come in a wide range of sizes and shapes. The design principles elucidated above are an effort to identify core principles rather than blueprints for how best to govern environmental goods and services, especially in federal systems of governance. Applying these principles to small and medium sized resource systems is a challenging task, but one that is simpler than designing effective institutions for global resources (Ostrom *et al.* 1999). The tough task ahead is to do the exacting empirical and theoretical work to identify which of these principles scales up to larger size and what new principles have to add.

NOTES

1. I am deeply appreciative of the support provided for my research in recent years by the National Science Foundation, Ford Foundation and MacArthur Foundation. The brilliant editing and insights of Patty Lezotte have helped immensely with this manuscript and many others.
2. Until recently there has been considerable rebel activity in Nepal that disrupted activities, creating many tragedies for Nepali farmers. The findings discussed in this chapter are based on data, most of which was collected in earlier peaceful times.
3. Readers who wish to dig deeper are encouraged to read Lam (1998), Joshi *et al.* (2000), and Shivakoti and Ostrom (2001) and the extensive references cited therein.
4. For an important study of Philippine irrigation systems with findings consistent with our findings in Nepal, see Araral (2005).
5. This section draws on Chapter 9 of E. Ostrom (2005).
6. Four levels of monitoring were recorded: never, occasionally, seasonally or year-round. We dichotomized this variable and recoded seasonal or year-round monitoring as regular and never or sporadic monitoring as sporadic.

2. An ecosystems services approach: Income, inequality and poverty

Kerry Turner and Brendan Fisher

The concept of ecosystems services was developed to strengthen the link between well functioning ecosystems and the flow of economic benefits that they generate on a long term basis (Daily 1997; Turner and Daily 2008; Fisher *et al.* 2008). Although the term and concept of ecosystems services has received a great deal of attention in contemporary academic literature, an operational decision support system for better ecosystem conservation and environmental change management has been slow to emerge. Any approach adopted should demonstrate the role that healthy ecosystems can play in the sustainable provision of economic development, poverty alleviation and enhanced human well being.

The human welfare benefits derived from ecosystem goods and services (for example, recreation and amenity, climate stabilization, water supplies, crop pollination, to name a few) represent both private and public goods. This supply spans a range of temporal and spatial scales and is enabled or hindered by property rights and other institutional arrangements. The resource space can represent common property, be privately owned, publicly owned by a community or nation or be subject to international treaties and agreements. The gainers and losers in any environmental change situation will therefore vary according to the type and scale of the ecosystem service conserved or threatened. They will also depend on the mix of stakeholders involved, the socioeconomic characteristics and the sociocultural context. This complexity ensures that equity, justice and legitimacy concerns will be significant in the political economy of ecosystems conservation (Adger *et al.* 2001; Paavola and Lowe 2005).

This chapter first reviews the literature dealing with distribution, development, ecosystems services and their valuation. It then makes the link between ecosystems conservation and poverty alleviation. Finally it describes a full decision support system, the ecosystems services approach (ESapp) and assesses its prospects in terms of conservation and human development objectives.

ENVIRONMENTAL CHANGE AND INEQUITY

During the twentieth century, the world experienced an unprecedented increase in the scale and rate of economic growth, as conventionally measured by GDP (gross domestic product). GDP has doubled almost three times since 1950. However both nature and poor people seem to have lost out to a significant degree. A growing number of commentators have questioned the axiom that economic growth, stimulated by human ingenuity and technical innovation, is the most important and powerful force for human progress and poverty reduction (Stiglitz 2003; Wade 2004). If the view of economic development is as a process for improving the overall quality of human life and livelihoods, then it seems that something more than mere want satisfaction (dominated by the consumption of marketed and heavily advertised goods and services) is required. A good and happy life must also encompass satisfactory human relationships and communities, capabilities (choices) and opportunities (Sen 1999; Layard 2005). Even more fundamental is the continued support system provided by nature, that is, ecosystems and their services (known as natural capital) so that humanity's long term livelihood needs (shelter, food, clothing and so on) are adequately catered to. The recent focus at the political level on climate change and its impacts has served to draw attention to a whole host of associated empirical evidence pointing to the fact that global economic activity fuelled by consumer spending and international trade, together with population growth, are pressurizing the ecosystem support systems, possibly to breaking point.

The economy has largely failed to register the warning signals (for example, scarcity driven price increases) because many ecosystem services are public goods that tend to be underpriced, or treated as free, and therefore will continue to be prone to overexploitation. Our ecosystem capital assets may be irreversibly lost (literally, or on grounds of cost and practicality) and their demise can be abrupt with the breaching of poorly understood thresholds. Poor people and communities are least able to cope with the negative socioeconomic consequences that such stresses and shocks cause and thus remain in a poverty trap (Adelman and Morris 1997). Those stuck in this trap include the one billion or so people who lack daily access to safe drinking water, electricity, secure food supplies and basic education (Gleick 1999; FAO 2003; World Bank 2001).

As bleak as the snapshot is, there is evidence that the gap between the rich and poor may be growing (Wade 2004). Bourguignon and Morrison (2002) conclude that the income divergence between the rich and poor countries has at best decelerated since 1950. The average person living in the richest country 100 years ago had nine times the wealth of the average

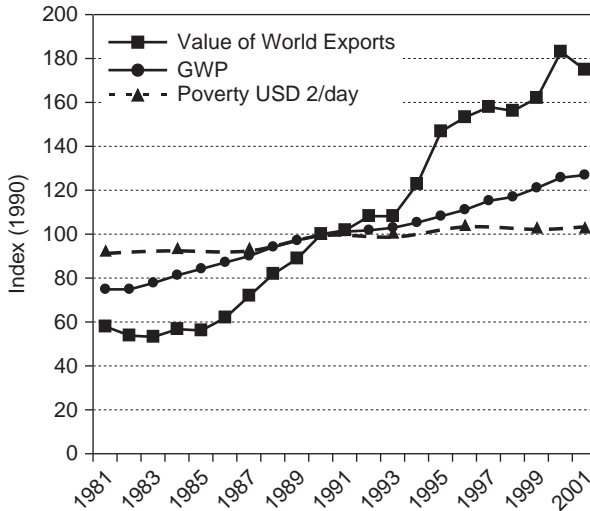
person living in the poorest country. Today the average person in the richest country is 60 times wealthier (Florini 2003).

Two recent studies on poverty conducted by the World Bank (WB) have produced very different snapshots of the world poverty trend (Wade 2004). The 2000/2001 World Development Report showed a 20 million-person increase in the number of people living on less than USD 1 per day during the 1990s. However, the report *Globalization, Growth and Poverty* (Collier and Dollar 2001) reported a 200 million decrease in the number of people living below this extreme poverty line. These conflicting statistics on world poverty from the very institution mandated to help 'the poorest of the poor' begs the question: how efficient is this model of development?

Even taking the optimistic figure of 200 million rising above the extreme poverty line, the outlook is depressing if we continue operating in a business as usual manner. The World Bank (WB) states that economic growth is the most powerful force for poverty reduction (Collier and Dollar 2001), but following a pro growth path, pushed by the WB and International Monetary Fund (IMF), and using the optimistic figure of 200 million persons, it would take an annual Gross World Product (GWP) growth rate of 25 per cent to halve the number of people currently living in extreme poverty in the next ten years. That growth rate is almost five times the GWP growth rate over the 1990s.

Figure 2.1 depicts gross world product, value of world exports and the number of people below USD 2 poverty line since 1980. The past 25 years, beginning in the early 1980s, has been a time of urgent push towards trade and financial liberalization, following the neoliberal model of development. As reflected in the value of world exports. While gross world product has seen a strong increase over the past few decades, based on these figures, the number of people living on less than USD 2 per day, including those below the USD 1 extreme poverty line, has also increased.

The engine of economic growth, international trade, involves an ecologically unequal exchange and arguably the accumulation of ecological debt, which rich countries owe to poor countries (Martinez-Alier 2002). The causes of ecosystem change often are activities beyond a nation's boundaries or within its territory but beyond its control. The resource exploitation frontier, for example, for oil and gas, metals, shrimp, palm oil and similar advances into new territories have local costs usually borne by the poorest social groups. The prices received for exports from the frontier do not include compensation for the local or, sometimes, global environmental costs. This exacerbates the debt burden problem because rich countries make disproportionate use of environmental space or services without proper payment or recognition of other people's entitlements. So far evidence to support the proposition that the environmental costs



Note: Despite large gains in GWP and global trade, the number living on less than USD 2/ day has stayed steady.

Source: Data from *World Development Indicators Database*, www.worldbank.org.

Figure 2.1 The value of the world exports, gross world product and USD 2/ day poverty line as indices (1990 = 100)

of human economic activity are distributed unevenly in favour of richer countries, has been qualitative or context and case specific (Martinez-Alier 2002). In a novel study (Srinivasan *et al.* 2008), researchers have for the first time provided an aggregated quantitative analysis at the global scale, of the distribution of environmental impacts across income groups, for the period from 1961–2000, with important implications for ecological debts between groups.

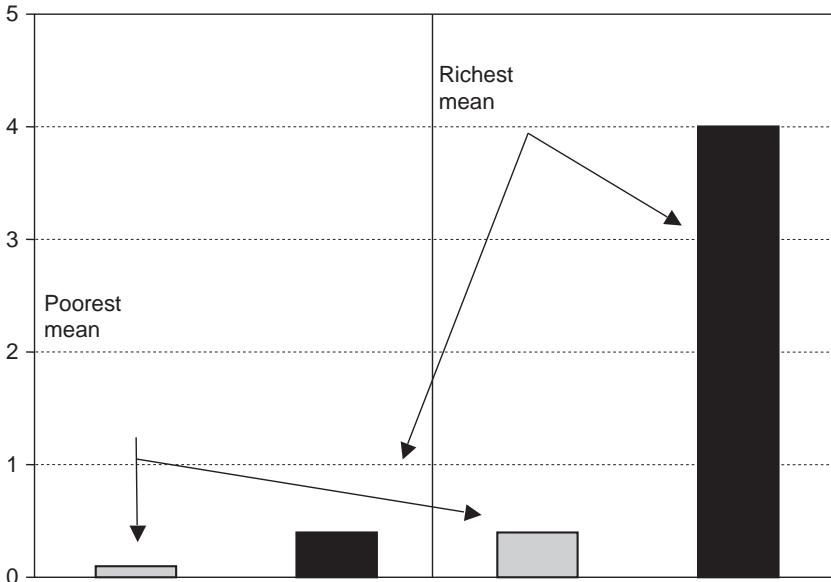
Six major categories of environmental change – climate change, stratosphere ozone depletion, agricultural intensification and expansion, deforestation, overfishing and mangrove conversion – were investigated and the costs borne by low income (L), middle income (M) and rich nations (H) were calculated as a discounted stream (two per cent discount rate) and adjusted for different currency purchasing power. Total costs distribution was uneven across the groups, with the L group bearing 20 per cent, M group 60 per cent and H group 20 per cent. When adjusted for equity weighting (that is, each pound or dollar is worth more to a poor person than a rich person), the percentages were 45 per cent, 52 per cent and 31

per cent, respectively. A significant proportion of the cost burden borne by a particular income group showed links to activities by other groups. Thus, the climate change and ozone depletion impacts estimated for poor countries come from emissions from richer countries and the same pattern appeared for overfishing. The study notes that rich countries may have imposed climate damages on poor countries, which are greater than the poor countries' existing foreign debt.

Several caveats are in order to put these striking results into proper context. The study is only as good as the available data, which is far from perfect and therefore the results are indicative. Some significant omissions occurred and we looked at biodiversity loss, see examples at the end of this section. Only costs have been quantified and the benefits (except in the climate change analysis) of all the increased economic activity, material, health improvements and the rest were ignored. Nevertheless none of these quibbles is enough to reverse the study's results. It turns out that the available, albeit partial, evidence on benefits points to the fact that there is also an uneven distribution present. The trends in the aggregate indices are clear as indicated by the growth level of rich versus poor countries over the last 200 years (Figure 2.2; see also Figure 2.1).

The conclusion, again, from Bourguignon and Morrison (2002) is that divergence between rich and poor nations has at best decelerated. The international community has been sufficiently alarmed to put forward, through the United Nations, a charter containing eight Millennium Development Goals focused around livelihood improvement (UN Millennium Project 2005). By 2015 the aims, among others, will be to abolish extreme poverty and hunger; establish universal primary education and reduce child mortality; and ensure environmental sustainability through the continued maintenance of healthy ecosystems and biodiversity.

The safeguarding of healthy ecosystems and biodiversity, directly and increasingly link to poverty and poverty alleviation goals. There is a high incidence of poverty in rural areas of developing countries and rural livelihoods intimately relate to natural capital stocks. Furthermore the rural poor often occupy marginal land, that is, steep slopes in watersheds or boundary zones surrounding biodiverse forests (FAO 2007). While the land may be relatively unproductive in agricultural terms, it may nevertheless provide a range of ecosystem services of benefit to a number of local/national/international stakeholders. So an important policy question may be, are there win-win solutions to be found *via* policies that combine biodiversity conservation and poverty alleviation objectives? The answer is somewhat equivocal. Some analysis seems to show that biodiversity hotspots, or areas that contain exceptional concentrations of endemic species and are experiencing loss of habitat, do overlap with areas containing extreme poverty



Note: The 4-fold difference that existed in 1820 was up to a 10-fold difference in 1992.

Source: Data from Bourguignon and Morrison 2002.

Figure 2.2 The mean incomes of the poorest 60 per cent of countries and the richest 10 per cent for the years 1820 and 1992 (indexed poor countries = 1 in 1820)

as measured by indices such as access to clean water, food scarcity and national debt service difficulties (Fisher and Christopher 2007). However this work and related studies are set at the national level and therefore do not reflect subnational spatial poverty patterns (Cincotta *et al.* 2000; Smith *et al.* 2003). The limited evidence available at the local spatial level casts doubt on the extent of the overlap between areas of high ecosystem conservation value and poor people. Pagiola *et al.* (2007) found no correlation between the importance of an area for water related ecosystem services provision and either the incidence or the density of poverty.

Adams *et al.* (2004) categorized poverty alleviation and biodiversity conservation viewpoints into four positions: poverty and conservation are separate policy realms; poverty is a constraint on conservation; conservation should not compromise poverty reduction; and poverty reduction depends on living resource conservation. Turning to the discipline

of economics for guidance, we can note that according to the *Tinbergen Rule* (Tinbergen 1956), in a second best world with inevitable market, institutional and information failures, a combination of policy instruments is required if multiple objectives are to be met. What the rule indicates is that a single policy instrument is unlikely to provide efficient and effective generic solutions to problems requiring the satisfaction of two or more objectives. Thus adopting Adams *et al.*'s fourth category and deploying a payment for ecosystem services aimed at conserving some ecosystem services and alleviating local poverty will only produce win-win outcomes in particular circumstances. Crucially, the payment schemes have to fit the specific context and be part of a wider policy package or strategy (Pagiola and Platais 2007). We examine ecosystem-service payment schemes in more detail in the next section dealing with the ecosystem services approach (ESapp) to policymaking.

ECOSYSTEM SERVICES APPROACH (ESAPP)

Integrating economic and ecological services into an operational decision support system may be a key step for global conservation and sustainability goals fulfilment. Couching ecosystem service research within economic theory gives us one way to move to a more practical combination of biophysical science, social science research and policy (Fisher *et al.* 2008). The operational decision support system (ESapp) put forward in this section addresses three interrelated policy relevant issues: marginality, infrastructure, insurance or 'glue' value associated with healthy ecosystems, and the necessity to capture nonmarket ecosystem service-values and benefits through some set of institutional arrangements (Daily 1997; Turner and Daily 2008).

Despite a proliferation of interest in ecosystem services, there have been relatively few attempts to define the concept clearly enough to make it operational (De Groot *et al.* 2002; Boyd and Banzhof 2007; Wallace 2007). Building on the Boyd and Banzhof (2007) position, we can define ecosystem services as those aspects of ecosystems utilized (actively or passively) to produce human well being. The services can be further qualified as intermediate and final services. Thus, food provision is a final service, whereas pollination is an intermediate service. The human well being (welfare) impact is the benefit, food for consumption. Benefits typically generated by ecosystem services (natural capital) in combination with other forms of capital include human capital, physical capital and social capital. In any capital accounting and/or valuation exercise, to avoid double counting, only aggregate and value the benefits of final services. Yet in contexts

where a single ecosystem service provides multiple benefits, such as flood regulation, drinking water and recreation, aggregation is legitimate.

We now turn to examine the three key research issues that an ESapp must accommodate. First studying ecosystem services should include things such as marginal changes in landscapes or seascapes. Marginality denotes that the value of a particular service, regardless of the metric, is a function of (small) changes in the flow of that service. So when, for example, forest services such as fuel-wood provisions or the supply of poles for construction are abundant relative to demand, our willingness to pay (valuation) for an additional unit would be small. However when the service benefit becomes scarce, the value assigned to it increases. Policy and economic decisions tend to focus on the marginality domain. For example, what are the implications of losing ten per cent of a given forest reserve to encroaching ranching or agricultural land use development? But not in contexts in which the total value of the loss of all global forest cover is hypothesized (Balmford *et al.* 2002; Turner *et al.* 2003). Marginal analysis also assumes that the response of an ecosystem to a small increase or decrease in structure or function does not result in large scale changes in the services provided as the ecosystem moves from one equilibrium state to another (Dasgupta and Maler 2003). Uncertainty often surrounds the existence and position of ecosystem change thresholds and therefore some degree of risk aversion is required in the policy process and recognition of the possible insurance, infrastructure or 'glue' value provided by a well functioning ecosystem.

Due to nonlinearity and time lags in how ecosystems respond to change, managing natural systems for ecosystem services will include some consideration of the precautionary principle, given that we lack sufficient information to determine accurately a minimum level for a healthy ecosystem. That is, an amount of structure and process capable of providing a sustainable supply of services at a particular location. However at the species level, more information is available on the role of increased biodiversity in perturbed systems (Naem and Li 1997; Tilman and Downing 1994; Tilman *et al.* 2006). The challenge will be to replicate this structure-service relationship research at the landscape scale. For the moment, any safe minimum standard-based conservation policy will have to err on the side of caution and recognize the insurance value provided by intact habitats, as well as balance the benefits with the relevant opportunity costs.

The third policy-research focus concerns capturing the benefits of ecosystem services so that realizable welfare gains achieved flow directly to people. Both formal institutional arrangements and informal communal arrangements can capture service benefits. Among the formal arrangements, the application of market-based mechanisms is increasing.

Mechanisms include taxes and user fees to curb undesirable behaviour, as well as payments and subsidies to give incentives for desirable behaviour (OECD 2001; Grieg-Gran *et al.* 2005). One particular group of price-based instruments have been labelled payments for ecosystem services (PES) and seem to offer potential 'double dividend' payoffs in terms of biodiversity conservation and poverty reduction (Bulte *et al.* 2008; Engel *et al.* 2008; Wunder 2008; Zilberman *et al.* 2008). Research into whether the poor really do gain in PES schemes clearly needs to explore the direct impact on poor people over time, but also recognize that if PES programmes proliferate, there will be a macroeconomic impact on a national scale. This impact may come in the form of food prices, labour and land costs indirectly conditioning livelihoods of the poor.

PES schemes that require land to be set aside to ensure service provision are only likely to benefit the poor if they themselves own the land and if the land is low grade agricultural land, but not high grade ecosystem services land. The poor may gain indirectly if the PES scheme serves to improve local environmental assets such as water supply and quality. Otherwise larger landowners will gain at the expense of the urban poor, landless and small landowners. PES schemes that involve working the land, for example, silvopastoral projects, tend to increase labour demand and affect productivity and output prices (including food). Landless groups such as the urban poor may gain if employment opportunities expand and food prices stabilize or fall. Yet landowners outside the PES scheme could lose if labour costs increase and output prices fall.

Institutional arrangements and transaction costs will play a significant role in whether poor people gain from PES schemes. Informal and insecure land tenure and the existence of large numbers of small landowners plus high transaction costs, constraining collective-action limit the extent to which the poor can benefit from PES. Overall, the evidence on PES and poverty reduction is mixed. In line with the Tinbergen rule, PES is certainly not a generic panacea with an inevitable 'double dividend' payoff. Combining poverty reduction and biodiversity conservation objectives routinely into a single simple PES can result in low efficiency and effectiveness. Nevertheless there are locations and contexts in which the poor can and do participate and gain benefits individually and even collectively via social capital augmentation. Such examples require appropriate design features, including safety net compensation provisions (Pagiola *et al.* 2005).

Tapping into stocks of social capital also provides an alternative or supplementary approach to ecosystem services maintenance. Currently there are more than 450 000 collective resource management groups in the world, governing resources such as watersheds, irrigation systems and forests

(Pretty 2003). While human societies throughout history have exploited their resources and degraded their environment to their peril (see Diamond 2005), situations where resource users face accountability to their fellow users can be managed sustainably for generations (Ostrom *et al.* 1999).

CONCLUSIONS

The adoption of an ESapp decision support system (see Figure 2.3) can help to achieve the Millennium Development Goals by halting and reversing the global decline in wild habitats and populations or, at the very minimum, show society the magnitude of the tradeoffs between conservation and conversion of natural systems.

An ESapp would serve to analyse and synthesize relevant knowledge and provide mechanisms for capturing the benefits that flow from healthy ecosystems and their services. The ESapp framework encompasses a comprehensive analytical and practical process, which begins with a problem/issue identification stage in which ecosystem service provision and the social, economic and politicocultural contexts are delineated and scaled. Then the chosen ecosystem services are mapped and valued. The management choices and their opportunity costs can be explored via scenarios of future states of the world and/or policy interventions. The public goods characteristics of some ecosystem services highlight the need for practical and inclusionary payments/compensation mechanisms to ensure real progress and the safeguarding of poor people and their livelihoods. Finally, adequate investment in capacity building, monitoring and reappraisal efforts is necessary to complete the circle.

The challenges that an ESapp will have to overcome remain formidable. Detailed information at scales useful to decision-makers on how people benefit from specific ecosystem services remains deficient and therefore conservation investment finance is still too low. PES schemes often require locally tailored and sensitive designs with adequate safeguards to protect the most vulnerable people. A 'one size fits all' approach is doomed to failure. The role that collective-action can play both within PES schemes and as an alternative approach should not be underestimated. More support for an ethical code that seeks to retain/enhance the 'opportunities set' for the least advantaged groups in the current generations, and the long run 'opportunities set' across generational time would underpin an ESapp. When contemporary business cycles turn downward and longer term perspectives become politically more difficult to support, the ethical basis on which local, national and international communities operate needs to be reaffirmed and not abandoned to short term expediency. As discussed

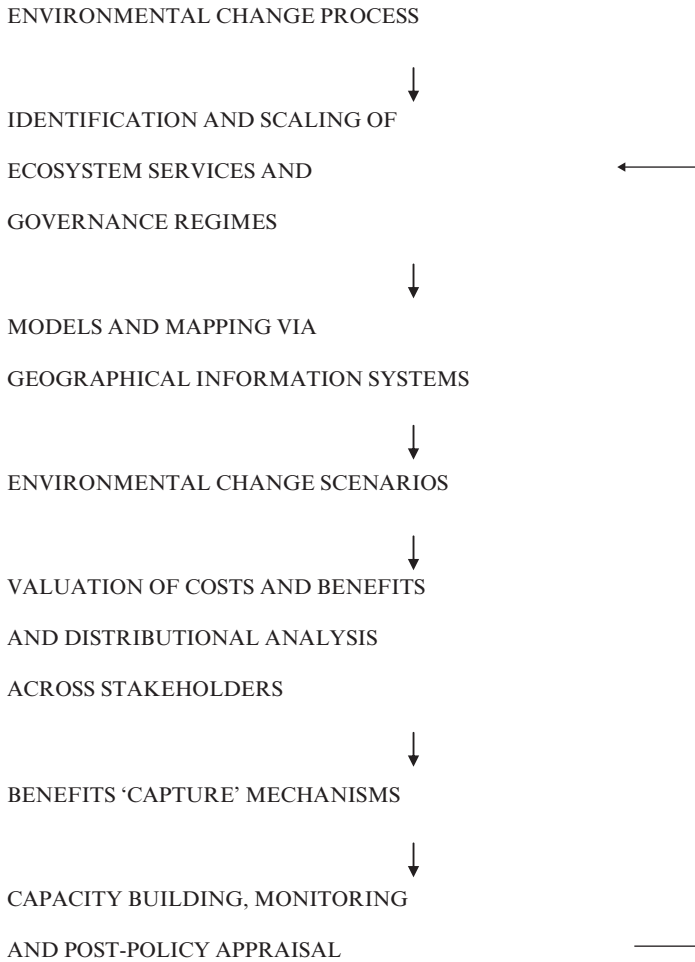


Figure 2.3 A simplified ESapp Framework starting at understanding changes in the physical environment through to post-policy appraisal

above the short term profit maximization has, on the global scale, driven externalities that with current information seem to fall disproportionately on the poor. The incorporation of ecosystem service assessments into policy and development contexts should go some way towards internalizing the costs.

3. Ecospace, humanspace and climate change

Ton Dietz¹

Geography as an academic discipline is back on stage after a century of gradual marginalization. Many scientists who call themselves economists, sociologists, hydrologists and so on, are contributing to our collective knowledge about the relationship between *man* and *environment*, the classic home ground of geography. Hans Opschoor is one of them. He was one of the nongeographers contributing to a recent book (in Dutch) entitled *From Natural Landscapes to Risk Society* (Dietz *et al.* 2008). The public and scientific worries about climate change have done much to revitalize geography, together with the improved abilities of geographers to visualize spatial and spatial-temporal phenomena, with the use of Geographical Information Systems (GIS). The dynamics of people's relationship with the earth result in a blend of earth sciences, social sciences and history. Particularly long history (or as the French say, *longue durée*) is part of that blend and it implies questions about the timescale to be used, but one can also not escape the question about spatial scale.

Issues of climate change put the terrestrial system centre stage, as well as extraterrestrial influences such as solar heat and its fluctuations and varying impact on the earth. In the distant past, meteorite collisions with the earth caused major climate change. Reconstructions and predictions of climate change for the earth as a whole are already complicated. Reducing levels of scale to regions on the earth is even trickier (see van Boxel 2008; Leemans 2008). Humankind's ability to understand climate fluctuations is only a recent phenomenon and the collection of systematic weather data is only a century old (in China a bit older). Proxy measures based on palaeobotanic and chemophysical evidence now allow scientists to formulate hypotheses about climates of older times, but there is much more to discover. We are only beginning to understand the dynamics of climate change coverage on geological and biological timescales (between 3–4 billion years), and of the evolutionary and migration histories of *Homo sapiens* (scale of 200 000 years) and its predecessors *homo*: 2.5 million years; *hominins*: 6–7 million years; *anthropoids*: 35 million years; and mammals in general: 200, but

primarily, 65 million years ago. Some scholars see the current era of climate change or, more generally, of human predation on earth's life support systems as the sixth extinction, in which humankind might be a victim too. The geological and biological timescale has sobering thoughts to offer. In the words of the authors of a fascinating book published by a geologist and a palaeontologist of the University of the Witwatersrand in South Africa:

The geological record has something to say about our being here. We know that 99.9% of all species that have ever lived are extinct, that they failed to meet the challenges of an ever-changing world . . . many species disappeared in mass extinction events . . . when environmental conditions changed abruptly – so fast that there was simply not enough time to adapt. The extinction toll in many of these events is frightening, especially in the so-called Big Five mass extinctions: 85% of the species lost at the end of the Ordovician, about 80% at the end of the Devonian, 96% at the end of the Permian, 76% at the end of the Triassic, and 70–80% at the end of the Cretaceous (McCarthy and Rubidge 2005, p. 299).

If we extend the timescale to astrophysical proportions, the thoughts become even more sobering. At some distant point in time, earth and the solar system will simply disappear and its remains become part of new constellations, with or without life, but certainly without humankind.

Perhaps we should use a timescale we can comprehend better, the lifespan of a single individual. Even then, the changes are overwhelming. If we consider the lifetime of Hans Opschoor, humankind was developing a tool of mass destruction, the atomic bomb, at the time of his birth and used it even before he could walk. A large part of humankind was busy killing each other by the millions. After humankind's recovery from that ordeal, we can now say that humankind experienced its most successful expansion as a species ever. The human population went from 2.5 billion when Hans was a toddler to the current 6.7 billion. Humankind developed an unprecedented growth of average economic well being, communication, average health and education levels. We developed tools for worldwide governance, which sped up globalization, including standards for human rights, nature conservation and, until now, the ability to keep the weapons of mass destruction in check. Still can humankind also develop global governance tools to keep climate change manageable and avoid its inclusion in the ongoing sixth extinction?

CLIMATE CHANGE AS A GOVERNANCE CONCERN

During Hans Opschoor's life the average temperature on earth increased 0.5°C, and CO₂ levels increased at least 70 ppm (or almost 25 per cent) (van

Boxel 2008, pp. 173–174). Data about The Netherlands show increased temperatures with the warmest months on record nearly all found in the years after 1980 and the coldest months almost all before 1940. The current worldwide attention for the causes and effects of climate change are a result of those facts, but certainly also, a result of the successful alliance of scientists, the media and politicians. Framing the changes as a problem for humanity has done much to give it its current urgency. The addition that the problem is ‘caused by humanity’s greed’ and some would say, short sightedness, did and does add to a feeling of collective guilt and of a collective task. There are solutions formulated both to mitigate the ongoing changes and to adapt better to these changes. Yet, between mitigators and adaptors, uneasy tensions exist. The mitigators think that as many efforts as possible should be directed to lower greenhouse gas (GHG) emissions (or avoid their rise to dangerous levels) and the adaptors feel that massive funds are needed to protect humankind and nature against inevitable changes. Despite this uneasiness, both mitigators and adaptors are fighting sceptics, who do not believe in human induced climate change, in the severity of its consequences, or regard it as one among many challenges for humankind, of which some deserve far more attention than climate change.

Climate watchers first started measuring GHGs in the 1950s and by the mid 1960s saw the first signs that GHG concentrations in the atmosphere were rising. In addition, scientists soon made the connection between the rising levels of GHGs and the rising levels of fossil fuel consumption in industry and transport, and to the expanding rice cultivation and growing livestock numbers. An American NGO, the Conservation Foundation, was the first to formulate a concern (in 1963), followed in 1965 by a presidential advisory committee. The 1970s pointed at the risks of major droughts and desertification, spurred by devastating droughts in Africa. The United Nations organized a conference against desertification in 1977 and created a separate UN Environmental Programme (UNEP), with its seat in Nairobi. A world climate conference in 1979 asked for more data about suspected climate change, but did not formulate any policy recommendations (Agrawala 1998). This lasted until 1985 when the World Meteorological Organization (WMO) warned of a rise in world temperatures ‘without precedent in human history’ at their famous Villach conference. In 1986, the International Council of Scientific Unions (ICSU) started its major research programme to speed up data collection: the International Geosphere Biosphere Programme. Particularly in the United States, fights had started at that time about the necessity for political action. The oil, energy and automobile industries were not prepared to invest heavily in what they viewed as, at most, an unclear problem where more research is

needed, supported by a Republican party that was fuelling pleas for less politics, more market. Conversely a strong environmental NGO community and the Environmental Protection Agency (EPA) lobbied for serious measures, supported by politicians and voters with a more Democratic outlook. The two international organizations which could be expected to take the lead (WMO and UNEP) had to engage carefully, dependent as they were on US government funding. Media coverage of some disasters led to sudden outbursts of attention and calls for action, like the heat waves in the US in 1987 and 1988 and the effects of hurricane Gilbert in the Caribbean. The fracturing of a major ice mass from Antarctica also caught media and popular attention. Meanwhile another atmospheric problem the world did attempt to tackle is, today, regarded as a showpiece of global governance: the limitation of CFC production to protect the ozone layer (the Montreal Protocol signed in 1987; see Junne 2008). Something had to happen, but the US faced an internal political impasse and has for the last 20 years. With pressure from the UK, Sweden and The Netherlands, and with the involvement of WMO, UNEP and ICSU, the formation of the Intergovernmental Panel on Climate Change (IPCC) was a way out. This body drew upon the global scientific community to study the severity of the problem and to come up with scenarios of likely effects, but it was not a global policy organ as it should have been (Agrawala 1998). Gradually the reports of IPCC became ever more alarming and convincing, based on a growing consensus among a large number of scientists. If one compares the 1995 and the 2007 reports, the change in tone is obvious (IPCC 1995, 2007b). Increasingly diverse scientists gradually began participating. In The Netherlands, initial dominant involvement of RIVM and KNMI led to an overwhelming presence of physical scientists (and some medical scientists). Later the involvement of NWO and its social science council MAGW led to growing participation of economists, human geographers, sociologists, political scientists and gradually psychologists, communication experts and legal experts in the ongoing research programme on Vulnerability, Adaptation and Mitigation (VAM). The Netherlands has been particularly successful in contributing to the development of integrated assessment models, like the IMAGE model, which tries to connect the dynamics of land and energy use with emissions, the carbon cycle, atmospheric processes, and effects on coasts, ecosystems, agriculture/food and health (Leemans 2008).

Soon after the start of IPCC, in May 1992, world leaders agreed to sign a UN Framework Convention on Climate Change, followed by the Kyoto Protocol in 1997. However, it only officially started after major disagreements, particularly with the sceptical US government under G.W. Bush that had taken over from the Clinton-Gore administration in 2000. For the

first time, goals had been formulated about emission levels of industrialized countries and about mechanisms to reach those goals, in and outside those countries (such as the Clean Development Mechanism, and Joint Implementation before 2012). Amidst controversies, the US administration did not ratify any agreements; hence the country with the largest GHG emissions on earth is still at large. Even if the US ratifies, reaching the 2012 goals would be impossible and even if it were possible, it would not be enough to keep global warming in check. Not only because of the insufficiency of targets for the industrialized world, but also because of increased emissions by the many newly industrializing countries over the past decade (China, India, Brazil, Turkey, Mexico and many others); changing the world's division of labour towards a pattern of northern services and southern factories. The best one can say is that the Kyoto Protocol offers room for policy experiments such as pricing of GHGs and international trade in emissions, until now, with dubious results. It is obvious that the negotiations that would lead to a new protocol for the period after 2012 need to incorporate fully the southern industrial countries and require global targets that are more robust and more forceful global implementation measures (see van der Gaast 2008). The worldwide growth of GHG emissions currently appears to be faster than in the most pessimistic scenarios of the IPCC (according to IPCC 2007b with currently 70 per cent more GHG emissions than in 1970), resulting in ever more dramatic horror scenarios that also led to very successful products from the entertainment industry. Ronald Emmerich's *The Day After Tomorrow*, released in 2004, shows the alarming prospects of dramatic climate change, leading to the paradoxical effect of a new Ice Age in the Northern Hemisphere as a result of global warming. Of course, it included Hollywood inspired scenes of droves of environmental refugees from the United States scrambling into Mexico and tearing down the fence that was meant to keep Mexicans out of the US. In 2006, Al Gore's *An Inconvenient Truth* used essentially a PowerPoint presentation as a tool to influence a truly global audience, although not yet with the necessary political impact in his own country. Documentaries by *National Geographic* show what would happen if the world's temperatures rose 1, 2, 3, 4, 5 or even 6°C during this century. An influential book by Jared Diamond, *Collapse* (2004) adds historical parallels to feed a millenarian feeling of apocalypse.

These and other messages result in numerous initiatives by municipalities and states (including many in the United States) to become more emission neutral and speed up mitigation measures, like clean energy, energy saving, transport rearrangements, carbon sequestration and underground storage, among many others (see Bulkeley 2003 for early experiences). World business has discovered that there is a future and niche, as well as

pioneer profits, in a more proactive stance, resulting in numerous initiatives by companies and public–private partnerships and with sometimes surprising collaborations between companies and NGOs. The chorus of socially responsible businesses give strong voice to environmental sustainability and to being wise protectors of earth’s atmosphere, and by implication of humankind. Feel good economics also plays a more prominent role now in convincing world leaders about possible win–win scenarios such as calculating the costs of climate change mitigation against the benefits of saving on adaptation or on lower healthcare costs (see Mitchell and Parson 2001). Some governments, such as Norway and Costa Rica have now even gone so far as to declare goals for their countries to become completely climate neutral. The European Union has taken the lead in formulating more serious mitigation targets and preparing more serious targets and implementation mechanisms for the decades to come. These are promising signs, but they are late, and maybe too late. Compared to the fast action with regard to CFCs and the ozone layer, GHG mitigation appears to be a much more complicated portfolio, as the causes and impacts are geographically so diverse. Now it is time to turn to geography.

CLIMATE CHANGE AND GEOGRAPHICAL DIFFERENTIATION

Earth’s ecospace consists of a large number of ecozones in which some have proven to be very attractive as humanspace and others regarded as harsh lands for human occupation and usage. Basic geography tells us that some of it has to do with intrinsic site values of the ecozone as a habitation and livelihood basis for human occupation, given the technologies at people’s disposal and given the cultural valuation regarding what is useful, beautiful and safe, or for that matter, useless, ugly or dangerous. Other reasons to make ecozones attractive have to do with situational aspects, their location vis-à-vis other places, hence, with aspects of centrality and isolation (or relative costs to deal with those situational aspects). On a global scale, the most attractive areas – in terms of demography – have as many as 50 000 inhabitants per square kilometre as in parts of Hong Kong. The most demographically unattractive areas are still huge expanses of unoccupied territory where no human has ever set foot, as in parts of Antarctica. The population explosion the world has witnessed, just since the middle of the twentieth century and the scientific and technological revolutions accompanying it have already resulted in rapid and massive changes in turning ecospace into humanspace and in changing the properties of ecospace itself, often dramatically. Climate change is now adding a

prospect of major additional shifts in the opportunities for humanspace, and in the composition of ecospace, some regarded as positive and others negative, although that qualification also depends on the valuation of both ecospace and humanspace and the cultural specificity of that valuation.

The slow implementation of mitigation measures, and the growing levels of GHG concentrations, will, at best, result in a bit less dramatic growth. The need for adaptation is obvious now and that begs for a more specific assessment of the geographical differences in the impact of climate change, not just by looking at doomsday scenarios. It may be superfluous to say that many things are not at all clear, yet, despite major recent gains in scientific knowledge, as the climate system is extremely complex with many positive and negative feedback loops. Particularly, the behaviour of the oceans in absorbing CO₂, in causing El Niño and La Niña disturbances and in creating Gulf Stream dynamics are not well understood yet, even as ever more (historic) data becomes available to fill gaps in our knowledge (see Caviedes 2007). The interconnectedness of climate and vegetation (both plants on the land and algae in the seas) does cause chain reactions locally, with poorly understood global repercussions. Regional scenarios of climate change expectations, in terms of rainfall and storms, are speculative as well and different models often give completely opposite outcomes (for West Africa, see for instance van Boxel 2004). Nevertheless, let us see what we do know.

A higher average temperature on earth definitely leads to sea level rise. For low lying island states, such as Tuvalu or the Maldives, this may mean the end (Barnett and Adger 2003) and for a country like Tuvalu, evacuation scenarios have already been developed, in this case assisted by New Zealand. Of course, low lying coastal areas are endangered as well, particularly when there are no dunes, dikes or dams to defend these areas against rising sea levels and storms. Rich countries with a history of defence works against inundation, such as The Netherlands will invest further in building higher dikes, constructing dams that are more robust and defending their dune system (see Borger 2008). The prospect of *Amersfoort at Sea* is a metaphoric warning with strong appeal, also because the western part of The Netherlands has an additional problem of tilting towards the sea due to physical processes in its peat soil, partly from increased drainage. The experience of the 1953 inundations (*watersnood*) is a strong reminder of what might happen, engrained in popular image, but nowadays the number of people living in threatened areas is much higher, as are the economic assets that could be lost versus half a century ago (Bouwer and Vellinga 2008). Civil engineering, architecture, spatial planning and public administration started to experiment with possible solutions for a variety of adaptations. Still, what happens in areas with less experience? Even the

United States had to be hit by a disaster of the magnitude of Katrina (1836 victims and USD 81.2 billion in damages in 2005) before it realized the vulnerability of its coastal zones. The public was confronted by what stared them in the face – the poor are the ones to be hit most, as they are generally in the most vulnerable locations, and often do not have the insurance and recovery capabilities the rich have, even if some of the rich lost more assets in absolute terms. Compared to a century ago both in absolute and in relative terms, many more people now live in vulnerable coastal areas, which have become the most sought after humanspace in many countries. Massive migration movements of people towards coastal areas, where economic prospects are generally better, have supplemented the global population explosion at least compared to isolated inland areas. West Africa is an interesting example. Between 1960 and 1994, almost everywhere, the coastal population increased at least fourfold (Dietz and Veldhuizen 2004). Many more people than before live in extremely vulnerable coastal cities, often with chaotic and incompetent municipal administrations.

Rising average temperatures will result in overall increases in rainfall and probably in higher likelihoods of rainstorms, leading to swollen rivers and downstream inundations. The Netherlands is more vulnerable in this respect, because it is a delta of rivers from a variety of watersheds, which together cover a relatively large area. Again, The Netherlands is in a position to defend itself and to spend considerable tax money on river dikes and other defensive and preventive structures, even leading to major investments in water planning (see van Schendelen 2008). On the other hand, the higher average rainfall, higher groundwater levels and higher water transport by rivers will (on a world scale) result in higher water availability for human, animal and plant consumption, countering somewhat the expected growing water stress because of growing water demand per capita (Donkers 2008; Allen 2003; Vörösmarty *et al.* 2000).

Storm frequencies and severity will likely grow as well. This requires stronger buildings and other civil engineering structures, more prudence and a health and insurance system that can deal with storm consequences. In Florida, this already causes major problems, with increasing costs for those who want insurance and higher risks for insurance companies. There is a moral problem as well. If the causes of storm damage are mainly found in the North, and the disasters mainly in the South; and if the insurance densities in the South are much less than in the North, should there be a global insurance polis, in which the ‘polluter pays principle’ is used as an element of global environmental justice (see Adger 2001)?

The expected changes in rainfall and storm regimes together with increased evapo(transpi)ration levels due to higher average temperatures will not be equally distributed over the earth’s surface. Popular images of

climate change invariably use droughts and famine as icons of danger, but this is not what to expect, generally. Many areas will receive more rainfall on average. Some areas will face drier conditions on average, due to changes in weather patterns. However, it is not very clear where these areas might be. What is clear is that climates will become less predictable and that seasons are, no longer, as they used to be. Farmers all over the world experience greater insecurity. The start of the rainy season is no longer normal; periods of rainstorms followed by long periods of droughts, often during parts of the agrarian cycle where it is most unwanted have become the norm. Of course, farmers everywhere always dealt with weather insecurity, but it seems that insecurity is growing and farmers have become more vulnerable. Higher average rainfall may increase possibilities for irrigation, although storms could damage the irrigation structures.

The major cause of climate change, higher levels of CO₂ in the atmosphere, does also have positive effects on farming, as some crops grow better under conditions of higher CO₂ levels. On average, this and higher average rainfall globally will probably result in better prospects for agriculture and better results per hectare. Moreover areas, which function as icons of doom (the Sahel, in particular), are not necessarily facing worsening agricultural conditions. Of course, the drought between 1970 and 1985 had severe consequences, but after 1986 rainfall improved significantly and sequential satellite images show a much greener environment. Better rainfall and farmers who have adapted remarkably well to greater insecurity, plus a more stable, more reliable government and market environment are all reasons for optimism (Dietz *et al.* 2004; Batterbury and Warren 2001; Reij *et al.* 1996), until the next major drought.

In areas with a winter stop for plant growth, higher temperatures will result in longer agricultural seasons and probably higher yields. Higher temperatures will also push the vegetation and crop boundaries to areas further North, South and to areas higher up in the mountains. Because of the distribution of land surfaces on earth, it is a fact that at higher latitudes in the Northern Hemisphere a lot of land waits for colonization by (agricultural) plants. This could mean an enormous increase in potential cropland in Canada, Alaska, Siberia, Scandinavia and maybe even Greenland (where an agricultural settlement once existed, see Diamond 2004). Many of these lands are currently quite empty and mainly home to nomadic pastoralists, if used at all. One may expect major migration movements northward, and for the current inhabitants, the Inuit of America, the Samen of Europe and the various groups in Siberia, which either means a change to a more mixed economy or further moving northward following their food. Biologically one can expect a major increase of vegetation in these Northern zones, and hence a lot of additional CO₂ sequestration as a result.

In the stories of doom and gloom, some negative effects get far more attention: the melting of the taiga underground will release enormous amounts of methane, enhancing GHG emissions, destroying a lot of infrastructure now built on solid (frozen) ground. There are many oil and gas pipelines among it and that may be an ironic revenge of history. In mountain areas, rapid changes are happening as well and we see the same contradictions there in increased possibilities for habitation and agriculture, but maybe the end of a lucrative winter sports industry and of a tourist industry marvelling at the glaciers and snow caps of the world's mountains. The loss of Kilimanjaro's majestic cap of snow is an icon of doom indeed. What is probably far more destructive is the impact of changing temperatures on the Himalayas and the Andes, feeding the world's most important river systems and potentially disturbing the Ganges, Indus, Brahmaputra watersheds, the Amazon basin and many other river systems, on which major ecospace and humanspace depend.

Higher temperatures in areas with already high summer temperatures will lead to growing water stress among plants, animals and people. In some areas, it will make agriculture no longer viable and will probably lead to depopulation (as is currently occurring in inner Spain). It may also undermine tourism; the perception is that some of these holiday destinations are becoming intolerably hot, despite the growing and ever more expensive use of air conditioners. Heat waves like the one in France in 2005 caused alarming numbers of additional deaths during the summer months in areas formerly considered temperate zones. Health risks are also moving geographically; with ecozones for the malaria mosquito and the tick moving north (see Martens and Moser 2001). Heat and drought also pose a major fire risk and a risk for vegetation, built structures and human life. Forest fires in California and the Mediterranean get a lot of publicity and frequently connect to climate change. Forest fires in Kalimantan caused a lot of smog in cities like Singapore and released a lot of sequestered CO₂, with potentially spiralling effects. Climate change is not the only cause of these forest fires. A lot of it is a result of manmade changes in the rain forest, part of it deliberately caused to make room for humanspace or to feed the greed of forest and biofuel entrepreneurs.

In colder areas, higher average temperatures create the opposite, better habitats for humanspace, with more options for outdoor activities and lower energy bills. The recent *Mediterraneanization* of some North European coasts speaks for itself. As with many aspects of the dynamics in the relationship between humanity and our environment, climate change has winners and losers. One may expect that many of the winners can be found in the North (with cases like The Netherlands requiring massive investments to continue being part of those winners) and many of the

losers in the Tropics, particularly among the poor in the most vulnerable humanspaces in the low latitude and low prosperity areas of the world. Risky places attract the most vulnerable people that can least afford those risks.

Global warming does provoke questions of global environmental justice and questions of geopolitics and international law as can be seen in the geopolitical tensions at the North Pole and the prospects there of oil, gas and new transportation routes. Redistribution of wealth and a global system of insurance against the risks posed by the variety of impacts of climate change should be high on the agenda of global governance institutions combined with the concerns of environmentalists and the development industry.

Redistribution also plays a role with regard to one of the solutions, which currently has reached the policy and media coverage level of another hype – the global expansion of bio- or agrofuels. Brazil has been busy for years changing its fuel dependency from fossil fuels to ethanol produced from sugar cane. Currently biofuels provide only two per cent of global energy demand (32 billion litres per annum). The International Energy Agency (2004) talks about ten per cent in 2025 and 30 per cent in 2050: ethanol and biodiesel based on sugar cane (mainly in Brazil), maize (mainly the US), palm oil (mainly from Southeast Asia), linseed oil and soy oil (mainly in the EU), and other vegetable oils (with *Jatropha* a rising star, mainly in Africa). This is a likely but very controversial development. Energy experts point at the inefficient way in which solar energy transforms into fuel via plants and wonder if more investments in real solar energy would not be more useful in the end. One of the most controversial elements has to do with its geography. The ecospace that will most likely be developed as biofuel plantation zones will mainly be found in the (sub)tropics, undermining remaining areas of rain forest and other natural environments and potentially undermining food production in former subsistence or local market providing areas.

The first effect will potentially increase global warming; so that one form of mitigation (nonfossil fuel energy availability) becomes a threat to mitigation in general and hence will increase global warming. The second effect will increase income opportunities for those with access to land and it might further increase the overall prices for agricultural produce that are already happening as a result of growing urban and Asian demand for global food and energy. The scale that is required will favour large scale producers and will provide employment for many workers across the globe. Many of these large scale producers will be global firms and quite a number of them with history and headquarters in the global South, thereby adjusting further the unequal power structures in the global economy. It

is all a matter of balance. If growing incomes and employment opportunities based on biofuel and lower energy prices outpace the growing prices for food, the overall effect might be positive, but then it depends on who gains and who loses, as ever. Serious attention on these issues would also establish some kind of balance between the effects on humanspace and the effects on ecospace. What parts of nature will be more sustainable and what parts will be the victim of these developments?

That brings us back to those core notions in Hans Opschoor's own work: the combination of the balance between instrumental and intrinsic values of ecospace and the balance between current humanity (and its widely divergent interests), future humanity and other elements of the world's ecological heritage. It begs for a continuation of the work started by Hans Opschoor in the 1980s, with its combination of economic analysis and moral appeal (see Opschoor *et al.* 1989), though with due attention to geography and questions of spatial and temporal scale.

NOTES

1. Professor Ton Dietz was the Scientific Director of the Netherlands Research School for Resource Studies for Development (CERES) of which Professor Hans Opschoor was Chair of the Board

4. After us, the deluge? The position of future generations of humankind in international environmental law

Nico Schrijver¹

In response to Hans Opschoor's concerns about the future (Opschoor 1990), this chapter examines the particular contribution of international law and the extent to which contemporary public international law reflects the long term interests of humankind, with particular reference to international environmental law. After a short sketch of the environment and scarcity problem, the next section examines the position of future generations in international law and weighs the pros and cons of regarding humankind as a subject of international law. This is followed by a discussion of several experimental laboratories for the rights of future generations with special attention to the principle of the common heritage of humankind. Subsequently, the chapter examines three further principles that are central to the discussion on the rights of future generations: intergenerational equity, precaution and sustainable development. Then an argument for a clearer exposition of the concept of sustainability in the international community and for agreement on concrete principles and rules of international law that would make this possible is presented. This would require better institutional structures, a subject discussed in the section, 'International architecture for the management of the earth'. The last section summarizes the rights of future generations before drawing a conclusion.

The world media report almost daily on environmental damage, poverty, famine and conflicts over access to natural resources. The past few years have recorded not only a devastating tsunami in the Indian Ocean, a severe earthquake in Pakistan and several large scale hurricanes in the Caribbean (*Katrina, Rita, Gustav*), but also a continuing rise in temperature, the melting of polar ice faster than feared and a worldwide increase in the production of greenhouse gases. The first events are natural phenomena over which humankind currently has no influence. However, the latter are probably the consequence of human activity and, therefore, can be influenced. They compel us to change production and consumption patterns. This is

increasingly expressed, internationally and, thankfully, now nationally, as the concept of sustainable development, which because of the Brundtland Commission is high on the international political agenda. In its 1987 report *Our Common Future*, the Commission succinctly defined sustainable development as, ‘. . . development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED 1987, p. 43).²

This concise description expresses both the needs of the current and future generations as well as the capacity of the earth and its natural resources. A small group of people (in industrialized countries) must not consume all the natural resources. People in developing countries and future generations, everywhere in the world, must be able to meet their needs. Furthermore sustainable development implies that the current generation may not burden future generations with irreparable damage to the environment, health or economy that would considerably limit their development potential.

The above issues raise vital questions. Will the international community be able to remediate the processes of climate change, deforestation, pollution and the continuing loss of biological diversity within our generation? Will it be able to halve, by 2015, the number of nearly one billion people who now live in abject poverty on less than USD 1 a day and reduce child mortality as agreed at the Millennium Summit of the United Nations (United Nations 2000)? Will it be able to guarantee sustainable development by 2015 by integrating sustainability in national policy, thereby stopping the loss of natural resources and cutting the number of people without access to safe drinking water?³

HUMANKIND AS A SUBJECT OF INTERNATIONAL LAW

Do future generations bear any rights or duties under international law or can there be none ascribed to future generations simply because they do not yet exist and therefore cannot themselves invoke these rights (if they can be classified as such)? Before looking into this question, it is useful to ponder another: ‘Who constitutes humankind?’ It appears meaningful to understand humankind as all preceding and all succeeding generations. In other words, all the people who have ever lived, all the people now living and all the people who shall ever live in the future.

This chapter focuses upon the future, on the rights of the generations to come. Are they subjects of international law, especially in the sense of rights holders? There are no simple criteria for determining whether a

certain entity is a subject of international law, but certain common characteristics have been able to develop. Key characteristics are rights, competences and duties that are invocable and enforceable at an international level. Still, what is at issue is not a cumulative total. In the international law of the twentieth century, various gradations of being a subject of law evolved. The most complete is undeniably that of States. However as the International Court of Justice stated in the *Reparations for Injuries* case: ‘The subjects of law in any legal system are not necessarily identical in their nature or in the extent of their rights . . .’ (ICJ 1949, p. 178).

During the course of the twentieth century, the circle of international law subjects experienced a remarkable and multifarious expansion. The increased role of international organizations in the international legal order allowed for recognition of these organizations as independent legal subjects. Another striking development was the recognition of individuals and peoples as bearers of public international law rights and duties. This period also saw multinational companies accorded a limited international law status. World society has been clearly emancipated from a purely state and interstate paradigm. In principle, international law could accord future generations’ contemporary rights.

LABORATORIES FOR THE RIGHTS OF FUTURE GENERATIONS

Humankind is a concept regularly referred to in international law sources. By far the most well known reference is the opening words of the Charter of the United Nations in 1945, ‘We the peoples of the United Nations determined to save succeeding generations from the scourge of war, which twice in our lifetime has brought untold sorrow to mankind . . .’ (United Nations 1945; Simma *et al.* 2002).

A year later the International Whaling Convention of 1946 recognized the interest of ‘the nations of the world in safeguarding for future generations the great natural resources represented by the whale stocks’.⁴ Similar provisions also appear in the African Conservation Convention of 1968 and the World Heritage Convention of 1972 (UNESCO 1972). Within the framework of this last treaty, there was the formation of a World Heritage List that now includes almost 750 places of exceptional natural beauty or cultural significance. The interest of future generations is not the least, but rather the greatest consideration in protecting these World Heritage sites (Sands 2003).

At the initiative of Sweden, the first large scale international conference on the protection of the human environment was held in 1972. The ensuing

Stockholm Declaration has had a great influence on the development of international environmental law. There are references in several places in this document to the interests of future generations. In the preamble, there is emphatic reference to the importance of protecting the well being of future generations. 'To defend and improve the environment for present and future generations has become an imperative goal for mankind – a goal to be pursued together with, in harmony with, the established goals of peace and of world-wide economic and social development' (Stockholm Declaration 1972).

Principle 1 of the Stockholm Declaration consequently states 'Man . . . bears a solemn responsibility to protect and improve the environment for present and future generations', while Principle 2 declares that '. . . the natural resources of the earth, including the air, water, land and flora and fauna and especially representative samples of natural eco-systems, must be safeguarded for the benefit of present and future generations through careful planning and management'.

In the framework of the debate on a New International Economic Order, the General Assembly, at the initiative of Mexico, adopted a Charter of Economic Rights and Duties. In general, this Charter is full of demands for structural changes in the international economic order to benefit developing countries in today's world. Yet it concludes with a chapter entitled 'Common Responsibilities towards the International Community' in which Article 30 states that 'The protection, preservation and enhancement of the environments for present and future generations is the responsibility of all States' (United Nations 1973).

In 1980, the General Assembly adopted a general, nonbinding resolution on the 'Historic responsibility of States for the preservation of nature for present and future generations' (United Nations 1980). This resolution expressed concern for the disastrous consequences that the arms race, including the testing of weapons of mass destruction, can have on the environment. Furthermore the General Assembly, on the recommendation of the environmental organization, International Union for the Conservation of Nature and Natural Resources (IUCN), adopted the World Charter for Nature. In its preamble (but significantly, not in the operational part), this charter refers to 'the supreme importance of protecting natural systems, maintaining the balance and quality of nature and conserving resources, in the interest of present and future generations' (United Nations 1982).

The Rio Declaration on the Environment and Development of 1992, which was the political follow up of the Brundtland Report, placed this more in the framework of a right to development that '. . . must be fulfilled so as to equitably meet development and environmental needs of present and future generations'. In the 1990s various multilateral and

regional treaties were adopted that express explicit concern for the well being of future generations of humankind. Important examples are the UN Framework Convention on Climate Change and the Convention on the Conservation of Biological Diversity, both adopted in 1992.⁵ They also introduce the concept of the 'common concern of humankind'.

This theme of conserving nature to protect the interests and the rights of future generations continues in various ways, particularly within the framework of UNESCO (Schrijver 2007). On 12 November 1997, the General Conference of UNESCO adopted a comprehensive 'Declaration on the Responsibilities of the Present Generations towards Future Generations' out of concern for the fate of future generations in light of the enormous challenges facing humankind in the new millennium – challenges which form a threat to the continued existence of humankind and its environment. Thus, UNESCO wants to make the current generation completely aware of their responsibilities to future generations. The declaration adopts a comprehensive approach in which the continued existence of humankind is inextricably linked to the preservation of all life on earth, conservation of nature, protection of the environment, human genes and biological diversity as well as respect for human rights. Subsequently, UNESCO adopted a Universal Declaration on Cultural Diversity in 2001, which resulted in a Convention for the Safeguarding of the Intangible Cultural Heritage (UNESCO 2003) and a Convention on the Protection of Cultural Diversity (UNESCO 2005). These are both important new legal instruments to protect cultural practices, languages and religions in an era in which they all too often find themselves inundated by tidal waves of globalization.

In all these documents humankind is the subject of law. The general well being of humankind is, as such, also a recognized aim in other areas of classical international law including international economic law.⁶ However there is a tendency to recognize humankind as a direct subject of international law only in limited parts of international public law.

In the Outer Space Treaty of 1967, the universe was described as 'the province of mankind', while in the later Moon Treaty of 1979, the moon and all other celestial bodies, including their natural resources, were labelled as the common heritage of humankind.⁷ Meanwhile, a similar process took place with respect to the deep seabed and its mineral resources. In 1970, following a proposal by the visionary Maltese ambassador Arvid Pardo, an important UN Declaration was adopted that was part of the initiative for the negotiations on the new law of the sea, which took place from 1973 to 1982. These negotiations resulted in the UN Convention on the Law of the Sea, which covers all forms of jurisdiction over and all forms of use of the seas and oceans. Hence this treaty is also known as the Constitution

of the Oceans (Koh 1983, p. xxxiii). The new principle of the common heritage of humankind now applied to the deep seabed and its natural resources outside the limits of national (economic) jurisdiction. This legal principle implies that no State, people or individual can claim these areas and that the fair distribution of profits derived from exploiting raw materials should take into consideration the special interests of developing countries and future generations of humankind. There have been proposals to apply the principle to Antarctica, the entire radio spectrum and even for science and technology employed for the benefit of humankind, but these areas are yet unrecognized. Thus far attempts to declare areas and resources under national sovereignty as part of the common heritage of humankind have also been unsuccessful (Schrijver 1997). However, an adequate management of tropical rain forests, protection of biological diversity and care for maintaining vital ecological functions have been declared a 'common concern of humankind'. However with this last concept, which is particularly prominent in international environmental law, we are drifting further away from a direct recognition of the rights of future generations. There are no rights for humankind defined, but rather protection and maintenance duties with biological diversity or other vital ecological systems as the object. Therefore, for the time being, humankind is exclusively a subject of international law pursuant to the more concrete principle of the common heritage of humankind that applies to the deep seabed outside the borders of national jurisdiction, outer space, the moon and other celestial bodies.

THREE OTHER RELEVANT PRINCIPLES OF INTERNATIONAL LAW

Next to the principle of the common heritage of humankind, several other legal principles can be identified that are relevant for protecting the interests of, and even generating rights for future generations of humankind. These are in particular the principles of precaution, intergenerational equity and sustainable development (see Schrijver 2008).

The Precautionary Principle

There is increasing emphasis on the principle that States should not only act with due care with respect to the environment and the natural resources under their control but that they should also prevent any possible damage now and in the future in an institutionalized manner. This is termed the precautionary principle or the precautionary approach. The origin of which, as

a legal concept, is principally in German legislation (*Vorsorgeprinzip* 1976) and in the first North Sea Conference (1984) (Trouwborst 2006; Freestone and Hey 1996). In fact, Article XX of the GATT already recognized that trade restricting measures are possible under certain conditions when they are necessary to protect natural resources. The precautionary principle also arises implicitly in the UN Law of the Sea Convention, the Ozone Treaty and the IAEA Convention on Early Notification of a Nuclear Accident.⁸ It was particularly in the 1990s that the principle became prominent. A significant stimulus for the development of this principle was the Rio Declaration of 1992, which stated the following in Principle 15:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation.

Anticipating possible environmental damage is central to this principle adopted in several environmental treaties of the 1990s including the Convention on Climate Change, the Biodiversity Treaty and the Treaty on Migrating Fish Stocks.⁹ The principle also appears in plain language in Article 174, paragraph 2, of the revised EC Treaty. 'Community policy on the environment . . . shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay'.¹⁰

To a certain extent there is an ongoing conflict between EU countries and the United States on the question of whether to regard the issue as a precautionary *principle* or a precautionary *approach*. If a principle, the United States fears it would face more claims for damage compensation and therefore prefers the term 'precautionary approach' as a more neutral and less legal formulation. Nevertheless in recent years the precautionary principle has been successfully adopted many times in treaties such as the Biosafety Protocol (Cartagena 2000) (see ILM 2000, p. 1027) and the Treaty on Persistent Organic Pollutants (Stockholm 2001) (see ILM 2001, p. 532).¹¹ However it was excluded from the documents issued from the World Summit on Sustainable Development in Johannesburg.¹²

The precautionary principle relates to the obligation of conducting an 'environmental impact assessment procedure', which has become standard in many States. There is also reference in the clauses of many treaties to the obligation of precaution in projects with cross border ramifications.

Furthermore, State practice and *opinio juris*, as well as its recognition in international jurisprudence,¹³ indicate the existence of such an international

common law obligation. For example, the arbitration tribunal on the *Iron Rhine railway* (Belgium/The Netherlands) recently confirmed that in cases where economic development can cause serious damage to the environment, there is an obligation to prevent or at least to minimize such damage. Such an obligation to observe precaution has become, according to the Tribunal, a general principle of international law that is also applicable to activities in the implementation of specific treaties between the parties.¹⁴ The precautionary approach is also starting to take root in the practice of international organizations. Partly because of several large scale incidents during international protests and support against the construction of dams and reservoirs in India and China, the World Bank has set up the World Bank Inspection Panel and initiated various impact procedures within the Bank (World Bank 2003). Such procedures offer the possibility of assessing in advance the effects on the environment and development of projects in which the World Bank is involved.

In the meantime, it has become clear that the precautionary principle and environmental effect reporting until now refer almost exclusively to the environmental aspect of sustainable development and not, or barely, to the development, human rights and future generations aspects. An EU proposal in Johannesburg to declare the precautionary approach as applicable to the broader area of health (access to primary health care) foundered.

Proposals for a more general sustainable development impact assessment have to date not elicited a political response.¹⁵ Nevertheless there are many arguments in favour of developing such an assessment, particularly in order to take into consideration the interests of future generations in the maintenance of vital ecological systems (Davidson 2004). Brown Weiss quite rightly states that ‘. . . measures must be found to ensure that members of the present generation internalise the costs of their activities so as to deter behaviour harmful to future generations’.¹⁶ However in practice, the precautionary principle has barely developed in this direction.

The Principle of Intergenerational Equity

The principle of equity is a general legal principle that acquired a certain place in international law, as demonstrated by the reference to ‘equitable principles’ in the UN Law of the Sea Convention, which are further elaborated in the jurisprudence of the International Court of Justice.¹⁷

There are two important aspects of the equity principle. First, what is termed here, *intragenerational* equity, in other words, just and fair relations within the current generation of people. This can refer to more equal chances of development and a more just income distribution *within* a country as well as more generally *between* countries in an international North–South

context. There are clauses in various UN resolutions in relation to the former, which aim for more equal development opportunities and integration of the poorest or specific groups such as women and children, in the development process. However, this has scarcely been reflected in harder international legal sources. Furthermore, a more just income distribution *between* countries has made little progress in international law. There is a certain *usus* and concomitant *opinio juris* that rich countries provide 'official development aid' to developing countries according to OECD criteria but there are many different opinions regarding the amount (0.7 per cent of GDP?), the modalities (tied or untied?) and the channels (multilateral or bilateral, governmental or nongovernmental?). Furthermore various North-South and environment treaties have provisions on development aid, transfer of technology and other forms of development cooperation from which some State practice derives but none of this is yet very 'hard'. Hence equity can be at best attributed, a 'soft law' status within current generations (intragenerational equity), which appears to be more of an objective than a principle of international law.¹⁸

The second aspect is *intergenerational* equity, in other words, equity between the current and future generations. The current generation may not squander so many natural resources and cause such damage to the environment that 'the ability of future generations to meet their own needs' is compromised (in the well known words of the Brundtland Commission) (Brown Weiss 1989; Redgwell 1999). This general principle of equity between current and future generations has been included and developed further in the international law of the sea, space, international nature conservation and international environmental law. There is also occasional reference in international jurisprudence to the interests of future generations, in particular, the reference to 'generations unborn' in the advisory opinion of the International Court of Justice on the Legality of the Threat or Use of Nuclear Weapons (1996) (ICJ 1996, para. 29). However in other areas of law it is hardly mentioned. In international economic law or human rights law, for example, there is no, or virtually no, reference to the interests of future generations.¹⁹

The Principle of Sustainable Development

The concept of sustainable development gained relatively quick acceptance in international law, with its introduction into international politics by the Brundtland Commission in 1987 and acceptance by the UN Conference on Environment and Development in Rio de Janeiro in 1992. Of course, the concept did not come completely from nothing. In international fisheries law, the term 'maximum sustainable yield' had already been employed for

some time; although sustainability here, of course, has more the meaning of maximizing fish catch over the long term and hence the economic returns. The first main international political document in which the word 'sustainable' occurs and plays a central role is the World Charter for Nature, adopted by the General Assembly of the United Nations in 1982. Sustainable in this document means a sustainable use of natural resources. It is interesting that this document already speaks of 'sustainable benefit to present generations while maintaining [the potential of the biosphere] to meet the needs and aspirations of future generations' (Burhenne and Irwin 1986).

Also in 1982, the UN adopted The United Nations Convention on the Law of the Sea, with stricter provisions on the sustainable use of fish stocks (maximum sustainable yield) and on the obligations of coastal States to maintain a good and environmentally responsible management of their marine areas, in particular, the Exclusive Economic Zone.²⁰ This treaty also includes a separate Part XII that is wholly devoted to the protection of the marine environment. The opening article 192 of this part is short and to the point, 'States have the obligation to protect and preserve the marine environment' (Simm *et al.* 2002).

The principle of sustainable development only really began to take off after its adoption in the report, *Our Common Future* of the Brundtland Commission and the Rio de Janeiro Conference in 1992. Principle 1 of the Rio Declaration states, 'Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature'. As discussed earlier, Principle 3 formulates the right to development, in the sense of meeting both environmental and development needs in a just fashion, it also recognizes the rights of future generations. The Rio Conference also gave sustainable development a prominent place in Agenda 21 – the international action plan for the twenty-first century. From that moment, sustainable development also began to receive legal recognition as a principle.

First, it is extremely important that this concept acquired legal substance in various important treaties adopted in the 1990s and at the beginning of this century; including those regarding the combating of climate change, desertification and the loss of biological diversity. Also, a number of regional treaties in Europe, Africa, Latin America and South East Asia such as the ASEAN Agreement on Trans-boundary Haze Pollution in 2002.²¹ Sustainable development also figures in treaties with a more economic orientation such as the founding charter of the World Trade Organization (1994), the Treaty on Migrating Fish Stocks (1997) and EU treaties (Treaties of Maastricht, Amsterdam and Nice, as well as the 2007 Lisbon Reform Treaty). Article 2 of the Treaty of Amsterdam on the

European Union formulates the objective of 'economic and social progress as well as a high level of employment and the achievement of balanced and sustainable development'. Article 6 of the EC treaty demands the integration of requirements in the domain of environmental conservation in all activities and policy areas of the community 'with an eye to promoting sustainable development'. Explicitly reiterated as a concept in Title XX of the EC Treaty concerning development cooperation (see Article 177), which emphatically names sustainable development, a policy objective. This is elaborated in the various agreements of cooperation between the European Union and developing countries, particularly in the EU-ACP Partnership Agreement of June 2000 (revised in 2005) – the so-called Convention of Cotonou.²² This treaty formulates one of the main objectives of the EU-ACP development cooperation as '... reducing and eventually eradicating poverty consistent with the objectives of sustainable development and the gradual integration of ACP countries in the world economy' (Art. 9). This article reflects clearly the integrated approach towards environment and development.

It is also interesting to note that the concept of sustainable development, or elements derived from it, enjoy recognition in international jurisprudence (Sands 1993, p. 389). In an opinion on the lawfulness of the threat to use or the use of nuclear weapons (1996), the International Court of Justice first gave an interesting description of the concept of the environment and human living space. They said 'the environment is not an abstraction, but represents the living space, the quality of life and the health of human beings, *including generations unborn* [emphasis added]' (ICJ 1996, para. 29). In its judgment on the *Gabčíkovo-Nagymaros* project in the area of the Danube between Hungary and Slovakia, the Court explicitly addressed the principle of sustainable development:

... new norms and standards have been developed, set forth in a great number of instruments during the last two decades. Such new norms have to be taken into consideration, and such standards given proper weight, not only when States contemplate new activities, but also when continuing activities begun in the past. This need to reconcile development with protection of the environment is aptly expressed in the concept of sustainable development (ICJ 1997, para. 140).

In a separate opinion added to the judgment of the court, Judge Weeramantry went a few steps further by stating that sustainable development is '... part of modern international law by reason not only of its inescapable logical necessity, but also by reason of its wide and general acceptance by the global community'. He therefore reconfirmed that in the field of international law '... there must be both development and

environmental protection, and that neither of these rights can be neglected' (ICJ 1997, pp. 96–111).

Sustainable development or elements of it are also appearing in recent decisions of international arbitration bodies, such as that of the World Trade Organization (WTO). The best known is the decision in the so-called Shrimp-Turtle case concerning the prohibition of the import of shrimp (and shrimp products) caught in a turtle-unfriendly manner, in which the US was opposed by the Asian countries, India, Malaysia, Pakistan and Thailand. Based on the GATT and in contravention of free trade rules, measures that 'conserve exhaustible natural resources' (Article XX (g)) are allowed. The WTO Appellate Body noted the 'contemporary concerns of the community of nations about the protection and conservation of the environment' and the fact that the objective of sustainable development is explicitly adopted in the founding charter of the WTO. The Appellate Body took into consideration that sustainable development 'has been generally accepted as integrating economic and social development and environmental protection'.²³ Although the Appellate Body eventually ruled that the US import measures were discriminatory and unjustifiable for other reasons, these references support the legal status of the principle of sustainable development in international law and reflect the evolution of law that had taken place after the earlier Tuna-Dolphin rulings (GATT panel, in the case of Mexico *vs* the US in 1991).

The concept of sustainable development has also found recognition in the national jurisprudence of numerous countries. A famous example is the judgment of the Supreme Court of the Philippines in a case brought by an NGO, on behalf of children and future generations of humankind, which was eventually successful in resisting the continual deforestation of tropical rain forests in the country.²⁴ The pioneering aspect of this case was that the claimants (44 children, their parents and the Philippine Ecological Network) claimed that they represented both current and unborn generations. The Philippine Supreme Council agreed:

We find no difficulty in ruling that they can, for themselves, for others of their generation and for the succeeding generations, file a class suit. Their personality [i.e. as a legally recognized entity] to sue on behalf of the succeeding generations can only be based on the concept of intergenerational responsibility in so far as the right to a balanced and healthful ecology is concerned. Such a right, as hereinafter expounded, considers the rhythm and harmony of nature. . . . Such rhythm and harmony include, inter alia, the judicious disposition, utilization, management, renewal and conservation of the country's forest, mineral, land, waters, fisheries, wildlife, offshore areas and other natural resources to be aimed at their exploration, development and utilization be equitably accessible to the present as well as the future generations. . . . Needless to say, every generation has a responsibility to the next to preserve that rhythm and harmony for the full

enjoyment of a balanced and helpful ecology. Put a little differently, the minor's assertion of their right to a sound environment constitutes, at the same time, the performance of their obligation to ensure the protection of that right for future generations to come.

The case hinged on the explanation and application of Article 1.1 (15) of the Philippine Constitution that states 'The State shall protect and promote the right to health of the people and instil health consciousness among them'. Similar provisions are in the constitutions of other countries. One example is the Constitution of South Africa, which provides for each person the right 'to have the environment protected through legislative and other measures that secure ecologically sustainable development'.²⁵ Finally, yet vitally, 'care for the protection and improvement of the environment' (Article 21) was included in the latest revision of the Netherlands Constitution (Verschuuren 1993). In Netherlands law, Nieuwenhuis discusses how, partly because of the Supreme Court judgment on *De Nieuwe Meer*, made a start in considering the admissibility of the protection of general interests. He states that this generalization of interest, as required for a claim resulting from an unlawful act, should stretch into the future. 'The interests of future generations count', according to Nieuwenhuis (Nieuwenhuis 1988, p. 366).

GROUNDING OF SUSTAINABILITY AS A NEW GENERAL NORM IN INTERNATIONAL LAW

The principle underlying efforts to achieve recognition of the rights of future generations is that of sustainability. Sustainability is a principle that builds upon general norms such as respect for human life, for nature and its flora and fauna, trusteeship, justice, development and attention for the interests of future generations of humankind. These norms have roots in various cultures and civilizations.²⁶ Christianity demonstrated this within the framework of the Conciliar Process called for by the World Council of Churches in the 1980s and appropriately referred to as the 'oneness of creation'.²⁷

Sustainability is not, essentially, more abstract or more general than other important principles of the international community, such as peace and security, humanitarianism (respect for human rights and international humanitarian law) and democracy. However it should be noted that sustainability and also democracy, do not yet enjoy the same degree of recognition in international law as peace, security and humanitarianism (Schrijver 2006).

Amongst economists and moralists, there is debate between the

proponents of what is termed, 'strong' and 'weak' sustainability (Ayres *et al.* 2001; Tladi 2003). Weak sustainability implies the conservation of the entire capital base, including natural capital, as a guarantee for a welfare level, which at least remains the same. This is similar to the intentions behind the Brundtland Report definition. Weak sustainability implies that economic capital can replace lost natural capital. According to many economists, new knowledge and technology allows humankind to replace certain nonrenewable natural resources and to live with different forms of damage to nature and the environment. Strong sustainability, on the other hand, demands retaining every type of capital separately. The preservation of biological diversity, no significant, irreversible damage to the climate system and an economical use of exhaustible natural resources are essential conditions of this approach. Although this terminology is rare in international law, it appears that law concerning sustainable development, such as that which is currently evolving, is based more on 'weak' than on 'strong' sustainability.²⁸

INTERNATIONAL ARCHITECTURE FOR MANAGEMENT OF THE EARTH

The earth is ecologically an indivisible whole. However legally we humans have divided the earth into a couple hundred Nation-States plus a few areas, such as Antarctica, the deep oceans, international air space and outer space with international status. Based on the principle of territorial sovereignty and that of sovereignty over natural resources, every State has exclusive authority in the management and use of the natural resources found within its territory (both its land area and territorial sea), as well as economic jurisdiction of the continental shelf and the exclusive economic zone of 200 nautical miles. It could be the case that effective management of the earth and its natural resources requires a more limited sovereignty and increased international administration (Tinbergen 1987). Various alternatives have been suggested that vary from common management regimes for specific natural resources and nature reserves making use of forms of highly institutionalized and centralized consultation (a sort of Environmental Security Council) to forms of global management of specific natural resources (for example, oil) or international nature reserves. There has also been a proposal to transform the current UN Trusteeship Council, which has fallen into disuse, into a Council that operates as a 'trustee' and 'guardian' for the rights of future generations.²⁹ However such proposals are not politically realistic. There is little indication that States and their populations have less interest in preserving their sovereignty. Perhaps the

opposite is the case, given how many in parts of the former Soviet Union, former Yugoslavia and other parts of the world appear to see the founding of their own independent State as their ideal of freedom. Moreover, we see that countries rich in minerals (Russia, Norway, Venezuela and Bolivia) continue to assert their rights vehemently for national control of their natural resources and the exploitation of these resources. Nevertheless it is important to make clear that sovereignty has not been an 'absolute' but a 'relative' concept for a long time. In the literature, more attention is quite rightly devoted to functional, shared or cooperative sovereignty (Tinbergen 1976; Perrez 2000). Indeed the sovereignty of States increasingly implies duties as well as rights (Schrijver 1997, ch. 10).

Therefore, relative and functional sovereignty is steadily replacing absolute sovereignty. However it would not be correct to assume that State sovereignty is withering away. Moreover, it would be a misconception to think that the sovereign State is standing in the way of good environmental and development policy. As long as States at the international level remain the most important governing entities, the primary responsibility and accountability for good management of the environment and natural resources and the fostering of sustainable development lies with them. States are still indispensable for good management of nature, the environment and natural resources. For the time being they are in principle, the only actors held responsible, internationally, for fulfilling their obligations (Schrijver 1999). It is therefore of the greatest importance that States are well equipped to meet their international obligations in the areas of environmental management and sustainable development. That requires a well organized government, which stands firm against third parties who are possibly less committed to care for the environment and development. That also requires a government, which is future oriented and takes the interests of future generations into consideration and, to this end, is prepared to cooperate actively with other States, international organizations and other important actors, such as business and social organizations.

Currently consultation and decision-making on environmental and development issues are still inadequate at the international level. There is no authoritative international organization for sustainable development. The United Nations has had a special environmental body since 1972 – the United Nations Environment Programme (UNEP) – but it is poorly equipped and politically quite weak. A great number of specialized agencies are concerned with the environmental and developmental aspects of their policies, such as the Food and Agriculture Organization, International Maritime Organization, World Meteorological Organization, World Bank and UNESCO. However most of these organizations simply do not have the authority to enforce binding decisions upon the member States, let

alone institute sanctions for nonobservance. There is scarcely a place for nonstate legal entities, such as business corporations or NGOs (the International Labour Organization is an exception). The coordination between the activities of the specialized agencies is also minimal. Despite its mandate (see Chapter X of the UN Charter), the Economic and Social Council of the United Nations (ECOSOC) has not appeared sufficiently able to exercise its functions and authority for the necessary coordination between the United Nations and the specialized agencies nor amongst the latter themselves.

Secretariats of treaty organizations play an increasingly important role in attempts to formulate an adequate international environmental policy in specific areas. Examples include the secretariats of the International Tropical Timber Organization, the Convention on International Trade in Endangered Species, the Climate Change Convention, the Biodiversity Treaty and the Convention to Combat Desertification. They play an important role in exchange of information, the drafting of model legislation, monitoring implementation of agreements and arbitrating disputes between treaty parties. However not all treaties have a well equipped secretariat. Moreover for political reasons, the secretariats are dispersed all over the world (including Geneva, Bonn, Paris, Montreal and Nairobi), which does not encourage coordination or a unified approach.

Taking everything into consideration and in view of the continually inadequate international structure for environmental and development policy, the best idea might be to found a new *UN World Environmental Organization (UNWEO)*, as a specialized agency of the United Nations, along the lines of a recent proposal made by France and Sweden (Axelrod *et al.* 2005; Biermann and Bauer 2005). Such an organization would certainly put the issue of sustainable development and the concomitant issue of the rights of future generations more powerfully on the international agenda and could provide an effective centre for the coordination of international environmental policy and operational activities. However, there are significant disadvantages: the environmental issue is not specialized but in fact should be treated as an integral part of general financial, trade and development policy. There are already so many international organizations that there would be resistant to further proliferation and States would have to decide separately whether to become a member (and pay their contribution) or not. On the other hand, it is clear that politically, the UNEP and the UN Commission on Sustainable Development, set up in 1992, will never achieve the stature that the issue demands. Another recommendation is to aim for more cooperation between, and ideally in the long term, a merger of treaty secretariats and conferences, in order to encourage the necessary coordination and a unified approach.

THE RIGHTS OF FUTURE GENERATIONS

There is a certain level of consciousness in many documents and legal statutes, which the current generation of human beings should take into consideration, regarding the interests and the rights of future generations. Just as every individual has the right to life, to reproduce, to exist and not be subjected to genocide (Anti-genocide Convention 1948), humankind has the right to survive and the right not to be exposed to the danger of extinction by the over consumption or reckless behaviour of the current generation. In current international law, the rights of the future translate in particular, into duties, which are incumbent upon the governments of States. Duties that ensue from the rights of future generations include the following.

1. The general duty of States in the formulation of their economic policy to take into consideration the long term effects of this policy and to contribute through cooperation to a balanced development of the world economy. For example, WTO law demands that member States contribute to an 'optimal use of natural resources',³⁰ which implies that nonrenewable resources be treated carefully and the regeneration capacity of renewable resources remains intact.
2. The specific duty of States to respect the rights of individuals and peoples (including indigenous peoples), both of current and future generations. Modern international law sets many limits to the freedom of States to do whatever they want within their territory and jurisdiction. Large scale logging at the cost of the living environment, culture and identity of indigenous peoples, for example, is no longer a matter about which a government can say that it is no one else's business.³¹
3. The duty of States to observe the principles and rules of international environmental law. This duty is based not only on the transboundary and worldwide effects of a State's behaviour, but on sustainability oriented management of the State's territory and the wealth and natural resources it contains both on land and in the marine areas under its economic jurisdiction (such as oil, gas, fish) as well as based on the interests of future generations.

CONCLUSION

This chapter shows that to preserve the capacity of future generations to enjoy an adequate living standard requires bold action. In 1985, Hans Opschoor introduced the concept of 'environmental utilization space', *viz* the regenerative capacity of nature and our natural environment to serve

as a basis for the supply of natural resources and the absorption of waste. Opschoor put on record that we tend to operate structurally beyond the limits of this environmental utilization space thus infringing on the rights of future generations of humankind. In his book, *After Us, No Deluge*, (Opschoor 1990) he demonstrated how the current generation of humankind has to take responsibility for sustainability in a partnership between man and nature. Opschoor formulated a multifaceted strategy to initiate the necessary processes of change, arguing that tackling environmental destruction means implementing radical change at ethical, political, economic and legal levels. In a modest contribution to such an inevitable strategy, this chapter attempts to demonstrate that international law, in general, and international environmental law, in particular, can be instrumental in preserving the rights of future generations of humankind and the intrinsic value of nature and the environment, by serving as both a value system and a concrete regulatory framework for action. It is the solemn responsibility of the current generation to employ international law and policy towards this end. Hans Opschoor has certainly done his part for which we are greatly indebted to him.

NOTES

1. This chapter builds upon the author's preliminary report for the Christian Association of Lawyers in 2004. He is grateful to the Royal Netherlands Academy of Sciences for providing a subsidy for the translation.
2. The Chairperson was Gro Harlem Brundtland, the former Prime Minister of Norway.
3. See the Introduction by Salih in this volume for details on the linkages between sustainable development, climate change and poverty reduction; and the chapter by Arts, on Children's Rights Perspective on Climate Change.
4. Even in 1893 in the famous *Pacific Fur Seal Arbitration* between Great Britain and the US, there was already a reference to the interests of future generations. See text in 6 *American Journal of International Law* (1912), p. 6.
5. See UN Framework Convention on Climate Change, New York, 9 May 1992: 'to protect the climate system for . . . future generations' (preamble); Convention on the Conservation of Biological Diversity, Rio de Janeiro, 5 June 1992: 'to conserve and sustainably use biological diversity for the benefit of present and future generations' (preamble). An interesting example of a regional treaty is the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region, 1987: 'Conscious of their responsibility to preserve their natural heritage for the benefit and enjoyment of present and future generations' (preamble).
6. See the founding treaties of the International Bank for Reconstruction and Development ('the World Bank', 1944), the International Monetary Fund (1944) and the World Trade Organization (1995).
7. Agreement Governing the Activities of States on the Moon and other Celestial Bodies, 1979.
8. See Part XII of the UN Law of the Sea Convention, the preamble of the Ozone Treaty and the Convention on Early Notification of a Nuclear Accident, Vienna, 1986, 25 *International Legal Materials*, (ILM) (1986), p. 1370.

9. See as an example article 3, paragraph 3 of the UN Framework Convention on Climate Change, 1992: 'The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.'
10. Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, signed at Lisbon, 13 December 2007.
11. See 40 *ILM* (2001), p. 532.
12. See paragraph 109 (f) of the Johannesburg Implementation Plan in UN Document A/CONF.199/20.
13. See the ICJ judgment in the *Gabcikovo-Nagymaros case (Hungary vs Slovakia, 1998)*; the WTO Appellate Body in *EC Measures Concerning Meat and Meat Products (Hormones) WT/DS26/AB/R, Part IV, paragraph 123*; and International Tribunal for the Law of the Sea in *Southern Bluefin Tuna Cases (Request for Provisional Measures)*, *New Zealand/Australia vs. Japan, 1999* and *Land Reclamation case (Request for Provisional Measures)*, *Malaysia vs. Singapore, 2003*.
14. Arbitration Regarding the Iron Rhine railway between the Kingdom of the Netherlands and the Kingdom of Belgium, The Hague, 24 May 2005, paragraphs 59, 84 and 222. The award of the tribunal can be found on www.pca.cpa.org.
15. The EU has an interesting experimental project on 'Sustainability Impact Assessment of Proposed WTO Multilateral Trade Negotiations'. See europa.eu.int/comm/trade/issues/global/sia/index_en.htm.
16. E.D. Brown Weiss, *op. cit.*, p. 80.
17. In the *North Sea Continental Shelf Case (Tunisia vs Libya)*, for example, the maritime border was determined partly based on 'the various considerations which it regards as relevant to produce an equitable result'. *ICJ Reports 1982*, p. 60.
18. See also the somewhat noncommittal Rio principle 5: 'All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world'.
19. See, for example, the Declaration on Social Progress and Development, GA Res. 2542 XXIV (1969) or the Declaration on the Right to Development, A/RES/41/128/, 1986.
20. See in particular Part V of the UN Convention on the Law of the Sea.
21. ASEAN Agreement on Transboundary Haze Pollution, Kuala Lumpur, 10 June 2002, entered into force on 25 November 2003; reprinted in *IELMT 2002:44*.
22. Agreement amending the Partnership Agreement between the members of the African, Caribbean and Pacific Group of States, of the one part, and the European Community and its Member States, of the other part, signed in Cotonou on 23 June 2000, adopted on 25 June 2005; 2005 O.J. (L209) 27.
23. United States Import Prohibition of Certain Shrimp and Shrimp Products [Shrimp-Turtle], Appellate Body report, WT/DS58/AB/R, 12 October, 1998.
24. See *Minors Oposa v. Secretary of the Department of Environment and Natural Resources (DENR)*, 30 July 1993, in *International Legal Materials*, 1994, p. 173 ff.
25. See Section 24 (b) (iii) of the Constitution of the Republic of South Africa, Act. 108, 1996.
26. See Judge Weeramantry in his Separate Opinion in the *Gabcikovo-Nagymaros case, ICJ Reports 1997*, p. 96–111.
27. See the special issue on The Conciliar Process of *Wending, tijdschrift voor evangelie, cultuur en samenleving*, 1988, 4, to which Hans Opschoor also contributed.
28. The International Law Association described the multidimensional nature of sustainable development in its New Delhi Declaration, 2002, as follows, 'The objective of sustainable development involves a comprehensive and integrated approach to economic, social and political processes, which aims at the sustainable use of natural resources of the Earth and the protection of the environment on which nature and human life as well as social and economic development depend and which seeks to realize the right of all human beings to an adequate standard of living on the basis of their active, free and meaningful participation in development and in the fair distribution of benefits resulting

therefrom, with due regard to the needs and interests of future generations'. See the Declaration and the final report of the ILA Commission on Sustainable Development in ILA, *Report of the 70th Conference New Delhi*, London, 2002, p. 22 and 380; another source is www.ila-hq.org. See also N.J. Schrijver & F. Weiss (eds), *International Law and Sustainable Development: Principles and Practice*, Leiden, Brill, 2004.

29. For the idea to transform the Trusteeship Council into an Environmental Council: Kofi Annan, 'Renewing the United Nations System: Proposals for Reform' in UN Doc. A/51/950, July 1996. For a discussion of other proposals, see N.J. Schrijver (1989) 'International Organisation for Environmental Security', in *Bulletin of Peace Proposals*, pp. 115–22.
30. See the preamble to the Agreement on the Establishment of the World Trade Organization, Marrakesh, 1994.
31. See the recently adopted United Nations Declaration on the Rights of Indigenous Peoples, UN Doc. A/RES/61/295, 2 October 2007.

5. A child rights perspective on climate change

Karin Arts¹

The environmental and economic dimensions of climate change increasingly receive substantive attention, both globally and nationally. However the social dimensions of climate change are still largely neglected. This applies to the human rights dimensions of climate change even more strongly. From the point of view of the likely impact of climate change on people's future living conditions across the globe, these oversights are unfortunate. From the point of view of international law, these oversights are problematic and inconsistent.

This position and the issues raised by it are most compelling when one explores a child² rights perspective on climate change. As will be elaborated in more detail in this chapter, the justification for focusing on children is that they (as well as their children), are the group that will be most affected and in largest numbers by climate change in the future. Problematic in this regard is the fact that the most important global legal instruments that seek to address climate change – the United Nations Framework Convention on Climate Change (FCCC) and the Kyoto Protocol – do not provide for a procedure for people, children included, to seek redress for injury caused by climate change. The qualification 'inconsistent' arises from the circumstances that, except the United States of America, all 191 other States party to the FCCC have also ratified the United Nations Convention on the Rights of the Child (CRC). Likewise all 181 states party to the Kyoto Protocol are simultaneously party to the CRC.³ This chapter argues that these international juridical facts imply that States (and possibly other actors who claim to work within the framework of the Convention on the Rights of the Child) are thus explicitly obliged to consider the child-specific impact of climate change and to act accordingly.⁴

After all, if unaddressed, climate change will, in the long run, seriously hamper the prospects for realizing the Convention on the Rights of the Child. As will be explained in this chapter, the CRC articles on the rights to life, survival, development and health are the ones that are likely to

be affected most notably or directly. In addition the scope for realizing a broad spectrum of other children's rights guaranteed in the Convention is potentially reduced as well, including nondiscrimination and the rights to family life, education, standard of living, play or provisions on refugee children. While children are especially vulnerable to the effects of climate change it is rare to hear their concerns, experiences and voices in relevant negotiations or decisions on legal and other arrangements made to address climate change. This is a denial of the participatory children's rights codified in the CRC, which represent one of the backbones of the Convention regime. Besides its negative effect on the long term potential for realizing the Convention on the Rights of the Child, climate change is also likely to jeopardize the realization of most Millennium Development Goals (UNICEF UK, 2008, pp. 9–12).

Accordingly, it is urgent to consider the impact of climate change on children and their rights. According to the United Nations Development Programme (UNDP) in the Human Development Report 2007/2008:

What we do today about climate change has consequences that will last a century or more. The part of that change that is due to greenhouse gas emissions is not reversible in the foreseeable future. The heat trapping gases we send into the atmosphere in 2008 will stay there until 2108 and beyond. We are therefore making choices today that will affect our own lives, but even more so the lives of our children and grandchildren. This makes climate change different and more difficult than other policy challenges . . . And our children and their children's grandchildren have the right to hold us to a high standard of accountability when their future – and maybe their survival – is hanging in the balance (UNDP 2007, pp. v and 6).

Greater emphasis on the human and children's rights dimensions of climate change could perhaps help create renewed impulses for international climate change negotiators to act faster and with greater determination. Greater understanding of the impact of climate change on children and their rights could usefully inform such negotiations and other intervention efforts, and would facilitate the design of child rights based climate change policies, programmes and projects. This would do more justice to the combined international legal obligations that are contained in the UN Framework Convention on Climate Change, the Kyoto Protocol and the UN Convention on the Rights of the Child than currently is the case. As will be elaborated below, for States that are parties to both a climate change instrument and to the CRC, taking such a child rights approach to climate change is mandatory.

CLIMATE CHANGE AND HUMAN RIGHTS: A GENERAL INTRODUCTION

The substantive linkages between human rights, the environment and (sustainable) development were in principle explicitly recognized as early as the late 1960s. Many international political and other statements confirmed these linkages since and made at least a rudimentary start with the conceptualization of internationally recognized environmental rights. For example, the United Nations General Assembly Resolution 2398 (XXII) on 'Problems of the human environment', adopted on 3 December 1968, expressed concern about the consequences of 'the continuing and accelerating impairment of the quality of the human environment . . . on the condition of man, his physical, mental and social well-being, his dignity and his enjoyment of basic human rights', in both the North and the South. The 1972 Stockholm World Conference Declaration on the Human Environment drew attention to the fact that both the natural and the manmade human environment are essential to humankind's 'well-being and to the enjoyment of basic human rights – even the right to life itself'. It also proclaimed in Principle 1, 'the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being' while simultaneously according man 'a solemn responsibility to protect and improve the environment for present and future generations'. To underline the sensitivity and complexity of these matters, in 1992 during the World Conference on Environment and Development it proved impossible to find sufficient support for repeating, let alone enhancing, the 1972 references to environmental rights.

International environmental and human rights law instruments followed suit with great reluctance and delay. For example the relatively visionary Article 24 of the African Charter on Human and Peoples' Rights formulated a peoples' right to 'a general satisfactory environment favorable to their development' in 1981. In 1988, Article 11 of the San Salvador Protocol to the American Convention on Human Rights – covering the area of economic, social and cultural rights – declared that '[e]veryone shall have the right to live in a healthy environment' and that States party to the San Salvador Protocol 'shall promote the protection, preservation and improvement of the environment'. The 1992 UN Framework Convention on Climate Change and the 1997 Kyoto Protocol do not refer to environmental human rights at all. Article 3(1) of the former simply indicates that the parties 'should protect the climate system for the benefit of present and future generations of humankind'. Article 1 of the 1998 Aarhus Convention, developed under the auspices of the UN Economic Commission for Europe, represents the most explicit and far reaching international legal formulation

of a right to environment by protecting 'the right of every person of present and future generations to live in an environment adequate to his or her health and well-being'. The remainder of the Convention concretizes this through guaranteeing access to information, public participation in decision-making and access to justice in environmental matters.

The judiciary has also been an important actor in exposing the human rights aspects of environmental concerns, and the legal implications thereof. At the national level, the landmark 1993 Oposa case from the Philippines, made possible by a Constitutional provision on the right to environment,⁵ comes to mind. The Oposa case, brought by 44 children (represented by their parents) and the NGO Philippine Ecological Network Inc., challenged the issuance of timber licence agreements by the Philippines government, based on the argument that the resulting deforestation constituted a violation of their and future generations' constitutional right 'to a balanced and healthful ecology' (Oposa Judgment 1994, pp. 180 and 187; see also Allen 1994). The harmful environmental effects allegedly included the drying up of water streams, salinization, erosion, endangering of flora and fauna, drought, increasing velocity of typhoon winds, flooding and, of special interest for this chapter, 'perplexing and catastrophic climatic changes such as the phenomenon of global warming' as a result of 'the reduction of the earth's capacity to process carbon dioxide gases' (Ibid. p. 178). In its decision the Philippines Supreme Court confirmed 'the concept of inter-generational responsibility insofar as the right to a balanced and healthful ecology is concerned' (Ibid. p. 185). This implied that 'every generation has a responsibility to the next to preserve that . . . ecology'. In asserting their right to a sound environment in this lawsuit, according to the Philippines Supreme Court, the minors involved even performed 'their obligation to ensure the protection of that right for the generations to come' (Ibid). The Oposa Judgment made a critical contribution by this recognition of inter-generational equity and the implications thereof, including legal standing for the minors involved. On the practical effect of the case, the record is less encouraging as the court referred the case back to the trial court for logging concessions to be checked again. There the case disappeared, as the plaintiffs did not pursue it further, probably because administrative reforms had already helped to end the issuance of new timber licensing agreements (Houck 1997, p. 338; Manguiat and Yu 2003).

Among global international courts, the jurisprudence of the International Court of Justice (ICJ) scarcely contains references related to environmental rights. Examples include its 1996 Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, in which the ICJ recognized that 'the environment is not an abstraction but represents the living space, the quality of life and the very health of human beings, including

generations unborn' (ICJ 1996, para. 29, see also the separate opinion by Judge Weeramantry, *ibid.* pp. 456, 490–91, 506–8). In his separate opinion attached to the 1997 ICJ Judgement on the Gabčíkovo-Nagymaros Project, a case between Hungary and Slovakia, Judge Weeramantry addressed the relationship between environment and development quite elaborately and shared some of his views on the human rights dimensions of questions in this domain. According to Weeramantry (*Ibid.* p. 90), '[t]he people of both Hungary and Slovakia are entitled to development for the furtherance of their happiness and welfare. They are likewise entitled to the preservation of their human right to the protection of their environment'. Further on (*Ibid.* pp. 91–2) Weeramantry observed that:

The protection of the environment is likewise a vital part of contemporary human rights doctrine, for it is a *sine qua non* for numerous human rights such as the right to health and the right to life itself. It is scarcely necessary to elaborate on this, as damage to the environment can impair and undermine all the human rights spoken of in the Universal Declaration and other human rights instruments.

Regional human rights mechanisms have addressed environment and human rights much more straightforwardly and frequently (Shelton 2008, pp. 43–4). Perhaps the most directly relevant example of a case pursued at the regional level is a human rights petition filed with the Inter-American Commission on Human Rights in December 2005. This petition exposed the impact of global warming on the human rights of the Inuit in the Arctic and claimed US responsibility for this. In November 2006, the Inter-American Commission announced that it would not proceed with this petition at that moment in time because 'the information provided does not enable us to determine whether the alleged facts would tend to characterize a violation of the rights protected by the American Declaration' (Aminzadeh 2007, pp. 240–41) to which the US is not a state party. In March 2007, because of the high profile of the case, a Commission-invited hearing took place on the matters raised in the petition. Inuit leaders and environmental NGOs presented more evidence on the human rights impact of climate change and specifically drew the Commission's attention to 'the human face' of climate change in the Arctic (*Ibid.* p. 241). Despite the formal failure of the petition, Sara Aminzadeh (2007, p. 239) was quite right to observe that, as 'the first legal action to specifically connect climate change and human rights, the petition opens the door to future human rights-based climate change legal action'.

While the interconnections between environment, development and human rights are thus gradually becoming clearer, the process of synthesizing and integrating the implications of these linkages into environmental and human rights law is nevertheless lagging behind (both at international and national levels). The problem of climate change eminently tables a case

for approaching an environmental problem through a human rights lens. In the words of former UN High Commissioner of Human Rights Mary Robinson (2006, p. 3):

Can there be any problem today that requires this [human rights] approach more than climate change? . . . The human rights approach, emphasising the equality of all people, is a direct challenge to the power imbalances that allow the perpetrators of climate change to continue unchecked. And the human rights framework gives us the legal and normative grounds for empowering the poor to seek redress.

Without downplaying the potential drawbacks and limits to taking a rights-based approach to environmental protection (see Hayward 2007, pp. 439–44; Shelton 2008, pp. 45–6), it is clear that States that are parties to relevant international and regional human rights instruments are compelled to consider the substantive human rights aspects of environmental problems and will have to act accordingly.

In March 2008, the United Nations Human Rights Council recognized this when it adopted a consensus resolution on human rights and climate change (UNHRC 2008, pp. 3–4 para. 1). The resolution requested that the Office of the United Nations High Commissioner for Human Rights conduct ‘a detailed analytical study of the relationship between climate change and human rights’, to be submitted to the Council before March 2009.

IMPACT OF CLIMATE CHANGE ON CHILDREN

It seems that it is only roughly since the second half of 2006 that certain child-oriented organizations put serious work into analysing the significance of climate change issues for children and for child-focused policies (see International Save the Children Alliance 2008; Plan 2008; Save the Children UK 2007; UNICEF 2007; UNICEF UK 2008). Other organizations including many that are active on climate change have yet to single out children for special attention. According to UNICEF UK, the ‘potential impact on children has been a critical missing element from the debate about climate change’ (2008, p. 2). This is dramatic given the fact that on average about half of the people who will be most seriously affected by the expected effects of climate change are likely to be children. This gap occurred despite the fact that the international community of states has long been generally aware of the special impact of environmental problems on children. For example the outcome document of the 1990 World Summit on Children (the World Declaration on the Survival, Protection and Development of Children, para. 26) already declared that ‘[c]hildren

have the greatest stake in the preservation of the environment and its judicious management for sustainable development as their survival and development depends on it'. In chapter 25.12 of Agenda 21 (United Nations 1992), the Plan of Action adopted by the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, representatives of more than 178 states recognized that 'children in both developing and industrialized countries are highly vulnerable to the effects of environmental degradation'. Accordingly governments were charged (in Agenda 21's chapter 25.13) with the tasks of ensuring both the 'survival, protection and development of children, in accordance with the goals endorsed by the 1990 World Summit for Children' and 'that the interests of children are taken fully into account in the participatory process for sustainable development and environmental improvement'.

Scientific uncertainties about the exact extent and effects of climate change, and difficulties in establishing causal links (Posner 2007, p. 1934; Aminzadeh 2007, p. 233) continue to exist. This presents complications for example for litigation that attempts to curb climate change through forcing governments or corporations to reduce relevant emissions or through seeking redress for persons injured by the effects of climate change. However, the Intergovernmental Panel on Climate Change and others (see IPCC 2008; UNDP 2007; Stern *et al.* 2007) have carefully built up scientific evidence on the existence and the possible impact of the phenomenon through the years. Children, especially children in developing countries, consistently stand out as a high risk group in terms of the effects of sea level rise, natural disasters, decreased access to (drinking) water, diseases (such as malaria) and malnutrition. Climate change is likely to exacerbate all of these problems in the future (IPCC 2008, pp. 393, 402, 412, 441, 458, 482, 557, 671, 730; Sachs 2008; UNICEF UK 2008; Save the Children UK 2007; Bartlett 2008a). In line with the pattern of scientific findings on the impact of other environmental problems on children as compared to adults, it is to be expected that the youngest age group (0 to 5 years old), children living in poorer countries (where malnutrition is prevalent) and/or in rural or in poor urban areas will be worst off (*ibid*; DFID 2008; Hopenhagen and Esindola 2007, pp. 5–6; Licari 2005, pp. 5–25; Buck Louis 2006, pp. 7–14, 22–54; Bartlett 2008b, pp. v, 5–6). The human rights of the poorest will be hit 'first and hardest, in all likelihood, since they will have the least capacity to adapt to the adverse effects of climate change' (Hayward 2007, p. 443). For example according to the World Health Organization (WHO):

The burden of diseases attributable to environmental factors is greater in children and the poorest sector of society. Globally, 43% of the total burden of environment-related disease falls on children under 5 years of age, even though

they make up only 12% of the population. . . . In the poorest countries, up to 80% of the burden of disease in children under 5 years of age is of environmental origin (Licari 2005, p. 8).

And, '[a]ccording to the World Health Organization, in 2000, climate change was estimated to be responsible for approximately 2.4 per cent of worldwide diarrhoea and 6 per cent of malaria in some middle-income countries – diseases that disproportionately affect young children in developing countries' (UNICEF 2007, p. 4). A 2006 WHO Report (Buck Louis 2006, p. 15) stated that ozone depletion and global climate change 'have been identified as potential risks to children's health globally'. Specifically on climate change, the above mentioned 2005 WHO Report announced that the effects had been estimated and were found to include child health effects 'spawned by heat and cold; changes in aeroallergen levels, the incidence of infectious diseases and food production; and floods and other consequences of extreme weather events' (Licari 2005, p. 20).

While available data and attention often concentrate mainly on child health aspects, it is now clear and reasonably well documented that climate change is likely to affect children disproportionately overall. Next to the impact on child health, among other threats that might occur remain natural disasters, psychological effects, displacement, lesser possibilities for outdoor play and livelihood threats (see Bartlett 2008a, 2008b, pp. 30–36).

Although there is a need for much more (disaggregated) data, the contours of the actual and likely serious impacts of climate change on children are thus becoming clear. Yet, while a relatively large number of people vulnerable to the effects of climate change are likely to be (young) children, in debates on the responses to climate change children receive no systematic attention (Bartlett 2008a, pp. 72–3). Although scarcely framed as such, it is absolutely necessary and relevant to frame climate change as an issue of children's rights. As will be argued in the next section of this chapter, for governments, a child rights-based approach to climate change flows from the State obligations imposed by the Convention on the Rights of the Child and accordingly is even mandatory under international law. Nongovernmental actors who choose to work under a CRC mandate should follow the same path.

THE SUBSTANCE OF THE UN CONVENTION ON THE RIGHTS OF THE CHILD AND CLIMATE CHANGE

As outlined in the first section of this chapter, the full details of the exact legal relationship between environment, development and human rights

remain underdeveloped in international law. However, in doctrine supporting the progressive development of international law in this domain, there is broad backing for the idea that an adequate environment is an essential precondition for the protection of human rights. For example according to Dinah Shelton (2008, p. 42):

Environmental protection undoubtedly is a pre-condition to the enjoyment of some internationally guaranteed human rights, especially the rights to life, health, private and home life and cultural rights, and it also directly or indirectly impacts other rights as well. Environmental protection is thus an essential instrument in the effort to secure the effective enjoyment of human rights. . . . Conversely, the exercise of certain human rights is also essential to achieving environmental protection, which is sought not only for its relationship to human well-being, but because nature has intrinsic value.

Accordingly the human rights aspects of climate change are mainly construed indirectly. Climate change in itself is not a (potential) human rights violation, but the fact that climate change makes it impossible to realize the rights to life, health, livelihood and water to the fullest turns it into a factor that contributes to the creation of a disabling environment for human rights. According to Sheridan Bartlett (2002, p. 5), the human rights to survival, health and standard of living imply 'a right to the conditions that make these goals achievable'. Perhaps less obvious, but as important, is the impact of climate change on the right to privacy and family life (Aminzadeh 2007, pp. 246–8), the right to property, indigenous peoples' rights and the right not to be discriminated against.

The above outlined indirect approach has been followed in the 'Male Declaration on the Human Dimension of Global Climate Change', which was adopted by small island developing states in November 2007, in the run up to the 13th Conference of the Parties of the UNFCCC in Bali. The Male Declaration (last preambular paragraph, p. 2) expresses concern 'that climate change has clear and immediate implications for the full enjoyment of human rights including *inter alia* the right to life, the right to take part in cultural life, the right to use and enjoy property, the right to an adequate standard of living, the right to food, and the right to the highest attainable standard of physical and mental health'.

The United Nations Convention on the Rights of the Child also allows for an indirect construction only. While the CRC does not contain a separate environmental rights clause, the environment is not completely omitted either. Article 24(2c and e) on the right to health, and 29(1e) on education, do refer to clean drinking water, environmental pollution, environmental sanitation and respect for the natural environment as a subject in education. Although not mentioned in other articles, climate change or other instances

of serious environmental degradation would interfere drastically with the scope for realizing many of the CRC rights. According to Maaïke Jansen:

It is important to recognise that many of the legal obligations and moral aspirations encapsulated in the Convention, not least the right to life itself and the right to the highest attainable standard of health, are, in their word and spirit, dependent on the provision of a sound and safe physical environment (Fijalkowski and Fitzmaurice 2000, p. 210).

The legislative history of the CRC shows that on the side of the drafters there was indeed no intention to posit a separate and independent children's right to (a clean or healthy) environment. Rather the environment should be considered when implementing certain other rights. This was a prudent strategy. However in the compromise outcome of the negotiations on the environmental references in the Convention on the Rights of the Child, in the end only environmental health and educational objectives were explicitly addressed. Overall, the issue seems of low priority for the drafters (Brice 1995, pp. 595–7; Detrick 1992, pp. 343–59, 395–407; OHCHR 2007, pp. 580–603, 653–74). Nevertheless the few environmental references that were included have been qualified as 'unprecedented . . . in the text of an international human rights agreement' and, so it was argued, therefore 'should not go unnoticed; advocates of environmental human rights should take full advantage of the opportunities these provisions offer' (Brice 1995, pp. 591–2). Despite these opportunities, some have advocated for an amendment to the CRC to include a right to a healthy environment (see Brice 1995, pp. 606–9). Admittedly they see little chance for such an amendment to be realized.

The CRC reporting process reflects the scarcity of CRC provisions on environmental matters. Both the formal CRC Reporting Guidelines and the Concluding Observations by the Committee on the Rights of the Child give relatively little attention to environmental issues (Bartlett 2002, pp. 19–20). But already in 1994, the Committee on the Rights of the Child recalled that 'States parties are requested to provide relevant information on measures taken, factors and difficulties encountered and progress achieved in implementing the provisions of the Convention, including measures to combat the risks of environmental pollution (art. 24, para. 2c); to ensure that all segments of society are informed, have access to education and are supported in the use of environmental sanitation (art. 24, para. 2e); and to ensure that the child's education shall be directed to the development of respect for the natural environment' (UN Committee on the Rights of the Child 1994, pp. 35–36, para. 167).

While the CRC protected rights to life, survival, development (art. 6) and the right to health (art. 24) are definitely at stake, at least for the mid

and long term, several other rights might be at risk as well. These include the child rights not to be discriminated against (art. 2, potentially relevant in situations in which a particular group, for example of minority or indigenous children, is affected), to an adequate standard of living (art. 27), to education (arts. 28–29) and to play (art. 31). Natural disasters or other extreme physical changes in the living environment brought about by climate change may trigger (massive) displacement of people. Where such displacement occurs, the right to family life (arts. 8–10, 18), the right not to be (sexually) abused (art. 19), exploited (arts. 32, 34 and 36) or abducted, sold or trafficked (art. 35), and rights to enjoyment of one's own culture, religion and language (art. 30) may be at stake as well.

Apart from the periodic monitoring of state reports by the UN Committee on the Rights of the Child, the CRC provides no remedies for victims of child rights violations. In 2009, a civil society lobby was still ongoing in favour of introducing an optional protocol to establish an individual complaint mechanism for the CRC. Such a protocol would bring the CRC in line with most other global human rights treaties and would do justice to the CRC's own emphasis on children's right to be heard and to participate. However the chances for this lobby to succeed are currently unclear.

ACTION-ORIENTED IMPLICATIONS OF THE CONVENTION ON THE RIGHTS OF THE CHILD FOR CLIMATE CHANGE ACTION

Accordingly the main vehicle for implementing the Convention on the Rights of the Child is its 'general measures of implementation' provision. This article 4 provides that:

States parties shall undertake all appropriate legislative, administrative and other measures for the implementation of the rights recognized in the present Convention. With regard to economic, social and cultural rights, States Parties shall undertake such measures to the maximum extent of their available resources and, where needed, within the framework of international co-operation.

In line with the current well established thinking on obligations 'to respect, protect and fulfil' human rights (Skogly 2006, pp. 69–72; Nowak 2003, pp. 48–51), this CRC implementation article requires an active attitude on the side of States parties. Next to the duties of States not to interfere with the exercise of human rights (to respect) and to take actively all legal, administrative, judicial and practical measures to ensure that human rights will be realized (to fulfil), States should also provide protection against – or at least adequate remedies for human rights violations by State and nonstate

actors (to protect). The bearing of this article is so all encompassing that it certainly requires action when climate change would clearly jeopardize the implementation of one or more CRC provisions. The phrase ‘all appropriate legislative, administrative and other measures’ extends to climate change policy and measures, while the reference to ‘implementation of the rights recognized in the present Convention’ covers all the CRC rights endangered by climate change, as presented in the third section of this chapter. Measures designed to protect the right to life of children fall in the domain of civil and political rights and thus all States would be required unconditionally to comply. According to CRC article 4, measures designed to protect the right to health or other economic, social or cultural rights would only be required ‘to the maximum extent’ of the available resources of a state, and ‘where needed, within the framework of international cooperation’.

The UN Convention on the Rights of the Child is relatively sensitive to the needs and possible capacity problems of developing countries. In that light, it refers several times explicitly to the special needs of developing countries and to (nonspecified) obligations on others to promote international cooperation (see its last preambular paragraph and arts. 4, 17, 23–4, 28; Committee on the Rights of the Child 2003, pp. 14–5). The implication of this CRC approach to state obligations could well be that those who are in a position to support developing countries in their pursuit of a child rights-based climate change policy should do so through funding, technological or other appropriate support. According to Mary Robinson (2006, p. 13):

. . . we should support adaptation by poor countries and poor communities adversely affected by the inevitable changes to their climate. It is in this area that human rights principles need to be brought to bear to help them cope with food production, water availability, health issues, and their response to natural disasters.

Besides the detailed substantive rights and obligations presented in the CRC, the general principles contained in articles 2 (nondiscrimination), 3 (best interests) and 12 (participation) together shape a general framework for action that all actors who claim to work under a CRC mandate should adopt in all their activities that seek to benefit children, be they states or nongovernmental actors. While the specific implications for climate change measures of the CRC’s nondiscrimination⁶ and best interests provisions still need to be clarified, there is already a clearly visible consensus in the field that child and/or youth participation in climate change related activities represent an important right and are practicable. Good practice examples are building up and extend to the successful participation of four children

(from the Philippines, Indonesia, Sweden and the UK) in the 2007 13th Conference of the Parties of the UN Framework Convention on Climate Change in Bali (Children in a Changing Climate ND), for example. Other examples are the 2005 Montreal International Youth Declaration 'Our Climate, Our Challenge, Our Future', the Junior 8 Summit intended to complement the adult G8 held in Chitose, Japan in 2008 and the creation of a Global Youth Climate Movement supported by UNICEF (see also UNICEF 2007, p. 19; www.childreninachangingclimate.org). Obviously, there is still a lot of scope to expand and improve child and youth participation in climate change activities. The 'Children in a Changing Climate' programme particularly emphasized the need to strengthen child participation in national and international adaptation policy discussions, including at the World Bank (Children in a Changing Climate ND, p. 15).

The CRC participation provisions imply the active involvement of children in the conception and implementation of measures to mitigate climate change, to adjust to climate change or to reduce disaster risks. While such participation is likely to improve the quality of the measures taken, it may also help children to develop their capacities and/or to cope with their circumstances or the problem of climate change. Therefore participation is both a tool serving the quality of interventions and a vehicle for directly realizing various child/youth rights (see International Save the Children Alliance 2008, p. 2; Bartlett 2008a, p. 88, 2008b, pp. 38–9; Children in a Changing Climate ND).

A first step for problem analysis, policy response and meaningful participation to be possible is the availability of data. In the reporting procedure under the CRC, the UN Committee on the Rights of the Child consistently emphasized the importance for States to have adequate statistical and other data related to the children's rights covered in the Convention. Disaggregated data (by sex and age) are often unavailable, in both developed and developing countries. This certainly applies to data on the impact on children of climate change. Other implications of the Convention on the Rights of the Child for climate change action include the need to be aware and address the situations of vulnerable groups (in line with the nondiscrimination principle), which could include environmental refugees and/or displaced persons, in order to avoid or repair discrimination.

CONCLUDING OBSERVATIONS

This chapter has established that a child rights perspective on climate change results in a clear agenda for action. According to Bartlett (2008b, p. ix):

. . . addressing these concerns for children may appear to be an unrealistic burden in the face of so many other compelling priorities. Fortunately, this is not a zero sum game. There are strong synergies between what children need and the adaptations required to reduce or respond to more general risks. For instance, the most useful measures to protect children's health are also fundamental in reducing risks from potential disasters – like adequate drainage, waste removal, proper sanitation. Supporting adults so that they are better able to address their children's needs also leaves them better equipped to work collaboratively on reducing risks, preparing for disasters, and rebuilding their lives after a crisis.

This is quite a job to take on for all States party to the Convention on the Rights of the Child and for all nongovernmental actors who voluntarily committed themselves to the Convention by taking a child rights-based approach to their work. Nevertheless, that job is compulsory for the former and more generally imperative for the sake of maintaining an enabling environment, also, in the literal sense of the words, for the implementation of children's rights in the future. It entails finding ways to mitigate climate change effects through realizing what is termed climate-smart development, for example by reducing one's dependency on fossil fuels; ways to prepare adequately for dealing with the effects of climate change (DFID 2008, pp. 15–18); and in the longer term, ways to prevent climate change altogether. For these purposes, 'all appropriate legislative, administrative and other measures' are to be taken, as per Article 4 of the Convention on the Rights of the Child. In this regard, it is both necessary and interesting to invest in finding positive incentives for stimulating climate-smart behaviour. A creative example relating to developing countries might be found in the option to extend special trade preferences under the Generalized System of Preferences (GSP) (see McKenzie 2008); although the effectiveness of such a measure remains to be seen.

In the meantime in the short to medium term future, climate change is likely to have negative effects on the scope for implementing children's (and other human) rights. In response to this situation it would be just to fill the current gaps caused by the nonexistence of mechanisms for complaint and/or legal redress, including compensation where warranted.

If on all these accounts existing human rights mechanisms could play a supportive role, help to expose the human rights dimensions of climate change and to stimulate climate change action, that would be strong positive progress. Besides the Convention on the Rights of the Child, the constructive use of other relevant human rights instruments and/or procedures should also be considered, including the International Covenant on Economic, Social and Cultural Rights, regional human rights mechanisms and the newly established Universal Periodic Review procedure of

the United Nations Human Rights Council. Such concerted efforts will be required in order to address adequately the child (and human) rights related effects of climate change.

NOTES

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2. In line with the nearly universally ratified UN Convention on the Rights of the Child (art. 1), this paper defines child as 'any person below the age of 18 years unless, under the law applicable to the child, majority is attained earlier'.
3. Status as of 13 May 2008, as per data in unfccc.int and untreaty.un.org.
4. This chapter was written in honour of Professor Hans Opschoor, who has been so actively involved in the climate change debate, and who so admirably combines interest in the economic, environmental, social and legal dimensions of development problems. I am grateful to Professor Opschoor for the support that he has rendered in the past to my personal professional development in the field of international law and development.
5. At present around 130 national constitutions reportedly contain environmental clauses. According to Dinah Shelton (2008, p. 44) '[a]bout half the constitutions take a rights-based approach and the other half proclaim state duties'.
6. Children are not a homogenous group. E.g. age, sex or ethnicity bring differences to the situations of children, which will have to be actively addressed so as to realize the assignment of the nondiscrimination obligation. The latter entails treating equal cases/circumstances equally, but different cases/circumstances differently. Nondiscrimination measures may thus, legitimately and lawfully, amount to affirmative action in favour of members of certain groups and to treating them differently than others are.

6. Climate change and development (cooperation)

Joyeeta Gupta¹

The climate change problem has evolved from an abstract, future, luxury problem to a concrete, urgent, developmental problem. North–South funding for climate change measures evolved from the willingness to provide ‘new and additional’ compensatory resources, to a commitment to mainstream climate change assistance in existing development aid. The anticipated merger of these two debates leads to two questions: How logical is it to link climate change to development aid? Second, what can climate change assistance learn from the history of development aid? This chapter presents some background information on the evolution of the climate change discourse, the funding discourse and the aid discourse, before moving to address the first and second questions. It concludes that although it makes good practical sense to link measures with respect to climate change with existing aid measures, it will remain politically sensitive. This is because the South will view this as retracting from the original commitment the developed countries made to the South, until and unless new and additional resources are available, increasing the total aid funding to the South to more than 0.7 per cent of GNI. Further the packaging and evaluation of aid needs considerable modification if aid is to become more effective.

Originally negotiators framed climate change as an economic and technological issue solvable only through technological and economic measures. This added to the developing country perception of it as an abstract ‘Western problem’ and something that would occur in the future. However this issue is currently undergoing reframing and appears to be changing into a developmental issue, closely associated with basic developmental issues in the mainstream literature. The contemporary view is more of a common problem that would increase the vulnerability of developing countries as well. Further, there was agreement that the developed countries would provide ‘new and additional’ resources to the developing countries; such resources would thus be over and above the existing official development assistance that the developed countries had

already committed to providing. However there is an increasing tendency for developed countries to overlook this commitment and instead to focus on mainstreaming climate change into existing aid strategies.

Against this background, this chapter addresses the issue of whether climate change and development aid can be closely linked and whether lessons from the history of development aid can be applied to make climate aid more effective. This chapter is based on cumulative research in the area of North-South collaboration on climate change over the last 18 years. It first explores how the climate change discussion evolved into a development discussion. Next it presents the evolution of the financial transfer issues within the climate change regime. Third, it presents a brief history of aid and aid effectiveness. It then analyses the practical and political aspects of the mainstreaming discussion and whether lessons learned from aid can improve climate change assistance.

The following section traces the changing definition of climate change in the political arena over the last 20 years and its implications for developed and developing countries. It explores how it has evolved and why it has evolved in a particular direction.

EVOLUTION OF CLIMATE CHANGE DISCUSSIONS

Climate Change as an Abstract, Global, Future, Technological and Economic Issue

There were three critical elements in framing the climate change discourse in the early days. First, the academic literature (for example IPCC-3 1990), policy documents and political declarations (for example the Noordwijk Declaration 1989) highlighted the global nature of climate change. The Climate Change Convention (UNFCCC 1992) uses the term *global* nine times to frame the issue and does not use the term *local* at all.

The related financial mechanism to deal with the problem is the Global Environment Facility. In the initial framing of the issue, the precautionary approach in the treaty emphasized that: 'policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible costs' (UNFCCC 1992, article 3(e)). In further discussions, the concept of incremental costs was adopted (UNFCCC 1992, Art. 4(3); 4(4)), which implied funding for the costs of achieving global benefits minus the costs of achieving local benefits.

The combination of the definition of climate change as a global issue and the willingness of the developed countries to finance the global benefits

of measures emphasized the global, abstract and western nature of the problem. In doing so it tended to appear distant and remote from the day-to-day priorities of countries and peoples (Gupta 1997; Gupta and Hisschemöller 1997).

Second, the discourses tended to focus on the direct emissions of greenhouse gases and the impacts of sea level rise and average increases in global temperature. Although the emissions were from the energy, agriculture, transport and forestry sectors, there existed the impression that increasing use of incremental technological measures would address the problem rapidly. When presented at all, impacts were addressed in global terms that emphasized aggregate impacts. This framing, in aggregate and technocratic terms, allowed for the design of solutions in technocratic terms as well – namely the economic, financial and technological solutions to address this problem.

Finally, the discourses emphasized intergenerational equity. The Climate Convention refers to *present and future* three times – and through including the future in every reference, framed the issue more in terms of future generations than present ones; again framing the issue more as a challenge and/or benefit to future generations rather than as an urgent pressing issue.

The combined impact of the framing process was that climate change was viewed by developing countries as a western problem, which the West would have to address. Since the West had a more substantial contribution to causing the problem and the impacts would be felt ultimately in the South, it was argued that the West should compensate the South for the ‘disproportionate or abnormal burden’ the South would have to face (UNFCCC 1992, Art. 4(2)). The problem did not connect with domestic priorities and it became an imported foreign policy agenda item (Gupta 1997).

There are perhaps four reasons behind the technocratic framing of the problem. Initially the natural scientists had a key role in problem definition and tended to present scientific neutral facts. Second, there was confidence in the ability of countries to improve the development model incrementally in society without questioning its basic principles. Third, the framing of the problem in terms of its global nature helped to avoid framing it in terms of transboundary pollution and hence related liability. Fourth, as early discussions with negotiators in the corridors revealed, there was a fear that if climate change and development were linked too closely, there would be no way to address the problem of climate change effectively without addressing the problem of development. It was therefore necessary to keep the climate change discussions highly focused and to draw sharp boundaries in order to give the issue the attention it needed.

Climate Change as an Urgent, Present and Pressing Development Issue

A decade later, five factors led to the need to present climate change essentially as an urgent, present and pressing development issue. The first reason was the entry of new actors into the discussion – the NGOs and scientists working on development issues. The second reason was the scientific shift in emphasis to discuss the indirect causes of climate change (for example, energy systems, agriculture and forestry) and the indirect impacts of climate change (for example, on coastal zones, mountain regions, food production and water security, to name a few). Political theory focused on the need to identify issue linkages that would lead countries to prioritize climate change. Making such issue linkages also brought one in close contact with basic developmental issues – water, food, energy security and livelihoods (Gupta and Hisschemöller 1997). Fourth, the global political emphasis was moving from ‘environment and development’ as in Agenda 21 of 1992, to the Millennium Development Goals and sustainable development; the latter term was even included in the title of the Johannesburg World Summit on Sustainable Development in 2002. This accompanied the untiring efforts of Al Gore to put the issue on the political agenda of countries. Finally, and possibly most critically, there was increasing and alarming evidence of the rapidity with which climate change was possibly already manifesting itself (IPCC 2007; Stern Report 2007).

This shift was demonstrated on the one hand, by an increase in academic literature emphasizing the development aspects of climate change (for example OECD 2005; Halsnaes *et al.* 2008; Metz and Kok 2008; Kok *et al.* 2008) and by increasing emphasis given to including sustainable development in the definition of economic instruments in the legal regime. For example, the 1997 Kyoto Protocol explicitly established the Clean Development Mechanism (CDM) as an instrument that should both contribute to reducing greenhouse gas emissions as well as aim at sustainable development (Article 12). This political step reinforced the move towards emphasizing sustainable development and led to a series of new articles examining sustainable development in the context of the CDM (for example Barrera and Schwarze 2004; Sutter and Parreño 2007). The Intergovernmental Panel on Climate Change (IPCC) gave increasing emphasis to the relationship between climate change and sustainable development. The IPCC Third Assessment Report (2001) analysed the issue of sustainable development and, *inter alia*, concluded that policies can be more effective if the deliberative process took short to long term thinking into account, used an expanded list of tools for deliberation, took a broader set of policies and criteria into account; and used a portfolio approach to developing policies. The IPCC Fourth Assessment Report

also looked at the relationship between climate change and sustainable development.

In the developing world, we also see increasing recognition of climate change as a developmental issue. For example the recent National Climate Change Programme of China states, 'climate change . . . is an issue involving both environment and development, but it is ultimately an issue of development' (GOC 2007). As developing countries prepared their National Communications on Climate Change, they began to internalize the links between development and climate change.

By framing climate change as a developmental issue, it evolves into an urgent national priority that needs addressing in current policy. The climate change and development discourses are now merging and climate change priorities (energy, transport, industry, land use) can be effectively linked to development priorities (water and food security, employment and education, reduction of budget deficit and poverty alleviation, to name a few).

Aid Money Used for Market Mechanisms

At present some countries use aid money to partially finance the CDM (Yamin 2005a; see also Gupta *et al.* 2008). Against the background of brewing discontent at using aid funds to finance market mechanisms, the Conference of the Parties to the Convention decided, in Marrakesh, in 2001 that, 'Public funding for clean development mechanism projects from Parties in Annex I is not to result in the diversion of official development assistance and is to be separate from and not counted towards the financial obligations of Parties included in Annex I' (COP 13, 17/CP7). Continuing use of aid money for market mechanisms is highly controversial since public funds are used to finance a market mechanism, and since these funds lead to a diversion of ODA resources aimed primarily at achieving emission credits for the North. This violates the agreement made at Marrakesh and it violates the definition of ODA. However, the Designated Operational Entity (DOE) is not actually expected to screen the CDM projects to verify the source of funding (Yamin 2005a). This has led China to state that it will screen all CDM project proposals in the country to ensure that funding does not come from ODA sources (Ming *et al.* 2008). Meanwhile the OECD DAC adopted a decision stating that, 'The value of any [certified emission reductions] CERs received in connection with an ODA financed CDM project should lead to a deduction of the equivalent value from ODA. The DAC should also rule out the possibility of counting as ODA funds used to purchase CERs' (OECD DAC 2004). However loopholes remain in this advice as it appears that the sustainable

development component of CDM projects could well be financed by ODA and as some NGOs argue that related capacity building should be financed from ODA, especially with respect to Africa.

The financing discussions, within the climate change regime, apparently have changed considerably. First, one can submit that the primary grievance of developing countries is that, not framing climate change as a transboundary pollution issue resulted in the failure to adopt the liability and compensation principles. Second, the evolution of the discussion from a 'reduce emissions and assist developing countries' rhetoric in 1992, to 'reduce some emissions via assisting developing countries' by 1997 aggravated the situation with respect to developing countries. Third, evolution from a new and incremental funding commitment, through the promotion of market mechanisms sometimes financed by aid money, to the current tendency to mainstream climate change in aid irritated these countries further and led to an outcry.

EVOLUTION OF THE DEVELOPMENT COOPERATION DISCUSSIONS

Although there have been frequent reiterations within the UN system that developed countries should aim to provide 0.7 per cent of their GNI as aid to developing countries, this goal has been scarcely achieved by most developed countries. Based on UN aid data from 1990 to 2005, one can see that only eight countries are increasing aid as a percentage of their GNI and only four countries meet the 0.7 per cent target (Denmark, The Netherlands, Norway and Sweden).

This indicates that most countries have not met their development commitment, leave aside the call for 'new and additional' resources for climate change. The OECD Development Cooperation Report of 2007 shows that in 2006, the ODA provided fell in real terms by 4.5 per cent in 2006 with respect to 2005 (OECD 2007a). While some countries aim to increase their aid in the coming years (UK, France and Germany), some are frank that this increase will be the 'new and additional' money called for under the Climate Convention.

Changing Philosophy of Aid Provision

Over the years, the reasons for providing aid changed. While in the post World War II era, security and economic stability were driving forces for providing aid to other countries (Truman 1949), this evolved into a focus on development in the following decades (until the mid-1990s) and a more

recent tendency to focus on sustainable development and mainstreaming climate change in aid.

The developmental goals of aid has also changed over time. Based on Meier (2001), Wuyts (2002) and Pronk (2001, 2003), one can argue that the goals of development have shifted from the initial focus on increasing GNP through state and aid financed infrastructural investment. Subsequently, the focus appeared to be on increasing GNP per capita via promoting entrepreneurship and minimizing the role of the government. Lack of success led to a focus on enhancing development by examining nonmonetary indicators (for example, the Human Development Index), the idea that governments and markets should develop in a complementary manner and an emphasis on eradicating poverty through direct action and improved governance. In the 1990s, the focus shifted to sustainable development and new growth theory now emphasizes the need for ideas. In 1999, Sen promoted the notion of investing in social capital and freedom, as this would encourage people to invest in their own future. Since 9/11, there has been an increased focus on security issues, which complements the sustainable development focus. As the new evidence of climate change shows the urgency of the issue, there is also a strong tendency within Europe to focus on mainstreaming climate change in aid (see Table 6.1).

Within these broad phases, there has been the evolution of specific ideas. For example neoMalthusians tend to focus on population growth as the problem and seek to address population growth (for example Ehrlich 1968, p. 1; Ehrlich and Ehrlich 1990). Environmental economists focus on when environmental issues are likely to enter into the developmental equation (such as Malenbaum 1978; Jänicke *et al.* 1989 for material use; Grossman 1995; Selden and Song 1996 for pollutants). In other words, as developing countries become richer they will pollute more; however, beyond a critical point they may be more inclined to invest in pollution control technology and be less inclined to exhaust their natural resources.

In each decade, development scholars framed the developmental issues differently and accordingly designed solutions. However, many of the prescriptions led to new problems such as exacerbating income inequality (Vos 2002) or promoting 'non-viable' national economies (de Rivero 2001). Attempting to reduce the determinants of underdevelopment to one cause and then hoping that individual instruments could help address the cause, created these problems (Adelman 2001).

With the rise of the concept of sustainable development (WCED 1987) and the growing critique of the environmental consequences of aid sponsored investments in developing countries (for example Conroy and Litvinoff 1988; Werksman 1993), there was greater emphasis on

including environmental aspects in developmental issues. Initially, developing country stakeholders saw this internalization process either as a way to create further hurdles in their development process or, at the other end of the spectrum, as being too weak to question existing developmental paradigms in the West (Chatterjee and Finger 1994). In more recent years, as emphasis shifts to both intra- and intergenerational equity and to the economic, ecological and social dimensions of sustainable development (Beg *et al.* 2002; Cohen *et al.* 1998; Banuri *et al.* 2001) there is a greater willingness on the part of developing countries to accept this concept. Yet as Meier concludes, 'No formula exists for development. Aid alone cannot yield development' (2001, p. 1).

Current Aid Priorities and Policies: Mainstreaming Climate Change

Increasingly aid agencies are prioritizing climate change in high level declarations (EC 2006; OECD 2006) and policy guidelines (USAID 2007; World Bank 2006). Scientific literature has begun increasingly to talk about mainstreaming climate change in aid policies (Huq *et al.* 2003). The policy literature has also moved in this direction especially within the European Union and its member states (Marsden 2006). While the Maastricht Treaty of 1992 initially stated that EC development cooperation should focus on sustainable economic and social development and combat poverty (Article 177(1)), the European Consensus in 2005 and a complementary financial instrument in 2006 (Regulation EC No 105/2006) provided a common framework for all EU member countries. The third Environmental Action Programme (1982–86) integrated environmental, including climate change issues in sectoral (including development cooperation) policies, and the Council Conclusions of the Summit in Vienna in 1998 reiterated this integration. Following a number of steps, a Commission Communication of 2003 focused on climate change in the context of development cooperation. In 2004, the Council adopted a strategy and action plan that defines the objectives, guiding principles and strategic priorities (for example raising the policy profile of climate change; support for adaptation, mitigation and capacity development). The key discourse is in the Council Conclusions (2004) that say, 'Climate change is a risk to development. Adaptation strategies should seek to manage the risk, thereby supporting developing countries in building resilience to climate change impacts, and protecting national and EU efforts to eradicate poverty.' In this respect it considered that the 'mainstreaming of responses to climate change into poverty reduction strategies and/or national strategies for sustainable development is the main avenue to address both adaptation to the adverse effects and mitigation of the causes of climate change.'

Assessment of Aid Strategies

There are two key themes about the role of aid with respect to development. The first is that aid is an important, but temporary, factor promoting economic development in developing countries. However the literature shows that there is no statistically sound correlation between the two (for example, Boone 1994, 1996; Rajan and Subramanian 2005; Dollar and Easterley 1999), although others disagree (Gomanee *et al.* 2005). A second theme is that aid is merely a catalyst for change, where strategic intervention leads to substantial improvement in recipient circumstances and has a permanent character since the rich should always help the poor (Pronk 2001). Where aid aims to meet basic consumption needs, it has little effect on production or growth (Svensson 2000; citing Boone 1995, 1996).

Where aid has focused on changing policies such as through Structural Adjustment Programmes to promote good governance, such policies have either been ineffective or counterproductive (Burnside and Dollar 1997; Dollar and Easterley 1999; Anders 2005). Aid is more successful where donors identify reformers and assist them (Dollar and Svensson 2000). This has led to a focus on providing aid to those with good governance/policies in place (Burnside and Dollar 2000) although others use the same underlying data to argue otherwise (Easterley *et al.* 2003). Some argue that aid works better when external environmental features (such as terms of trade, climate shocks, real value of exports) are negative. This is because the need for aid is higher and hence the productivity of aid will be greater. Here the view of aid is as compensating and cushioning the negative effects of policies at the international level. Pronk (2001) argues that aid is sometimes a success even though aid agencies often have poor knowledge of the countries they work in, incomplete understanding of the processes, inadequate experience with the instruments they are working with and face changing political dynamics in their home and host country. He argues that the trend for scientists to identify specific indicators to measure the effectiveness of aid is doomed to fail, because there are a large number of factors for which to account.

The success of aid also relates to the motives of donors. These include altruistic (charitable, humanitarian, solidarity) motives such as poverty alleviation and disaster relief (Pronk 2001; FitzGerald 2002); also, enlightened self interest such as the promotion of values of democracy and peace (FitzGerald 2002), the promotion of political and strategic interests such as maintaining a sphere of influence, maintenance of links with former colonies and rewarding good policy (Pronk 2001; Alesina and Weder 2002); economic interests (promoting open economies,

creating markets for products and services (Pronk 2001)); and, finally, environmental interests (promoting solutions to environmental challenges), which may be altruistic, enlightened self interest, and/or may be also fuelled by political and strategic interests. While much of the literature deals with the first four options, few articles deal with environmental aid.

Some of the problems with the ineffectiveness of aid lie with the motives of the donor country. Where government-to-government assistance provides support to strategic leaders, irrespective of what they do with the resources, aid is likely to be ineffective. Using aid to promote and project western practices and solutions on other cultures also might be ineffective. The use of aid money to dump excess food, or other products, has often resulted in problems in developing countries. Sometimes the inappropriate transfer of technologies led to an accumulation of white elephant technologies in the recipient countries. Where there was no hope of recovering loans, governments often wrote off the debt and classified these as aid. Dichter (2003) argues that a focus on projects often overlooks the need to engage in discussions about the long term process of development. In its 2007 evaluation, the OECD DAC (2008) concludes that the goal of ensuring that aid leads to genuine transfer of resources to the developing countries has not been achieved and that progress towards the goal of ensuring that well thought through interventions are aligned to local priorities and programmes is not clear (OECD DAC 2008).

Problems with aid can occur in the donor country as donors choose recipient countries based on *strategic national policy* often leading to support for corrupt or nondemocratic regimes (see Joint European NGO Report 2006; Burnside and Dollar 2000; Svensson 1998; 2000), although Alesina and Weder (2002) argue that there is no robust evidence showing that corrupt governments receive more aid or debt relief. The *process of policymaking* occurs in a western cabinet while the money disbursement takes place through decentralized processes. 'This institutional set up has resulted in a strong bias towards "always" disbursing committed funds to the *ex ante* designed recipient, irrespective of the recipient governments performance and the conditions in other potential aid recipient countries' (Svensson 2003, p. 383).

Policies on allocation disbursements develop in the parliaments of developed countries and *not in consultation* with recipient parties (Gupta 1997). Donors may often have very *little contextual knowledge* about the way in which such aid projects must work (Pronk 2001). Too often, aid ties to economic interests in the donor countries and tends to help donors more than recipients by providing support for the transfer paradox hypotheses (Pronk 2003). About 41.7 per cent of current OECD aid is 'not tied';

the rest is either 'tied' aid or not specified (OECD 2006, p. 31). Tied aid can increase the costs of a project by 15–40 per cent (Jepma 1991; Joint European NGO Report 2006).

Conditional aid policies as a means to ensuring the achievement of donor goals are often doomed to failure because they irritate recipient countries; and because there may be no support for such conditionalities in the recipient country. Sometimes there are up to 100 conditions imposed on recipient countries making it practically impossible for them to meet these conditions because it is 'administratively burdensome' and distorts the existing policy processes (Joint European NGO Report 2006). Conditional aid does not work because of the lack of credible non-compliance mechanisms.

Many donors that cannot meet the international 0.7 per cent commitment engage in statistical *manoeuvring* ('saving face, not lives') to enhance their aid statistics. For example, NGOs claim that one third of reported European ODA was actually not, technically speaking, aid. This included debt cancellation for two countries – Nigeria and Iraq – in which money moves from one western ministry to another and not overseas, especially since here it concerned export credits given to subsidize western exports to these countries. Finally, they are afraid that mechanisms such as the Clean Development Mechanism will be financed from development cooperation money (Joint European NGO Report 2006).

In addition there are challenges in the recipient countries, such as poor governance and policies. Poorly designed aid can displace domestic savings and create dependency on foreign resources (Ndulu 2002; Jepma 1997; Pronk 2001) and can lead to displacement of local expertise by foreign expertise (Ndulu 2002). Where recipients expect that aid will flow into some sectors, governments move their resources to other sectors leading to a *policy substitution* effect (Svensson 2000).

Finally there are challenges in the donor–recipient relationship, which may include a mismatch between priorities resolved through conditionalities, poor diagnosis of the contextual problem through over reliance on theoretical solutions, and expensive and inappropriate technical assistance amounting to one fifth of aid (Joint European NGO report 2006), which fosters dependency. This leads to a mismatch between partners at the ground level and a very heavy administrative burden on recipient countries to ensure accountability to donor governments. An average African country has to prepare 10 000 quarterly reports to the different donors to account for the money received (European Joint NGO Report 2006).

Donor behaviour differs. Scandinavian and Australian donors, probably because they did not have colonies or nurture geopolitical ambitions, tend to provide aid as a reward for less corrupt governments, while the

US supports democracies, but does not always consider corruption. The French tend to provide aid more consistently to past colonies. Japan gives aid to countries that support its position in UN negotiations (Alesina and Weder 2002). Apart from Norway, other European countries label debt cancellation as aid; Denmark, France, Sweden, The Netherlands and the Czech Republic include the costs of hosting refugees as aid; while Germany, France and Portugal also try to include the costs of hosting foreign students as aid (Joint NGO Report 2006).

ANALYSIS

Merger of the Discourses

In the three fields – climate change, assistance for climate change and aid – there are parallel movements leading to a convergence with the mainstreaming discourse (see Table 6.1).

Table 6.1 Changing discourses in policy arenas

Time line	Climate change	Climate change assistance	Aid
1940s			Promote security and economic stability
1960s			Promote development
1990 onwards	Technocratic vision; North reduces emissions and helps developing countries	(no discussion of liability) Incremental costs of global benefits to be financed by ‘new and additional funding’	Integrate environment in ODA
1995 onwards	North reduces emissions partly via market mechanisms in DCs	Rely more on market mechanisms; use ODA if possible for market mechanisms	Promote sustainable development
2000 onwards	Climate change and development linked	Mainstream climate change aid in ODA	Mainstream climate change in ODA

Practical Logic Versus Political Sensitivities of Linking Climate Change with ODA

One can argue that there are three reasons why it makes perfect sense to effectively mainstream climate change into ODA discourses and instruments. First, there has been overwhelming criticism in the past over how ODA resources financed environmentally damaging infrastructure and technology in the developing countries (see Hicks *et al.* 2008; Werksman 1993). Second, ODA instruments aim to deal with a number of goals that need to take the impacts of climate change into account if they are to be successful. Agrawala and van Aalst (2008) show that, based on a study of six countries, climate change will affect a substantial percentage of aid flows. Third, traditional ODA sectors are very similar to the modern climate change sectors. For example, ODA has traditionally provided resources to the forestry and agricultural sector (see Table 6.2) as well as to the energy infrastructure sector. However, aid to energy infrastructure remained stagnant at USD 6–7 billion between 1997–2005 (Tirpak and Adams 2008).

In a similar vein, one can argue that there are four very good reasons why developing countries would receive such perfectly logical links with political scepticism, if not anger. First, the slow speed with which the developed countries are attempting, if at all, to meet their financial commitments for development cooperation has been a source of some frustration in developing countries. Second, the change in the discourse from liability/compensation through new and additional, incremental financing into a moneymaking business on the one hand, and mainstreaming on the other hand, further aggravates the situation as many developing countries suffer even though their own contribution to the climate change problem is minimal. Third, the potential possibility that mainstreaming climate

Table 6.2 Major aid uses by individual DAC donors

	1984–1985 (%)	2004–2005 (%)
Social and administrative infrastructure	26.5	33.4
Economic infrastructure	18.4	13.3
<i>Agriculture</i>	<i>11.5</i>	<i>3.4</i>
Industry and other production	5.9	2.3
Commodity aid and programme assistance	18.4	2.8
Humanitarian aid	1.9	10.0
Other	17.4	34.8

Source: Gupta and van der Grijp 2008; Based on: OECD DAC (2008).

change may imply a shift of resources from one priority area to another (instead of a true integration) creates an additional fear that aid money will be used to prioritize developed country concerns over developing country concerns (see Yamin 2005b). Fourth, is it possible to address poverty and environmental issues simultaneously? After all, in accordance with the Environmental Kuznets Curve, do countries not need to develop first before they are able to invest in environmental protection?

CONCLUSIONS

The debates and related scientific work within the climate change arena are moving from a technocratic, narrow perspective to a broader social and developmental perspective calling for greater integration of climate change into aid strategies. At the same time, a parallel process is visible within the aid policy world where there is increasing pressure not to simply incorporate environmental aspects into developmental aspects, but to go further and mainstream climate change in aid policies.

Still from a political perspective, these moves are sensitive. It makes sense for donors who are having difficulties trying to raise domestic resources to fund developmental issues, let alone environmental issues, to use the little money available in an optimal manner and focus on two goals simultaneously. However, for the recipients, the issue remains highly sensitive. Aid money channelled into the climate change market mechanisms is leading countries like China to screen such funding and the OECD to adopt formal rules on the issue. If aid money could be simultaneously used to both combat poverty and climate change then, in principle, that should not be a problem. However 'trying to link climate change adaptation to project development through notions of additionality of cost because of climate impact does not carry sufficient leverage to simultaneously address poverty alleviation and climate change' (O'Brien *et al.* 2008, p. 200). This raises the fear that aid money may go to areas that are not priorities for the developing world, that instead of fulfilling the commitment to provide more resources, developed countries will provide less. The whole move towards mainstreaming is likely to be a final blow as long as ODA remains far below the 0.7 per cent GNI level.

In terms of developing climate aid in a way that works, three messages appear crucial. First, the use of simple causal formulae for designing aid delivery is unlikely to be successful. Second, linking contextual needs within context relevant policy frameworks is vital for the design of aid frameworks. This requires overhauling the system of aid policy made within governments of the developed world and for decentralizing policy

and implementation to specialists in consultation with local stakeholders (see OECD 2007a). Third, evaluating such aid to determine cause–effect links to support economic development is likely to be ineffective. Where aid helps people cope with climate change, the impacts on national income is likely to be marginal.

However, in the final analysis, the question that arises is whether linking climate change to development in the aid context – without questioning the fundamental premises of the development paradigm globally – is likely to be effective. Further, a focus on mainstreaming climate change and development, may imply the risk of dilution of resources for both climate change and development; thereby not addressing either issue. For many highly vulnerable developing countries, this may be a policy mistake with irreversible impacts for their people and their economy.

NOTE

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7. Environmental security, politics and markets

Bas de Gaay Fortman

While sustainable development has shown a remarkable degree of persistence and staying power as a concept, implementation of intragenerational as well as intergenerational equity¹ remains as problematic as true universality of human rights. Notable is the Earth Charter that connects sustainability with justice, peace and participation, signed by more than 2000 civil society organizations, but not endorsed at an intergovernmental or governmental level. Like Dower (2004), Hans Opschoor believes that this may well be connected with the inconvenience of the truth underlying it (Gore 2006), the incompatibility of the charter's ethical direction with value systems such as free market libertarianism and its corresponding morally demanding character. To these constraints, Opschoor adds the Charter's political inviability in terms of concrete implications (Opschoor 2007b, p. 268). Truly, Hans Opschoor deserves wide acclaim as one whose work looks beyond the narrow boundaries of one (sub)discipline: A genuine political economist, focusing on not just problems, but solutions, and not afraid to tackle religious, cultural, political and social aspects of these as well. This chapter is an attempt to honour him by connecting the economic problem of sustainability with the politics of security.

Environmental Crisis

Students of economics, like Hans Opschoor and me, were taught *the only goods that cost nothing are water and air*, in university lectures until only some decades ago. By considering water and air as free goods, humankind proves itself capable of sawing off the branch on which it sits. Humanity now faces an environmental emergency largely because of misunderstanding the true nature of collective goods such as water and air, and their importance for humankind's own subsistence. This environmental crisis exists at three distinct levels of community:

1. Globally, with manifestations in, among other things, climate change and threats to the ozone layer
2. Regionally, with manifestations in, among other things, acid rain (Europe); deforestation and loss of biodiversity (South America and Asia); as well as in land degradation and desertification (Africa)
3. Locally, with manifestations in, among other things, soil and water pollution; as well as in various examples of absolute resource scarcity

It is in reaction to the environmental threats confronting the quality of human life and to human survival itself that the concept of environmental security became a basis for public policy. This chapter expounds on that notion and introduces some conceptual approaches and responses to the current environmental question. Subsequently the chapter analyses the institutional responses to the set of problems confronting humanity, given the structures and frameworks inherent in the present economic order.

SECURITY AND REDISTRIBUTION OF RISK

Dialectics of security

Few terms are as ambiguous and confusing as security. The security dilemma is old and well known. 'Such is the absurdity of today's world,' states *The Gaia Peace Atlas*, 'the more we pursue security, the less secure we become' (Barnaby 1988, p. 110). The concept of security arises in two different contexts. In the first part of the statement, the perception is of security from the military strategist's point of view. It involves the defence of one's territory against threats of occupation and invasion, the defence of strategic raw materials and markets, and the defence of society's political and social values. In the second part of the statement, the approach is from a more global level. It is the lack of a genuinely global security system, designed to protect humankind as a whole, which necessitates self help by individual states, based on state sovereignty.

Security appears to have not only military, but also political, social and economic aspects. Consequently new terms have been formulated, like economic security. Economic conditions, too, may lead to situations that are breeding grounds for violent conflict and confrontation. Numerous conflicts in developing countries relate to economic contradictions and economic failure. The *Human Development Report* (HDR) of the United Nations Development Programme (UNDP) broadened the security concept to human security, in the sense of people being free from worries, not merely from the dread of a cataclysmic world event, but primarily

from worries about their daily lives (UNDP 1994, p. 3). Human security is people-centred, while being tuned to two different aspects.

It means, first, safety from such chronic threats as hunger, disease and repression. And second, it means protection from sudden and hurtful disruptions in the patterns of daily life – whether in homes, in jobs or in communities (UNDP 1994, p. 23).

Both aspects touch upon environmental security. To interpret this concept, it is time to examine further the meaning of security in general.

Conceptualizing Security

In a broad sense, security encompasses safety from the many threats people face in their lives. In addition, security implies a minimization of risks, through both prevention and protection. It means freedom from disaster, fear, attack and violent disruption. Conceptually, though, security can be a difficult term for several reasons. First, security is relative. Absolute security is not only impossible, but also a ‘dangerous utopia’ as Erhard Eppler argued (1981). Hence security strategies have to be oriented towards reducing, rather than eliminating, threats or vulnerabilities to threatening events (Buzan 1992, p. 5). Second, security is wide ranging in nature and requires a comprehensive approach. Security has many different and sometimes conflicting aspects and it may be risky to focus on only one of these, while neglecting other elements. Third, security should not be analysed in a static context. Human security relates to a people’s place in the political, legal and cultural order. Similarly the security of a state has to do with its place in the community of nations. These aspects are inherently dynamic and subject to change (Béland 2007). Finally, security tends to be a matter of personal feeling. It comes from the Latin *securitas*, which has a subjective connotation. This is expressed well in the German term *Sicherheitsgefühl*, meaning a sense of security.

Environmental Security

A narrow interpretation of environmental security highlights the danger of inter or intrastate violence because of environmental and resource conflicts. One illustration is the Horn of Africa, where lack of sustainable development is one of the major causes of armed conflict (see Markakis 1998). Darfur is another example where the struggle for scarce resources is the root cause of intrastate collective violence (Costa 2008). A more contentious interpretation of environmental security is to link ecology with security in the sense that environmental degradation itself is a direct

threat to human survival (Soroos 1994, p. 319). Yet it is usually acceptable to broaden environmental security to include threats and vulnerabilities at large.

Buzan defines environmental security in an absolute way, as a concern with 'the maintenance of the local and planetary biosphere as the essential support system on which all other human enterprises depend' (Buzan 1991, p. 433). Moss provides a relative interpretation.

Environmental security is defined as the condition, which exists when governments are able to mitigate the social and political impacts of environmental scarcity of resources, drawing on their own capabilities as well as the capabilities of inter-governmental and non-governmental organizations . . . Environmental security is thus a function of three sets of factors: (a) current and projected levels of resource exploitation, (b) the social and political impacts of scarcity, and (c) the response capabilities that are available to mitigate the effects of scarcity (Moss 1992, p. 27).

The term 'mitigate' points to the existence of policies that respond to environmental risks, rather than avoid them. Today, however, we witness a general policy of risk aversion, through the redistribution of risk.

Redistribution of Risk

Despite recent attention to insecurity from within, the security concept primarily remains a state's concern with external threats and vulnerabilities. In this respect, the mandate of the United Nations Conference on Environment and Development in Rio de Janeiro (1992), as confirmed by the World Summit on Sustainable Development (Johannesburg 2002) and incorporated in the United Nations World Summit 2005 Outcome Document is rather ambiguous. The mandate emanated from a General Assembly resolution that stressed the sovereign right of states to develop their own resources pursuant to their own policies. The only limitation was that their activities must not cause environmental damage to areas beyond their jurisdiction. Thus the challenge of environmental security continued to be set in the context of a world of sovereign states. However it is precisely in such a setting that the environmental crisis developed.

Sovereign states relate their strategies for environmental security to other aspects of (in)security. In this regard, Opschoor has given specific attention to economic insecurity as a reflection of access to, or control over (1) outlets for surplus products and (2) natural resources (Opschoor 1989, p. 136). The first is termed market insecurity and the second resource insecurity. It is precisely in this context of economic power relations that states may choose their strategies for environmental security.

B	+	-
A		
+	++	+-
-	-+	--

Note: N.B. + = environment-positive strategy; - = environment-negative strategy

Figure 7.1 Environmental security strategies of two countries A and B

In view of existing and future threats and vulnerabilities, environmental security will require some rather hard decisions. The world of sovereign states still determines the spaces within which those decisions will be made. In accordance with Principle 15 of the Rio Declaration, each state has to apply the precautionary principle in estimating the risks related to its environmental behaviour (Verstegen and Hanekamp 2006). The general preoccupation with economic growth as endorsed by the same declaration makes it highly unlikely that a state's estimation of risks will be done honestly, wholeheartedly and with a full assessment of the human welfare consequences for its citizens.

Environmental choices are based on perceptions of risks and the protection of vested interests (Stoett 1994b, p. 745). Not surprisingly, what is noted in practice is not so much risk-aversion but rather risk-redistribution. The Prisoner's Dilemma, often used to elucidate the problem of finding the right security strategies in a world of States, may be illustrative here (see Soroos 1994).² Countries suffer the negative consequences of each other's environmental behaviour.³ The matrix above depicts the basics of a generalization to which the Prisoner's Dilemma belongs.

In this world of only two countries, A and B, a (++) situation, in the sense that both states follow responsible strategies regarding the environment, would be optimal. Out of fear that the other state follows a (-) strategy, while it would itself pay the economic price for a (+) strategy, each state

might opt for a (-) policy. The result would be the worst possible (--) situation. This model abstracts from power relations, which are a very natural phenomenon in the real world. For example, country A might create the option to buy a (-+) situation from B. In that situation, country A could use an existing dominant position to force B into more environmentally positive behaviour, while country A continues its own environmentally negative policies. In a highly simplified nutshell, this is what happens today between the North and South in response to environmental crises.

The redistribution of risk, rather than the redistribution of wealth and resources, continues to dominate the international agenda. Too often, the South is supposed to mitigate the effects of environmental threats and vulnerabilities in the North. Its contributions to the CO₂ problem, its supply of energy to the industrialized world and its portion of global pollution are all examples of that trend. In such a setting, the follow up meetings to the Rio conference could not produce much institutional progress.

The implementation of Agenda 21 – Rio's blueprint for a global partnership in handling the major environmental crises – suffered from three principal defects.

1. Insufficient recognition, 'because the solutions to the problems of the environment must be global, they present an unprecedented challenge to concepts of national sovereignty' (Newman 1989, p. 35).
2. Security is detached from peace and with that from a concern with the right relations among people. Thus, security and prevention are replacing poverty elimination as objectives of North-South cooperation. Environmental security should connect not only with other aspects of security, but with a norm like justice⁴ as well (Rice 2007).
3. Conceptually, the notion of sustainable development, which lies at the root of contemporary strategies for environmental security, is still primarily economic in nature. The Brundtland Report that launched the concept in 1987 noted, 'Meeting essential needs depends in part on achieving full growth potential, and sustainable development clearly requires economic growth in places where such needs are not being met' (WCED 1987, p. 44).

Another weakness of the Rio framework is that it did not address the dialectics of economy and ecology. As Rasmussen noted shortly after the conference:

There is a serious tension between the means proposed to achieve sustainable development (the reform of trade, aid and finance . . .) and the goals necessary to achieve such development (combating poverty and changing consumption

patterns . . .). It is, in fact, likely that the means utterly frustrate the end . . . Development as a concept remains anchored in the very strategies by which current economic growth was achieved, the kind of growth that is now the bane of ecological [existence]. It is rooted in post-World War II economic expansion and continues within the framework of globalized capitalist economy (Rasmussen 1994, p. 55).

Realization of Wolfgang Sachs' slogan 'No ecology without equity; no equity without ecology', the core of the whole notion of sustainable development remains impeded by the 'commodification/market oriented mainstream' (Opschoor 2007a). Here the background lies in ideas, as well as vested interests (Timmons Roberts 2004). What then is the ideology behind environmental insecurity?

Conceptual Responses to Environmental Insecurity or the Dialectics of Sustainability

Sustainability simply means that something can be maintained over a long period, if not indefinitely. The question naturally arises, to what does the something refer? In forestry, the term refers to yields (Opschoor 1996, p. 4). In economics, it refers to per capita consumption (see Common 1996, p. 83). The Brundtland Report of the United Nations' World Commission on Environment and Development (WCED) took the concept of sustainability in two new directions: development and the needs of future generations. It thus defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987, p. 46).

Sustainable Development

Although different interpretations are used, development is usually associated with an economy's growth of productive potential that continues to be assessed in terms of growth of per capita income (De Gaay Fortman 1999). The Brundtland Commission forms no exception here. It expresses a rather optimistic view:

Our Report is not a prediction of ever increasing environmental decay, poverty, and hardship in an ever more polluted world among ever decreasing resources. We see instead the possibility for a new era of economic growth, one that must be based on policies to sustain and expand the environmental resource base (WCED 1987, p. 44).

The identification of development with economic growth is also apparent in the United Nations Framework Convention on Climate Change

(UNFCCC), which proclaims a need to ‘maintain strong and sustainable economic growth’ (art. 2a).

Economics Paradigm

Economics itself has almost become an ideology; the ideology of unlimited material progress within a limited time perspective. This form of progress involves increasing specialization in production and decision-making, based on a continuous drive towards ‘bettering material conditions’ (Adam Smith [1776] [1976]). The ideology of economic growth guides decisions regarding the use of scarce resources and the quality of our physical environment. Additionally aggregate economic expansion is still supposed to offer solutions to a broad spectrum of social problems (Du Boff 1974, p. 206).

Since it equates value with pecuniary market price and progress with increasing material production and consumption, economics has come under attack from environmentalists. Henderson for example noted, ‘Science has become a religion for all too many, while human values and ethical concerns are driven into hiding, because they are embarrassingly un-quantifiable and non-rigorous’ (Henderson 1978, p. 307). Her judgment of economics is rather blunt, ‘the discipline of economics itself is now the chief stumbling block to the rational discussion that our nation must have over what is valuable and how our resources are to be allocated’ (Henderson 1978, p. 317). Since this was written, a slow move from a science of allocation to a science of valuation is noticeable, to follow Klein’s terminology (1979). Yet the preoccupation with macroeconomic growth remains, as substantiated by Opschoor (2007a).

Economic Growth and the Environment

Economic growth in the usual terms of Gross Domestic Product (GDP) per capita simply implies an increase in aggregate production. In calculating GDP, usually there is no price attached to nature. This way of calculating progress affects our society in many ways. It dominates policies regarding production, income and the use of resources. One resulting fallacy is the belief that in order to sustain the environment, a lot of money must first come through economic growth. This is a modern macroeconomic paradox (Keynes).⁵ For an individual enterprise, it is true that the money needed for cleaning polluted air, water and soil has to come from earnings (profit), which normally implies growth. However what is true at the micro level is not necessarily valid at a (national or international) macro level. Aggregate growth of production at a macro level means more depletion of resources, more waste and more pollution.

When sustainability became *en vogue*, it became at once the subject of a heated debate between economists. This began with an article by Beckerman in which he belittled weak sustainability (maintaining existing levels of per capita consumption over time) because it added nothing to economic welfare theory on intertemporal welfare maximization. He criticized strong sustainability on the other hand, for setting an absolute constraint on the use of natural capital and was hence 'morally repugnant' (Beckerman 1994, p. 203). The strongest criticism of Beckerman's article came against his attack on strong sustainability. His critics argued that he had transformed that concept into something so absurdly strong as to imply that 'no species could ever go extinct, nor any non-renewable resource should ever be taken from the ground, no matter how many people are starving' (Daly 1995, p. 49).

With Opschoor, Daly belongs to that small group of prominent economists who incorporate a primary ecological perspective in their analyses. In the latter's view, natural capital should be maintained, but not necessarily in the sense that the ecosystem is not affected by human behaviour. Daly further argues that natural capital and man made capital are not substitutes, but complements. Hence there are limits to growth, not primarily in the sense that the world is finite (Meadows *et al.* 1972), but because there is finite substitutability between man made and natural capital.

At this point some attention should be given to the second part of the Brundtland Commission's definition of sustainable development: The ability of future generations to meet their own needs. Beckerman argues that balancing present and future claims on the resource base is possible through price discounting. Here Daly correctly pointed to the issue of ownership. If the perception is that the resource base belongs entirely to the present generation, a different set of prices and a different interest rate emerge than in the case of a distribution of ownership over generations (Daly 1995, p. 53). If the starting point of policy is that natural capital must remain intact – albeit not without changes in its composition – this snag is avoided.

ENVIRONMENTAL INSECURITY: THE DIALECTICS OF LAW AND POWER

By economic order, we understand the organizational and institutional framework within which processes of production, distribution and consumption of goods and services take place. Its essence lies in the distribution and control of economic power, which is the power that gives access to resources and provides claims to goods and services. Debates concerning

the concept of economic order used to occur during political confrontations between capitalism and socialism. With regard to socialism, brevity is easy. The socialist system results in an enormous waste of resources. It is common knowledge that environmental security is at its lowest in authoritarian socialist economies. In Eastern Europe in 1984, sulphur dioxide emissions per head of population were almost three times higher than in the West European Community. In 1987 with a much lower per capita income, energy consumption in Eastern Europe was still higher than in Western Europe. The incredible state of pollution in Beijing, which received global coverage when the world's number one marathon runner refused to take part in the 2008 Olympic Games in that city, constitutes a more recent example. Dictatorship is not conducive to environmental protection. The problem is that in such political systems, decisions on production and investment are in the hands of those also responsible for environmental policies and implementation.

Hence institutional responses to environmental insecurity must be studied within the remaining framework: An economy in which demand and supply can freely meet and which is, in principle, based upon free formation of prices. In terms of environmental quality however, this framework is still problematic (Mason 2008). Markets can manage interactions of supply and demand, but they cannot manage interactions with the environment. Intervention of some sort is needed. What forms of institutional response to environmental insecurity exist within the framework of a market economy?

Cleaning Markets

The freedom of the free market economy refers to freedom of enterprise and consumption. Market economies, however, cannot operate without external (public) influence on certain parameters of decision-making. This is especially true for decision-making responsibilities concerning the production and consumption of collective goods and services, and the provision of law and order (Green 2007). Hence some form of public office is needed. Public offices however, can be (ab)used for other purposes beside those for which they were created (think, for example, of public lobbying on subsidies and price of licences).

In a particularly strong chapter of her book *Costing the Earth* (1991), written in her time as *The Economist's* environment editor, Frances Cairncross exposed the madness of government subsidies for environmentally damaging activities such as intensive farming, uneconomic forestry and wasteful forms of energy use. In this connection, Daly speaks of uneconomic growth. Indeed the political pursuit of growth often leads to

policies that are bad for the economy and environment alike. Behind the corresponding political schemes are often strong lobbies that have bought their entry into the centres of power. In opposing their counterproductive interventions in markets, NGOs have a vital role to play.

Informing Markets

Economists, it has been said, ‘know the price of everything and the value of nothing’ (Oscar Wilde 1892). Conventional economic theory has reduced the issue of value to the measuring rod of money. Understandably the value of our natural environment cannot be expressed in free market prices, because it is a collective good in the sense that its enjoyment is collective rather than individual. However, one can attach prices to collective goods through processes of collective (public–political) valuation. Could not these be prices that reflect real scarcity?

The point is that the environment is not a collective good in the normal sense of the word. Collective goods like education, defence and a social security system originate from collective-action that demands their supply. Supplying those demands requires labour and technical organizational skills. In the case of our physical environment however, there has been no such collective-action. Rather in terms of supply, water and air tend to be regarded as free goods. In a market economy, producers tend to miss the real (positive or negative) value attached to nonrenewable resources or the deterioration of nature through pollution of water, soil and air. This results in an externalization of costs by both producers and consumers. In other words, producers and consumers are not inclined to calculate costs that they do not have to pay for themselves.

In response, pragmatic environmentalists seek to help decision-making by treating nature as a resource in the economic sense of the word. In reality, it has to be treated as the scarcest of all resources, to be managed sensibly or at least valued economically. Various environmental cost techniques have been developed, based on different techniques of shadow pricing and discounting. Benefit–cost analysis is used to substantiate policy decisions. However many different benefit–cost techniques exist, each of which produces a different outcome. One controversy concerns the current practice of measuring people’s willingness to pay for an environmental resource, rather than the sum required to compensate them for the loss of it. The latter represents ‘an amount which will normally be far larger than their willingness to pay’ (Knetsch 1994, p. 351). A more fundamental question though, is whether contingent valuation methods (CVM) could really measure benefits and costs in such a way that, for instance, the CVM estimate of the environmental value of old growth

forests would be directly comparable to the market value of timber (Knetsch 1994, p. 357).

In a report written for the Club of Rome that would have deserved as much international attention as *Limits to Growth* managed to acquire (Meadows *et al.* 1972), Orio Giarini proposed a different concept as a foundation for economic valuation, utilization value. This notion refers to the time during which we can effectively enjoy certain goods and services (Giarini 1980). It reflects the idea that production may not only add value, but may also reduce value, particularly when nature and culture are negatively affected. To put this concept into operation, economic theory must develop a concept of wastage. What we do find in this respect is a notion based on maintaining the environmental infrastructure in terms of 'the source and sink aspects of the biosphere' (Opschoor 1995, p. 137). This he calls the 'environmental utilisation space'. Naturally the challenge remains to put that concept into operation.

Another difficulty concerns the assessment of environmental risks. The principal problem remains that the valuation of stocks in a monetary system is based on measurements of flow. Hueting in particular has attempted to find practical solutions to this theoretical dilemma (1992). His efforts to devise methods for green accounting have resulted in some important insights. One significant finding is that 'the lion's share of the contribution to growth comes from the most damaging activities' (Hueting 1996, p. 85). Clearly environmental security requires more than merely providing markets with better substantiated data. Insofar as sustainable development confronts humankind with physical constraints, there is no alternative to regulation.

Restructuring Markets

Markets, no matter how well cleaned and informed, cannot adequately ensure environmental protection. Besides market stimuli, this requires utilizing legal and institutional incentives in the form of juridical and administrative regulations. This requires permits, licences and bureaucratic procedures.

A first requirement for a successful institutional response is a strong state. It has been observed, rightly, that insofar as environmental protection requires concerted global intervention, all states may be regarded as weak. Yet as we all know, 'while all states are weak in this sense, some states are weaker than others' (Hay 1994, p. 91). A weak state in this context might be characterized as one in which government intervention is more likely to pollute markets, rather than to structure them in an environmentally responsible manner.

A second condition for effective regulation is that legal systems must function adequately. Substantive law is only part of the legal system; other elements include procedural law, decision rules, personnel organization and resources. Law, however, is not a product in the sense of a given set of rules and procedures; rather it is a process. It is impossible to abstract from its social context because the law is not the only influence on decisions people make. Rivalry, social, religious or economic coercion, or various types of inducement and collaboration also affect those decisions. The view presented here implies a rejection of instrumentalism in the approach to law as a method of social change. If social change takes place, legal change will reflect it. Thus the law tends to be part of social change, which is quite different from the law acting as its major instrument. The core problem with any type of regulation from above is that of the principals and the agents. If the agents are to follow the rules and directions of the principals, the rules and directions should, in some way, conform to the agents' own incentives.

The motivations and situations of the agents who would have to conform to the new rules will depend upon their entitlement positions and perceptions regarding future entitlements (De Gaay Fortman 1999). Hence the effectiveness of environmental legislation is likely to depend on analyses of questions such as those put by Dietz (1996, p. 41):

1. Who has access to which natural resources and what type of access rules exist?
2. Who holds the rights over natural resources and what does this mean for others, who have an interest in the use of those resources?
3. Who plays a role in natural resource extraction and natural resource maintenance?
4. Who are the natural resource managers and who invests in what Blaikie and Brookfield (1987) call, *landesque capital*?
5. Which institutions have what sort of rights to intervene in natural resource management?
6. Who benefits from resource or environmental management and who bears the costs involved?
7. What are the spatial levels of involvement and what does that mean in practical terms? From which geographical levels of scale do the actors who actually influence the natural environment operate?
8. Who determines the ideas behind resource access and resource exploitation (and . . . these ideas can be as far apart as ecototalitarianism and ecopopulism)?

Replies to such questions require detailed studies of entitlement systems (De Gaay Fortman 1999). These analyses involve confronting the matter

of environmental regulation with other issues, such as poverty and distributive justice. From such a perspective, bureaucratic responses to environmental insecurity are rather difficult. Indeed failure in the form of nonlaw (legislation without effect) and side law (legislation with unintended side effects) abounds, particularly in a Southern context. In order to escape such dialectics of law and power, there have been attempts to deregulate. This implies reregulation, in the sense of a transition from strict environmental control to the use of economic incentives through price manipulation.

Using Markets

One way of using markets is to make the ingredients of regulation subject to the forces of demand and supply. Thus, pollution permits might be issued, at some percentage (e.g. 75 per cent) of present levels, but how does one determine the initial distribution? In a global context, this question poses a particular problem for CO₂ emissions. Kverndokk (1995) rightly typifies it as a justice problem. Markets may also be used to achieve environmental goals through public price manipulation. Governments can directly influence the price of certain commodities (natural gas, for example). In other situations, they can use instruments of taxation (Value Added Tax).

There are strong perspectives for more responsible resource use in better informed markets. Already in the last century, a plea was launched under the name Factor Four, which implies that twice the prosperity can be achieved with half the use of natural capital. With the right calculations and the right parameters, based on modern technologies, a growth of resource productivity by a factor of four would be possible. The authors of Factor Four presented no less than 50 examples of technologies that imply factor four results (Weizsäcker *et al.* 1998). Indeed increased energy efficiency is more than feasible in an industrial-technological society that 'largely reflects a time when concern for nature had not yet penetrated people's consciousness' (Vischer 1997, p. 151). 'However advantageous it would be, the inertia of society means that an unusual amount of imagination and effort would be required to advance in this direction' (*ibid.*). Sustainability, in other words, is more than a matter of economics and politics; at all levels of decision making it concerns culture.

CONCLUSIONS

Obviously the environmental crisis requires a more fundamental response than merely a number of conceptual and institutional adaptations. The challenge is to rethink and redefine such policy signposts as development

and progress. The Brundtland Report and the Rio Earth Summit could escape the inherent tensions and dilemmas by simply identifying development with economic growth in free market economies.

However the term environment may obscure the nature of the contemporary crisis confronting humanity. Humankind faces certain absolute limits, albeit not for the first time in history. This becomes more obvious if we use the term nature instead of environment. The ultimate attack on nature is transforming the climate. The planet is warming and by changing the weather, every spot on earth becomes man made and artificial.

The question then is what are the implications of the global, regional and local common good? How do people perceive their personal and group interests in particular and the public interest in general? Environmental security then implies a civilizing process towards societies that function better in terms of our needs and purposes, as Elias has argued (1982). Social constraint becomes self constraint and people (or countries) perceive the common good (the public interest) at a higher level. Insecurity on the other hand, arises out of a fragmentation of the public interest. Through such fragmentation and the accompanying loss of self restraint, polarization increases.

An indicator of the current environmental crisis lies in the striking dichotomy between economic globalization and the lack of global political control (Schaeffer 2005). Conceptually the foundation of a universal intergovernmental organization for peace and development, the United Nations, may be one of the few 'breakthroughs in twentieth century politics, regardless of how successful it has been in practice' (Bassin 1994, p. 1). However world government remains an illusion. In a national context, processes of social development can correct economic inequality and social imbalance. Yet there are no such global mechanisms and in a world of sovereign states, both global poverty (and exclusion) and the environmental crisis become impenetrable. This predicament became visible quite some time ago as the following graphic presentation shows (Netherlands Ministry of Foreign Affairs 1993, p. 24); see Figure 7.2.

The obvious lesson is that policies for redistribution of risks are bound to cause trouble for the world as a whole, including the framers of such policies themselves. For those who did not yet believe this sociopsychological truth, the failure of the follow up conferences on sustainable development may have opened their eyes. These times are unique in the sense that survival has become a genuinely global challenge. The North has to reorient its value system. The challenge is to connect the material to the moral, to tie growth to sustainability and to link production with human development.

This means a revitalization of public interest in a genuinely global sense (Young 2008). Notably the United Nations 2005 World Summit Outcome Document, although primarily concerned with the unsatisfactory

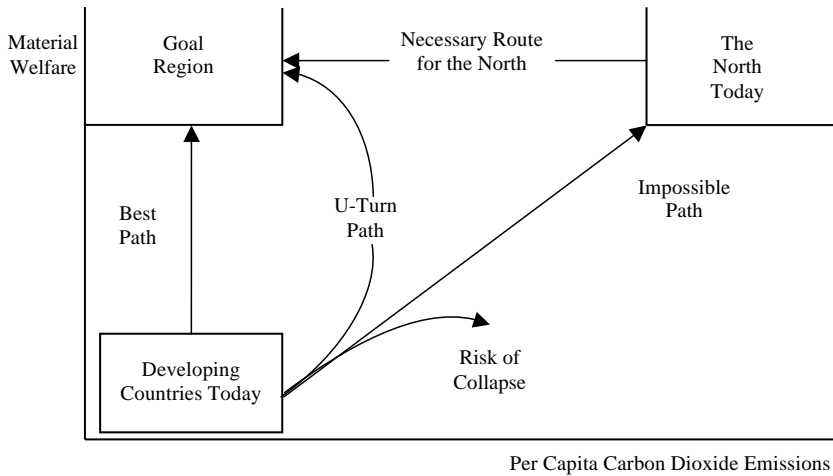


Figure 7.2 *Achieving the sustainable energy goal*

achievements in respect to the Millennium Development Goals (MDGs), referred to the ‘interdependent and mutually reinforcing pillars’ of sustainable development as economic development, social development and environmental protection. ‘Feeding the . . . poor and vulnerable populations in Africa, while preserving the natural resource base and the environment’ as Akin Adesina put it, ‘is one of the most pressing development challenges of the twenty-first century’ (United Nations 2008c, p. 4).

The challenge is to find combined strategies to combat environmental crises, global poverty and exclusion, a subject that is at the heart of Hans Opschoor as an economist and environmentalist. This does not only involve state representatives in their conference buildings. All sections of the global population, all types of actors – individual citizens, corporations, nongovernmental organizations and states – will have to work together to reorient civilization. There is a reason why we see a growing demand today for ‘a new consciousness’: ‘What is required is a systems shift, a new holistic view of the world we live in’ (Leiserowitz and Fernandez. 2008). Indeed, Hans Opschoor is a living testimony to the possibility of combining rigorous analysis with such a vision of a better world.

NOTES

1. Hans Opschoor adds here a third equity-related component: Fairness in respect of nature in the sense of sustaining biodiversity. See Opschoor 2004a.

2. The Prisoner's Dilemma game is well known. Two prisoners could achieve an optimum result in terms of low sentences if they both persevere in denying their crime. The worst outcome would hit the person who had denied while his mate had confessed. Out of fear for that situation they both confess, effecting a higher sentence than each would have received.
3. A clear illustration was the dumping of low level nuclear waste into the Sea of Japan by Russia, which was cause for concern by Japan and South Korea (Maddock 1995, p. 27). Western winds blow acid rains to the east while eastern winds transport sulphuric acid to the west.
4. Justice is a norm pertaining to relations among human beings. It differs from norms regarding the relationship between people and the environment, such as ecosystem health or – a standard *en vogue* in Christian ecumenical circles – integrity of creation. A term like 'eco-justice' confuses the issue. The challenge lies in a simultaneous realization of norms, rather than in mixing them like a cocktail.
5. For example, a person who hoards money gets richer; a whole society that hoards money does not become wealthier, but reduces effective demand with the accompanying negative consequences for national income and employment (the hoarding paradox).

8. Humans are the measure of all things: Resource conflicts versus cooperation

Syed Mansoob Murshed¹

Civil war is a multifaceted problem. Not only does it produce human tragedies on a colossal scale, but it also creates humanitarian crises that are of concern to the international community, as well as contributing to global and regional insecurity. Civil war is also a major cause of underdevelopment and perpetuates poverty (see Murshed 2002; Collier *et al.* 2003). Civil wars are not a homogenous phenomenon. Their origins, motivations and objectives vary. A useful guide to the typology of conflict is in Besançon (2005). The discussion on the typology of civil war points to four broad types: genocides, revolutions or rebellions against the state, secessionist wars and internationalized wars (where adjoining states or the great powers get involved). Many examples of contemporary conflict do not always fit neatly into only one of the categories mentioned. According to the rational choice paradigm, conflict is a result of choice. This may be of a myopic nature, as negotiated settlements that avoid losses that ensue from war are usually Pareto superior.

Two phenomena utilized to explain conflict onset among academic economists are greed and grievance. The former is due to the influential work of Paul Collier (see Collier and Hoeffler 2002, 2004) and is more popular amongst economists. According to this view, conflict reflects elite competition over valuable natural resource rents, concealed by the guise of collective grievance. Additionally rebellions need to be financially viable: civil wars supported by natural resource based rents like blood diamonds or oil, or when sympathetic diasporas provide a ready source of finance are more likely to occur. Above all there was the assertion that inequality played no part in adding to the risk of civil war. Paul Collier and his associates (2003) emphasize the poverty trap: poverty makes soldiering more attractive, generally lowering the opportunity cost of war in poor nations. In turn, conflict serves to perpetuate poverty because of war's destructiveness; a vicious cycle of poverty–conflict–poverty ensues. Fearon and Laitin (2003) assert that ethnic or religious diversity makes little contribution to civil war

risk, which comes mainly from diminished state capacity in the context of poverty. This finding taken together with Collier's work has a simple intuitive appeal; civil wars occur in poverty stricken, failed states characterized by venal, corrupt and inept regimes, with the dynamics of war sustained by a motivation akin to banditry. It also provides intellectual excuses for direct, colonial style, intervention to prevent failing states from collapsing.

In many ways these views go against the grain. There is a long standing position in political science that relative deprivation (Gurr 1970) and the grievance that it produces fuels internal violence. Identity is also crucial to intrastate conflict. This is due to the collective-action problem, as discussed in Olson (1965). It is difficult to mobilize large groups to undertake collective-action, because of mutual mistrust, monitoring difficulties and the free rider problem. Ethnic identities, whether based on race, language, religion, tribal affiliation or regional differences, may serve as a more effective amalgam for the purposes of group formation, compared to other forms of more transient differences traditionally stressed by Marxist writers, such as socioeconomic class. The formation of enduring identities are therefore central to mobilizing groups, including the machinations of conflict entrepreneurs who organize men to fight each other (see Tilly 1978; Gurr 2000). Conflict cannot proceed without the presence of palpably perceived group differences or grievance, which may have historical dimensions. Frances Stewart (2000) introduced the notion of horizontal inequality, the inequality between groups, rather than the inequality that may exist amongst an ethnically homogenous population (vertical inequality). It may indeed be the case that vertical inequality in a homogenous population, despite the class differences it engenders, does not seriously increase the risk of conflict. However, that could still leave a role for intergroup or horizontal inequality in causing conflict.

The purpose of this chapter is to conduct a critical review of the greed versus grievance hypotheses; situating these into the notion of a malfunctioning social contract. The next section compares and contrasts the greed and grievance hypotheses; followed by the synthesis of greed and grievance as related to malfunctioning institutions, described as the social contract. The chapter ends with brief conclusions.

GREED AND GRIEVANCE EXPLANATIONS FOR CONFLICT

Greed

Evidence for greed motivation behind civil wars comes from empirical work analysing a cross section of conflicts in different nations together

econometrically, with greed proxied by the availability or abundance of capturable natural resource rents. In Collier and Hoeffler (2004), civil wars stem from greedy behaviour of a rebel group in organizing an insurgency against the government. Greed is about opportunities faced by the rebel group. Collier and Hoeffler (2004) conclude that the set of variables representing rebel opportunity or greed akin to loot seeking are the main reasons for civil war. By implication the alternative hypothesis of grievance (justice seeking) focusing on ethnic religious divisions, political repression and horizontal inequality is dismissed, although its invalidity is not formally tested. Natural resource rents constitute booty and this fact has emphasized the greed or criminal motivation for civil war. Central to Collier and Hoeffler's empirical testing for the greed hypothesis is the role of primary commodities in the economic structure. They measure dependence on natural resources by the share of primary commodity exports in GDP, calling into question the validity of this metric as well as the statistical robustness of the relationship between resource rents and the risk of conflict. The combined messages of Collier and Hoeffler (2004) and Fearon and Laitin (2003) about greed and state failure causing rebellion or civil war has had an immense influence in the media and the donor policy community's thinking about conflict.

The econometric models purporting to establish the empirical validity of the greed hypothesis are atheoretical, in the sense of not having a formal economic model based on optimizing behaviour by economic agents, to explain why greed may cause conflict. If economic agents (*Homo economicus*) actuate only by self-interest,² we must demonstrate why they choose war over other alternatives. Therefore, any theorizing about greed must have a basis in economic motivations for violence and criminality. Belligerents in the wars of natural resource rich countries could be acting in ways closer to what Olson (1996), referred to as roving bandits – with no encompassing interest in preserving the state or its people but simply intent on looting – than stationary bandits who take control of the state and seek to maximize their own profit by encouraging stability and growth in their new domain. Civil wars motivated by the desire to control natural resource rents could also mirror warlord competition, a term that owes its origins to the violent competition between leaders attempting to control economic resources in the context of Medieval Europe (Skaperdas 2002).

To summarize, a proper greed based theory of civil war must relate to the trade off between production and predation in making a living, where one may view war as theft on a large scale. Violence is one means of appropriating the resources of others. Note that armed conflict implies the absence of contractual interaction (Edgeworth 1881), and is in stark contrast to the alternative method of benefiting from the endowments of others via

peaceful and voluntary exchange (trade) between economic agents, groups or nations. This implies that we also need to specify the conditions under which violence becomes a viable or more attractive option relative to other alternatives.

A variety of game theory models describing the noncooperative and conflictive interaction between groups exist, where the object is to capture the rival's endowment by force (see for example Hirshleifer 1995; Skaperdas 1992). Both these models neglect the destructiveness of war (collateral damage) and its capacity to ravage productive capacity, additional to direct military expenditure. The possibilities of peaceful exchange need to be limited in order to rationalize conflict. In traditional economics, the gains from trade arise mainly from differences in tastes, technology and endowments, and these gains from trade need to be minimized in order to make conflict an optimal choice. Violent means are attractive when the intent is to extract resources (as in the case of colonial plantations and mines) or accumulate surpluses at the expense of others (mercantilism). They also assume symmetric information. In the presence of asymmetric information – misperceptions about contest success, the opposition's intentions and so on – wars that do not maximize expected utility under full information may break out, akin to problems associated with moral hazard and adverse selection. Such theorizing is blind to institutions, despite ruling out the existence of property rights, between group contracts and the presence of transaction costs that breed mutual mistrust. Wars can also reflect the absence of institutions, which facilitate negotiation and peaceful exchange.

War implies the absence of contracts, and warring parties may enter into contracts that make their interactions more peaceful, especially if war causes substantial collateral damage. Groups may also decide to merge in order to reap economies of scale in production. If they do not do so when it is clearly in their mutual self interest, we have to resort to explanations based on misperceptions, mistrust or lack of institutions that enforce contracts. Alternatively the institutions that once bound groups together may have disintegrated. More on these issues later in the chapter, it is now time to revert to the empirical hypotheses that buttress cross-country econometric studies of civil war, which are dominated by various forms of greed (or modified greed) and state failure hypotheses.

While Collier and Hoeffler (2002, 2004) push for the case of greedy rebel mechanism derived from their findings regarding the strong explanatory power of primary commodity export share to GDP (as a proxy for natural resource wealth), others are less sanguine. In short the empirical controversy over the link between natural resource wealth and greed hypothesis are about the saliency of mechanisms between natural resource rents and

conflict, as well as measurement issues and estimation techniques (see Murshed and Tadjoeeddin 2008, for a review of these issues).

In summary, greed-based explanations for conflict require further refinement by utilizing better data on capturable resource rents. Proper consideration should also go to institutional mechanisms that cause competition for resource rents to descend into outright warfare. Ultimately greed theory is unsatisfactory, because conflict is rarely a rational or Pareto optimal strategy, except in circumstances illustrated by the Hirschleifer (1995) and Skaperdas (1992) models discussed above, where property rights are absent and the possibilities of exchange are limited. More generally, it points to institutional failure, which encourages noncontractual behaviour, as well as the existence of asymmetric information. The presence of grievances is necessary for group formation and violent collective-action, and to this we now turn.

Grievances

Central to grievances is identity and group formation. An individual's utility may relate to his identity, specifically the relative position of the group he identifies with in the social pecking order (see Akerlof and Kranton 2000). An individual may derive utility from certain normative forms of behaviour appropriate to his identity but considered deviant by other groups, and may even face sanctions from like-minded group members if he deviates from them. This type of behavioural paradigm may be related to solving collective-action problems (Olson 1965), without which organized, large scale violence is impossible, even if we believe conflict is primarily motivated by greed. As noted in the introduction some appropriate definition of ethnicity may be a superior basis for group formation compared to social class in an ethnically homogenous society.

We may subdivide theories of grievance into relative deprivation, polarization and horizontal inequality. While it is important to differentiate them, some overlap among the three definitions is inevitable.

Relative deprivation

The notion of relative deprivation dates back to the work of Ted Gurr (1970) who defines it as the discrepancy between what people think they deserve, and what they actually believe they can get; in short the disparity between aspirations and achievements. Thus educational achievements may raise the aspirations of young people, but they will become frustrated if unemployed, occasionally venting their feelings in mass political violence. Gurr puts forward the following hypothesis, 'the potential for collective violence varies strongly with the intensity and scope of relative

deprivation among members of a collectivity' (1970, p. 24). This lays down the notion of relative deprivation as the microfoundation for conflict. Relative deprivation is a major cause of civil war, as well as sectarian and routine violence.

Polarization

A related notion is that of polarization (Esteban and Ray 1994). Polarization occurs when two groups exhibit great intergroup heterogeneity combined with intragroup homogeneity. Economic polarization (along with high vertical income inequality) can occur in culturally homogeneous societies. Ethnic polarization could exist along with a degree of economic equality. What is useful is a hybrid concept that combines identity and economic polarities, as in Østby (2007). In their seminal concept of polarization, Esteban and Ray (1994) focus on the identification and alienation framework. Their idea is as follows: polarization relates to the alienation that groups of people feel from one another and the feeling of within group identity fuels such alienation. Furthermore, Esteban and Ray argue that the traditional measures of inequality are only concerned with interpersonal alienation, but fail to capture the dimension of group identity. It is important to note that ethnic polarization requires a small number of ethnicities. When a society has a very large number of identities, then the term ethnic fractionalization is more appropriate. Therefore polarization is what may matter for conflict, rather than fractionalization and/or overall vertical (interindividual) inequality. Few studies have empirically demonstrated the existence of such an argument. Montalvo and Reynal-Querol (2005) find that ethnic polarization is a significant explanatory variable for civil war onset, while ethnic fractionalization is not.

Horizontal inequality

The notion of horizontal inequality between groups, classified by ethnicity, religion, linguistic differences, tribal affiliations and so on, is an important cause for contemporary civil war and sectarian strife, but not routine violence. The idea of horizontal inequality may overlap with the notion of relative deprivation and polarization. The expression, horizontal inequality, originates in the work of Frances Stewart (2000) and should be distinguished from vertical inequality, which is inequality within an otherwise homogenous population. The four sources of horizontal inequality are outlined here – discrimination in public spending and taxation, high asset inequality, economic mismanagement and grievances over natural resources (Murshed and Tadjoeddin 2007).

Horizontal inequalities have significantly affected conflict in Nepal and Indonesia, to cite two examples of its application to individual nations. Nepal has had a Maoist armed insurgency since 1996, which has recently subsided. Based upon data on human development indicators (HDI) at the district level in the year the conflict began in Nepal (1996), Murshed and Gates (2005) find that HDI gaps with the capital Kathmandu, as well as greater landlessness, significantly explain the intensity of conflict related fatalities across different districts in Nepal, whereas natural resources do not. Thus, variables of enduring grievance such as landlessness are most significant compared to more temporary income differences; at the same time the greed hypothesis is invalidated. In Indonesia, differences in district health status can explain ethnocommunal violence, measured by a horizontal inequality index (population-weighted coefficient of variation) (Mancini 2005). Tadjoeeddin (2003) finds interesting results in this connection. Converging gaps in socioeconomic achievements of the two competing groups contribute to ethnic violence amongst Muslims and Christians in Maluku, whereas widening indicators have contributed to Dayak-Madurese violence in Kalimantan. What matters is the perception of change in the relative position of each ethnic group's rival community.

Østby (2007) manages to construct polarization indices and horizontal inequalities across 36 developing countries for 1986–2004 based on ownership of consumer durables (which she uses to calculate measures referred to as economic) and educational attainment (which she uses to calculate measures referred to as social) based upon household surveys. The data comes from demographic and health surveys (DHS) and does not contain information on income or wealth. Nevertheless this represents a pioneering application to the cross-country conflict debate. In her panel and cross sectional analysis, she finds that social and economic polarization, and social horizontal inequality based on education significantly contribute to conflict, whereas vertical inequality and purely ethnic or socioeconomic polarization do not. A priori one would expect more enduring horizontal inequalities based on health, education, political exclusion and asset holdings to be more significant compared to transient income differences. Østby (2006) utilizes the same data set on horizontal inequalities along with a variety of political variables ranging from democracy to political inclusiveness. The idea is that democracies and semi-democracies may facilitate the transformation of horizontal inequalities into conflict, by permitting protest. Her empirical analysis supports this assertion. Inclusiveness implies an electoral system that has greater characteristics of proportional representation, and where minority groups participate in elections. Inclusiveness combined with high horizontal inequality and democracy can exacerbate conflict at low levels of economic development. Thus

economic development and reduced horizontal inequalities in parallel with democratic development and inclusiveness are the requirements for peace. Despite the paucity of data on horizontal inequality, reasonable proxies show that it does matter in explaining conflict onset in a cross section of countries, in contrast to the earlier assertions by many that inequality was immaterial to conflict risk.

SYNTHESIS AND SOCIAL CONTRACT

The greed versus grievance dichotomy is a useful entry point into debate about the causes of conflict. In certain instances where there are substantial quantities of capturable natural resource wealth present such as alluvial diamonds, oil or drugs, greed may be the dominant factor prolonging conflict. Yet without group formation (for which some historical grievances are important) violent collective-action cannot take place. In short grievances can be present without greed, but it is difficult to sustain greedy motives without some grievances. Although most scholars regard greed and grievance as competing views, they may be complementary, as greed may lead to grievances and vice versa. The greed or grievance explanations (or some hybrid form of both) may be necessary for the outbreak of civil war, but they are arguably insufficient. This is because the causes enumerated in the previous two sections contribute to the risk of civil war. Yet some societies, despite having conditions predisposing them to civil war, such as horizontal inequality, polarization and natural resource rents, do not descend into conflict. We argue that for the forces behind either greed or grievance to take the form of large scale violence, there must be other factors at work. Specifically, a weakening of what Addison and Murshed (2001) call the social contract (see also Murshed 2002). This is similar to the weak state capacity and, by implication, poor institutional quality, arguments made above. Therefore, even if rents from capturable resources do constitute a sizeable prize, violent conflict is unlikely to take hold if a country has a framework of widely agreed rules, both formal and informal that govern the allocation of resources, including resource rents and the peaceful settlement of grievances. Such a viable social contract can be sufficient to restrain, if not eliminate, opportunistic behaviour such as large scale theft of resource rents and the violent expression of grievance.

War implies the absence or breakdown of contractual interaction, as indicated earlier. In traditional international relations theory, if nation states exist in a state of anarchy vis-à-vis each other, they may make war with each other if it is in their interests, a point also emphasized by the great philosopher Immanuel Kant in 1795. One, however, expects the presence

of some degree of contract or consent within the modern nation state. Consequently, civil war is a reflection of the breakdown or degeneration of a contract governing interactions between various parties. Hirshleifer (1995) draws our attention to the fact that within a society, social contracts can be vertical if they are authoritarian in the sense of Thomas Hobbes, or they may be horizontal if fashioned with popular consent, as advocated by John Locke. The former may be described as dictatorial and the latter as democratic.

What constitutes the basis for a good social contract? Kant's (1795)³ essay on 'Perpetual Peace' provides us with the fundamental clues in this direction. First, observe the usage of the expression *perpetual*, implying permanence as opposed to a transient truce. In the contemporary parlance of game theory, such agreements or contracts are described as renegotiation proof or self enforcing, so that there are no incentives to deviate from it. Second and most crucially, Kant refers to a *republican* constitution. By this, he means the separation of powers⁴ between the executive and legislature, which ensures their proper and efficient functioning and we may add the independence of the judiciary. Put simply, this concept implies good government that holds the social contract together. Our contemporary understanding of good governance can include a host of other factors beyond the separation of powers, such as decentralized decision-making powers. Third, the stability of peace depends upon the source of sovereignty or legitimate power within the nation. Although not enamoured of certain forms of rabble led democracy, Kant nevertheless points out that good governance provided by a dictator or an absolute monarch is inherently unstable as he or his successors face temptations to deviate from good government and the assurance of good governance is more forthcoming in a system of power that is representative of the people.

To Kant's list of conditions for a perpetual peace (what we refer to as a stable social contract), we could add economic interdependence manifested in peaceful economic exchange. The fact that commerce promotes peace was also pointed out by Thomas Paine (1791–92, p. 265), as well as by Montesquieu (1748). Montesquieu argued that commerce between peoples made them familiar with each other and therefore specific in their attitudes towards one another. Just as war between nations becomes less likely, due to their mutual all encompassing nonviolent economic interdependence, the same argument stands for competing groups within a nation state. It is because of the lack of economic development, evidenced by a relatively smaller manufacturing sector and a low per capita income (implying less exchange) that leads to what Humphreys (2005) describes as sparse economic interaction, which makes wars between competing groups more likely, as they have less to lose from the collateral damage

and destructiveness of war. Thus war, or the breakdown of the social contract, is more likely when there is economic underdevelopment, the result of a poor growth record. Interestingly Kant (1795) and Paine (1792, p. 320) point to a form of the greed hypothesis, when they refer to colonial wars aimed at expropriating resources from inhabitants of distant lands, considered to be outside the pale of the civilized comity of nations. In other words, they do recognize that there can be a form of greed, motivated by the desire to expropriate rents and resources, as in the case of mercantilist colonial exploitation.

So what factors lead to the breakdown of the social contract within a nation state? What circumstances create incentives for groups within societies to choose war rather than resolve disputes peacefully? Clearly these seem to occur in failing states. Yet the epithet 'failed state' may be too vague and unhelpful in this regard. Among the various factors, three are highlighted here. The first refers to the fiscal and revenue sharing agreements the state (or those in power) have with various stakeholders, where the breakdown of these arrangements can produce greed and/or grievance. Second, there is the political system. In the face of an unstable polity where the separation of powers and the sources of (legitimate or illegitimate) power are inherently unstable, it is important to focus on individual incentives faced by rulers that may or may not cause them to promote development and modernization. In the third, the famous Lipset (1960) modernization hypothesis states that demands for democracy surely follow economic development and the attainment of a high standard of living; once a particular (high) level of average income is achieved violence becomes a very costly means of settling disputes. The road to peace and democracy lies along sustained economic growth and the real culprit in the breakdown of the social contract is growth failure in low income, developing countries because it creates conditions where violence is more attractive. Low growth also implies a less diversified economic structure, increased susceptibility to economic shocks and dependence on external aid.

Within nation states, the fiscal system will secure a workable social contract if the allocation of public expenditures and the apportionment of taxes are fair, or at least, not unfair to the point that some groups judge taking resources by force the better option. There are many examples of conflicts emerging out of fiscal disputes (Côte d'Ivoire, Nigeria and Indonesia). Contemporary civil wars relate more often to the breakdown of explicit or implicit arrangements to share resources or revenues than the absence of an agreement to share resources or rents. One reason that a contract to share revenues encounters difficulties is the imperfect credibility with which the side that controls the pot honours its commitment.

Conflict affected nations have histories of weak social contracts (or a once strong social contract that has degraded). This weakness is in many instances a legacy of colonialism. A final complexity in fatally weakening social contracts was the interaction of these domestic factors with external events, notably the Cold War, which provided finance and ideological succour to ruling elites and rebels. The net result of these processes is the accumulation of grievances within the context of a disintegrating social contract that would otherwise have provided the rules to govern the distribution of the social contract and to achieve peaceful conflict resolution. These circumstances can also promote greed-based motivations aimed at controlling natural resources.

Hegre *et al.* (2001) point out that the risk of conflict is lower in both established democracies and autocracies. It suggests that conflict risk is at its highest during transitions to and away from democracy when state capacity is weak, also in fledgling and imperfect democracies (anocracies). Most developing countries are imperfect democracies, or at any early stage of the democratic transition. In the interim between full blown forms of either autocracy or democracy, (anocratic) countries may have electoral processes that characterize democracy, coexisting with weak or non-existent separation of powers between the executive and the judiciary, in particular. This not only prevents them from functioning like true democracies, but also impairs governance, especially the rule of law. Another problem is the widespread electoral violence in anocracies. Finally there is the risk that new democracies can periodically slide back to autocracy engendering a vicious cycle of democracy to autocracy, back to democracy and so on.

Regarding incentives faced by rulers in developing countries, one has to remember that until the end of the Cold War, strong men ruled most developing countries. In other words, they were autocracies. Some of which promoted development, others did not. Dunning (2005) makes an argument based on a two-period, two-agent, two-sector game theory model, about rulers' choices regarding future economic growth path in the context of natural resource abundance. He compares Mobutu's Zaire (1965–97) to Suharto's Indonesia (1965–98) and Botswana during the same period. In Botswana revenues from Kimberlite (deep-mine) diamonds were very stable, due to Botswana's unique relationship with De Beers and its important position as a major supplier. It did not need to diversify its economy, but it chose a developmental path because of the mature nature of political elites there. In Indonesia and Zaire, resource flows were volatile. In one case, the dictator (Suharto) chose diversification and growth enhancing strategies, as well as policies aimed at equalization and poverty reduction to contain political opposition. In the other case (Zaire, now DRC), Mobutu did not, because he felt that diversification and investment

in infrastructure would loosen his grip on power and strengthen political opposition to him based on ethnicity. Zaire or the DRC has perhaps the poorest post-1960 growth record on the planet. Perhaps in East Asia greater fears of communism strengthened benevolence in dictators (South Korea, Taiwan, Singapore and Indonesia), whereas in Africa, a certain type of factionalism dominated policies and politics, retarding growth, enhancing economic diversification and infrastructure development.

Turning to the ultimate importance of growth in promoting peaceful economic interaction and the social contract, it is worth examining a few of the broad stylized facts regarding conflict across developing countries since 1960. To get an empirical feel for some of these macro channels, a descriptive look at the data may be in order. Table 8.1 gives us 17 countries with the highest conflict incidence since 1960⁵ along with their average annual long term growth rates of per capita income accompanied by the typology of the economy and the most frequently occurring regime type. Table 8.1 compares growth rates, the combined democracy and autocracy score known as Polity,⁶ endowment type and conflict intensity or incidence in selected developing countries during the period 1965–2000. The Polity score is an imperfect proxy for institutional capacity and governance, but there is good time series data on these. This is coded 1 for autocracies (those with an autocracy score below -4), 3 for democracies (for democracy scores above 4) and 2 for anocracies that have both democratic and autocratic characteristics (with scores between -4 and 4). The basis of the endowment typology is a country's principal exports⁷ and is subject to change. Note that countries can have more than one year of civil war in any given calendar year if there are several conflicts taking place within the nation simultaneously, as in Burma or India. This does not imply anything about conflict intensity, measured by fatalities.

Only five of these high conflict incidence nations reported in Table 8.1 have a per capita income growth rate in excess of two per cent per annum in the long term: Indonesia, India, Sri Lanka, Colombia and Uganda. Poor growth performers have more conflict years in Table 8.1. Only four economies (India, Philippines, Sri Lanka and Mozambique) have no point source (mineral/fuel exporting) or coffee/cocoa economies. Data paucity on the Burmese conflicts prevents accurate reporting. However, there is evidence that the trade in illegal substances fuels these conflicts. This lends some support to arguments about conflict and its association with natural resources across countries.

Murshed (2006) points out that only four point-sourced and three coffee/cocoa-based economies have had growth rates of more than two per cent per annum in per capita income. Botswana and Indonesia are the best performing point-sourced economies. Furthermore only three point-sourced

Table 8.1 Conflict years, growth, polity and economic typology in selected countries

Country	Conflict incidence in years, 1960–2000	Most frequent regime type	Annual average Per-capita income Growth rate 1965–1999	Economic typology
Burma (Myanmar)	177	1	1.5%	Diffuse, Point
India	104	3	2.4%	Manufacturing
Ethiopia	81	1	–0.3%	Coffee/Cocoa
Philippines	59	1, 2, 3	0.9%	Diffuse, Manufacturing
Iraq	57	1	–3.5%	Point
Angola	43	1	–2.1%	Point
Iran	41	1, 2	–1.0%	Point
Algeria	37	1, 2	1.0%	Point
Chad	36	1	–0.6%	Point
Colombia	35	3	2.1%	Coffee/Cocoa
Indonesia	32	1	4.8%	Point, Manufacturing
Guatemala	31	1, 2	0.7%	Coffee/Cocoa
Sudan	31	1, 2, 3	0.5%	Diffuse, Point
South Africa	31	2	0%	Point
Mozambique	27	1	1.3%	Diffuse
Uganda	23	1, 2	2.5%	Coffee/Cocoa
Sri Lanka	22	3	3.0%	Diffuse, Manufacturing

Source: Murshed (2006), Table 4.

countries and four coffee/cocoa economies did not descend into some form of civil war, as noted in Murshed (2006). Diffuse economies also have conflict; examples of the high incidence of civil wars occurring in diffuse economies in South Asia, the Philippines and Burma, as well as Mozambique and Zimbabwe in Africa. In total, eight of 30 diffuse economies have avoided civil war, a record that is better than the four point-sourced and coffee/cocoa based economies. Two prominent examples of growth failures not experiencing civil war are Tanzania and Zambia. Notwithstanding India, manufacturing exporters are least likely to experience outright civil war. Perhaps this is because they have the best growth rates and institutional quality. They are

also more diversified economies and are able to withstand the commodity price and national income fluctuations that make growth failure more likely. Growth also needs to be pro-poor, which ultimately means less inequality, to minimize the effects of horizontal inequalities and polarization.

It is discernable that India, Sri Lanka and Colombia are stable democracies (in the post-1960 era) that have had civil wars, including high intensity conflict. Murshed (2006) described many of the transitions in regime type from autocracy to anocracy to democracy during 1960–2000. Multiple switches in all directions are possible and not just from autocracy to democracy. Nevertheless only five out of the 17 nations with a high conflict incidence have ever been democracies with a democracy score greater than four. Democracy, even stable democracy, does not guarantee the absence of armed conflict, both of the secessionist and rebel varieties, as the examples of India, Colombia, Sri Lanka, the Philippines and others indicate. Autocracies also fall into conflict; nevertheless, stable autocracies such as China and Singapore have avoided civil war, as did Taiwan and South Korea, which became democracies recently. Despite prominent outliers such as India, Colombia and Saudi Arabia, most conflict prone countries are neither stable democracies nor autocracies, lending support to the Hegre *et al.* (2001) finding that conflict risk is greatest when regime types are in transition, say from autocracy to democracy.

In summary the breakdown of the social contract captures institutional malfunctioning, the counterpart of the mechanisms in the middle of the greed hypothesis discussed earlier in the chapter; it is also crucial in transforming grievances into collective violence. A failing social contract may be the real signal of the risk of civil war, for the purposes of conflict prevention.

CONCLUSIONS

Pure versions of the greed hypothesis are, on their own, unsatisfactory explanations for the causes of conflict. In addition to resource rents, grievances also play their part in fuelling conflict by explaining intergroup noncooperation and serving to lower the cost of participation in conflict. Conflict can increase because of heightened intrinsic grievances or because there are more lootable resources. In reality, the competing greed versus grievance hypotheses may be complementary explanations for conflict. Insofar as they do provide alternative views, a fair test for their relative explanatory powers is best conducted at the level of a quantitative country case study because cross-country comparisons of horizontal inequality are still in the very early stages of development due to lack of data. Indonesia's

resource rich regions that have had separatist conflicts with the federal government offer us a striking contrast in gauging the relative explanatory power of greed versus grievance explanations for conflict. When viewed via the lenses of a detailed quantitative case study, the grievance and horizontal inequality explanations dominate any greed motivation. Yet when looked at through the prism of a cross-country study, Indonesia's resource rich regions are examples of a modified form of the greed explanation. Generally, resources help to prolong the duration of conflict and encourage secession, as pointed out by Ross (2003). Therefore it would appear that the greed explanation for conflict duration and secessionist wars works in cross-country studies, but has to make way for grievance based arguments in country case studies. Grievances and horizontal inequalities may be better at explaining why conflicts begin, but not why they persist. In short the presence of neither greed nor grievance is sufficient for the outbreak of violent conflict, something that requires institutional breakdown, described as the failure of the social contract.

This chapter outlined the reasons for a failing social contract: the imperfect credibility of the fiscal mechanism governing broad based transfers, an imperfect or unstable polity and above all the lack of economic growth, which would have allowed for redistribution towards losers and disadvantaged groups. Most developing countries particularly low income, conflict prone nations, are imperfect democracies with a weak separation of powers between the state's executive, legislative and judicial functions. The separation of powers, especially an independent judiciary, may be as important as good governance (the control of corruption, the absence of regulatory burden and the quality of the bureaucracy) in preventing conflict long term. This is because an independent judiciary is central to the proper functioning of the rule of law. In turn the rule of law is the ultimate guarantor of secure property rights; something that is crucial for encouraging investment and fostering economic growth. At higher levels of prosperity and affluence, the temptation to engage in violent organized conflict diminishes, as there is too much to lose from this form of dispute settlement.

NOTES

1. Professor Syed Mansoob Murshed is Professor at the Birmingham Business School, University of Birmingham, UK; Institute of Social Studies, The Netherlands and the Centre for the Study of Civil War (CSCW) PRIO, Oslo, Norway.
2. This commonly held view is actually a gross over simplification.
3. Although Kant speaks about a perpetual peace between nations, we can extend his argument to groups within a nation state.
4. Despotism is when there is no separation of powers; those who administer laws are the

same as those who decree them. Despotism is not simply confined to absolute monarchy or dictatorship, but can also be a feature of flawed democracies.

5. Israel is excluded with 49 years, as it is a rich country and the Palestinian territories, Cambodia (36 years) and Yemen (23 years) because of the paucity of economic data.
6. These scores range from -10 to 0 for autocracy, and 0 to 10 for democracies, making -10 the greatest autocracy score, and 10 the highest democracy score (see Murshed 2006 for further details).
7. This is based on a country's principal exports, which are described as point (mineral or fuel), coffee/cocoa, diffuse (other agricultural) or manufacturing, where arguably dependence on mineral or fuel exports *ex ante* enhances the risk of conflict.

9. From climate refugees to climate conflict: Who is taking the heat for global warming?

Betsy Hartmann¹

The spring and summer of 2007 brought a spate of alarming articles and reports about the security implications of climate change. Writing in the April issue of the *Atlantic Monthly*, journalist Stephan Faris attributed the violence in Darfur in large part to global warming induced environmental degradation and drought. Several months later a report on the Sudan by the United Nations Environment Programme (UNEP) drew similar conclusions, arguing that a combination of demographic pressures, resource scarcity and climate change were at the root of ethnic conflict in the region and increasingly threatened security in other parts of Africa as well (UNEP 2007).

Along with the Darfur stories came other dire predictions about the threat of so-called climate refugees. In May the UK based NGO Christian Aid (2007a) released a report entitled *Human Tide: The Real Migration Crisis* that painted an apocalyptic scenario of millions of displaced climate refugees roaming the globe and wreaking havoc, creating ‘a world of many more Darfurs’ (Christian Aid 2007b). Journalists and pundits alike joined the cause. Writing in *Scientific American* online, Columbia University economist Jeffrey D. Sachs warned that climate change could soon force ‘hundreds of millions’ of people to relocate (Sachs 2007). In the *New York Times*, Canadian political scientist Thomas Homer-Dixon claimed that ‘Climate stress may well represent a challenge to international security just as dangerous – and more intractable – than the arms race between the United States and the Soviet Union during the cold war or the proliferation of nuclear weapons among the rogue states today’ (Homer-Dixon 2007).

National security agencies have also entered the arena. A 2003 Pentagon sponsored study of the impacts of abrupt climate change paints a grim neoMalthusian scenario of poor, starving populations overshooting the reduced carrying capacity of their lands, engaging in violent conflict over scarce resources, and storming en masse towards our borders (Schwartz and Randall 2003). More recently the defence think tank, CNA, gathered

a team of 11 retired US generals and admirals to produce a report, *National Security and the Threat of Climate Change*, which argues that global warming could trigger widespread political instability in poor regions and large refugee movements to the US and Europe (CNA 2007).

While in many places environmental changes due to global warming could exacerbate already existing economic and political divisions, whether violent conflict and mass migrations result depends on so many other factors that it is far too simplistic to see climate change as a major cause or trigger. Moreover, such threat scenarios ignore the way many poorly resourced communities manage their affairs without recourse to violence. A substantial body of research indicates that violent conflict in the global South connects more to resource abundance (rich oil and mineral reserves, valuable timber, diamonds, and so forth) than resource scarcity (see Fairhead 2001). Above all it is institutions and power structures at the local, regional, national and international levels that determine whether conflict over resources turns violent or not.

The images and narratives in the articles and reports cited above have an all too familiar ring, drawing on neoMalthusian environmental security discourses of the 1980s and 1990s that blamed intrastate conflict in the global South on environmental degradation, resource scarcity and migration. Then as now, this line of reasoning not only naturalizes profoundly political conflicts, but casts poor people as victims-turned-villains, a dark, uncontrollable force whose movement ultimately threatens our borders and way of life.

As Nordas and Gleditsch note, neoMalthusian climate conflict scenarios are based largely on speculation and questionable politicized sources. While there is little substantive research to corroborate their claims, they are nevertheless fast making their way into influential policy arenas. In April 2007, for example, the UK government was able to convince the UN Security Council to establish climate change as a security issue (Nordas and Gleditsch 2007).

Why are these narratives taking hold when there is little evidence to support them? To answer that question one needs to look at both their construction – the history of the key assumptions, stereotypes and images upon which they draw – as well as their strategic uses by various actors and institutions. In the process, this chapter will argue, one cannot avoid the salience of race.

Western environmental thought has a long tradition of both racism and climatic determinism, with dangerous places and inferior races an especially common motif in the period of European expansionism. As historian David Arnold writes, 'While race was often regarded as a self-sufficient and self-evident dynamic, used to explain and justify the superiority of

Europeans on a global scale, geographical and climatic determinism was also used to bolster racial arguments' (Arnold 1996, p. 28). Climatic determinism also has links to conflict. For example in the early part of the twentieth century, American geographer Ellsworth Huntington argued that drought and famine caused by climate changes rendered Asian societies in particular permanently unstable and uncivilized (Arnold 1996). It is remarkable how these assumptions, albeit with modifications, survive and thrive in the present day. Their resilience is due in part to how they draw on a reservoir of core racial stereotypes,² such as Africans as savages.

Contemporary literature on policy narratives also helps explain how certain narratives persist because they are useful to powerful interests. For example, Emery Roe has coined the phrase 'crisis narrative' to describe the Malthusian population/scarcity scenarios applied indiscriminately to different African countries, designed to justify the intervention of Western development agencies (Roe 1995). Often a part of this narrative is the unproven assertion that vast areas of the continent are experiencing a 'soil fertility crisis' (Keeley and Scoones 2003). Deeply embedded racial stereotypes are in these crisis narratives. Their primary association with Africa provides a link to negative domestic stereotypes about African-Americans.

This chapter explores connections between past and present narratives that link migration and conflict to environmental change. The first section focuses on the evolution of climate refugees/conflict discourses. This is followed by a look at the role of climate change narratives about Hurricane Katrina in linking racist assumptions about Africans and African-Americans. The next section considers the intended and unintended consequences of portraying climate change as a national security threat through examining possible impacts on immigration and defence policies. This is followed by some concluding remarks on how building fear of the poor, especially of poor migrants, draws our attention away from more positive and effective approaches to climate policy that centre on poverty reduction, equity, human rights and sustainable development, in the global North and global South. As other chapters in this volume illustrate, there are many possible alternatives to the politics of fear and threat described here.

FROM ENVIRONMENTAL REFUGEES TO CLIMATE REFUGEES

The relationship between environment and security has a long and complicated history in the US. It has deep ideological roots in the peculiar

qualities of US mainstream environmentalism, in which neoMalthusian fears of overpopulation, ignorance of international development issues, apocalyptic predictions of imminent ecological collapse, romantic beliefs in the wilderness and pure nature, and the associated conviction that people are necessarily bad for the environment, serve as a dark filter through which to view poor people in the global South. These perspectives helped give rise to and reinforce a powerful policy narrative called the 'degradation narrative' (Hartmann 2003, 2006).

Drawing on old colonial stereotypes of destructive Third World peasants and herders, degradation narratives go something like this: population-pressure induced poverty makes Third World peasants degrade their environments by overfarming or overgrazing marginal lands. The ensuing soil depletion and desertification then lead them to migrate elsewhere as environmental refugees, either to other ecologically vulnerable rural areas where the vicious cycle is once again set in motion or to cities where they strain scarce resources and become a primary source of political instability (Hartmann 2003). Despite salient critiques by international development scholars and practitioners,³ the degradation narrative has proved particularly popular in Western policy circles because it kills a number of birds with one stone. It blames poverty on population pressure and not, for example, on lack of land reform or off farm employment opportunities. It blames peasants for land degradation, obscuring the role of commercial agriculture and extractive industries, and it targets migration both as an environmental and security threat.

With the waning of the Cold War, growing interest in sustainable development and alternative visions of security increased the authority of the degradation narrative. In particular, concern began to mount about the dangers posed by so-called environmental refugees. It is not clear who first coined this term; analysing its origins, Patricia Saunders goes all the way back to Malthus and points to neoMalthusian environmentalist Lester Brown and the Worldwatch Institute as its contemporary originators. Central to the concept is the assumption that population pressure is one of the main precipitating causes of environmental degradation and resulting migration (Saunders 2000).

In 1995, the Climate Institute in Washington DC published a report, *Environmental Exodus: An Emergent Crisis in the Global Arena*, which further popularized and legitimized the concept of environmental refugees. Authored by the neoMalthusian environmental writer Norman Myers, the report offered a working definition of environmental refugees.

Environmental refugees are persons who can no longer gain a secure livelihood in their traditional homelands because of environmental factors of unusual

scope, notably drought, desertification, deforestation, soil erosion, water shortages and *climate change* [my emphasis], also natural disaster such as cyclones, storm surges and floods. In face of these environmental threats, people feel they have no alternative but to seek sustenance elsewhere, whether within their own countries or beyond and whether on a semi-permanent or permanent basis (Myers 1995, pp. 18–19).

The report stressed the role of population pressure as a cause of environmental degradation; in many cases, Myers wrote, environmental refugees are actually ‘population pressure’ refugees (1995, p. 63). The report made the statistical claim that there were at least 25 million environmental refugees in the world, compared with 22 million refugees of ‘traditional kind’ (Myers 1995, p. 1). Despite the fact that the 25 million figure was arrived at more by conjecture than scientific method⁴ it began to circulate widely in the international policy arena. For example, in 1999, the *World Disasters Report* of the International Federation of the Red Cross and Red Crescent Societies cited it as fact (Saunders 2000). It is interesting to note that the Myers report, published by an NGO working to heighten policymakers’ interest in global warming, was already linking climate change to environmental refugees. Myers now makes the claim that there are 250 million environmental refugees, a figure presented in the Christian Aid report *Human Tide* (Nordas and Gleditsch 2007).

In addition to unreliable statistics, the environmental refugee concept has a number of shortcomings. First, it is depoliticizing because it naturalizes the economic and political causes of environmental degradation and masks the role of institutional responses to it. Should people forced to leave their homelands because of the development of a large dam, mine tailings, petroleum pollution or flooding caused by illegal logging, all be categorized together as environmental refugees? Should the powerful actors primarily responsible for the degradation and displacement; whether local elites, government agencies, international financial institutions or private corporations, not be named? In the case of extreme natural events such as droughts, storms and floods, whether people are forced to migrate permanently from their homes usually depends on preexisting social relationships (who is most vulnerable) and post disaster responses (what kind of aid/relief is provided and who receives it). Economic, ethnic, age and gender stratification all matter, as well as the political disposition of those who dispense relief (Wisner *et al.* 2004).

Second, the concept of environmental refugee is dehistoricizing. To understand why particular populations and landscapes are more vulnerable to the effects of environmental change requires moving beyond the immediate present to explore the past. For example when Hurricane Mitch struck Honduras and Nicaragua in 1998, the floods and landslides that

displaced many communities were mainly due to 50 years of deforestation to clear land for export crops such as beef, coffee, cotton and bananas (Wisner *et al.* 2004). Who set that particular pattern of agricultural and economic development in motion, who has benefited and who has lost from it; these are considerations missing from the overarching categories of both natural disaster and environmental refugee.

Third, rooted as it is in neoMalthusian thinking, the concept of environmental refugee overemphasizes the role of demographic pressures in migration. The causes of migration are extremely complex and context specific and there is little evidence to support the view that demographic pressure is at the root of many population movements (Suhrke 1997). In addition, negative neoMalthusian narratives of migration obscure the positive roles migration can play in improving people's livelihoods and diminishing vulnerability to environmental change. Often migration from rural areas is not a linear phenomenon or a rejection of rural livelihoods, but instead a vital part of sustaining them. Black (1998) notes that African Sahel migration is less a response to environmental decline than a strategy of income diversification, with remittances playing a major role in household and regional economics.

Despite such shortcomings, the environmental refugee concept was employed by a variety of political actors. Sustainable development advocates found it useful to focus policy attention on environmental degradation issues (Black 1998) and population agencies to drum up support for international family planning assistance (Hartmann 2003, 2006; Hartmann and Hendrixson 2005). It also appealed to Western interests in favour of more rigid immigration controls, including limiting the grounds for political asylum. Kibreab attributes the invention of the term in part to the effort to 'depoliticize the causes of displacement, so enabling states to derogate their obligation to provide asylum' (Kibreab 1997, p. 21; cited in Saunders 2000, p. 240). Interestingly, in 1999 Climate Institute Director John Topping stated that there was considerably more media and policy interest in Norman Myers' report in Europe than in the US because at that time, Europeans were more anxious about immigration than Americans (personal communication, 27 May).

As the concept gained favour, environmental refugees were increasingly portrayed as a security threat. As Black notes, whatever the precise number and definition of environmental refugees:

A common feature of the literature is to talk of "millions" of displaced people, and their dramatic impact on host regions, such that regional security is threatened. The image is one of misuse or overuse of the environment leading to progressive decline in the resource base, and possibly contributing to further dramatic (and unintended) environmental collapse. Environmentalists and

conflict specialists see common cause in talk of “environmental refugees”; even if the linkages between conflict and refugees remain to be proven (Black 1998, p. 23).

In the 1990s, Canadian political scientist Thomas Homer-Dixon propelled the degradation narrative and its negative depiction of migration into the high politics of national security. Homer-Dixon’s environmental conflict model maintains that scarcities of renewable resources such as cropland, fresh water and forests, induced in large part by population growth, contribute to migration and violent intrastate conflict in many parts of the developing world. In his own words:

Population growth and unequal access to good land force huge numbers of people onto marginal lands. There, they cause environmental damage and become chronically poor. Eventually, they may be the source of persistent upheaval, or they may migrate yet again, helping to stimulate ethnic conflicts or urban unrest elsewhere (Homer-Dixon 1999, p. 155).⁵

This conflict in turn can potentially disrupt international security as states fragment or become more authoritarian.⁶

Homer-Dixon’s work had a major influence in Washington policy circles particularly in the early years of the Clinton administration when Al Gore championed the environment as a cause. In addition, instrumental in the promotion of Homer-Dixon’s ideas was generous financing from private population funders seeking support from the national security establishment for US government involvement in the 1994 International Conference on Population and Development in Cairo (Hartmann 2003, 2006; Hartmann and Hendrixson 2005). The Woodrow Wilson Center’s Environmental Change and Security Project also gave Homer-Dixon and other academics, policymakers and military officials involved in environmental security a platform from which to spread their views (Hartmann 2003). A measure of Homer-Dixon’s success was that in 1994 and 1995, the Clinton administration’s *National Security Strategy of Engagement and Enlargement*, an important blueprint for foreign and defence policy, stated boldly in the preface that ‘large-scale environmental degradation, exacerbated by rapid population growth, threatens to undermine political stability in many countries and regions’ (White House 1995, p. 47).

While the influence of the environmental conflict model waned in the latter days of the Clinton administration and was pushed further backstage after 9/11 and George W. Bush’s ‘war on terror’, its legacy persists today in the climate change arena where degradation narratives again link environmental change to violent conflict. UNEP’s report *Sudan: Post-Conflict*

Environmental Assessment, for example, draws on Homer-Dixon's model and related research to make claims that overpopulation of both people and livestock, coupled with environmental stresses such as water shortages related to climate change, are at the root of conflict in the region. According to the report:

Northern Darfur – where exponential population growth and related environmental stress have created the conditions for conflicts to be triggered and sustained by political, tribal or ethnic differences – can be considered a tragic example of the social breakdown that can result from ecological collapse (UNEP 2007, p. 95).

Atlantic Monthly journalist Stephan Faris similarly argues that the real fault lines in Darfur are between 'settled farmers and nomadic herders fighting over failing lands'. And he attributes the failure of those lands primarily to climate change induced reductions in rainfall. 'With countries across the region and around the world suffering similar pressures, some see Darfur as a canary in the coal mine, a foretaste of climate-driven political chaos' (Faris 2007).

The Darfur climate conflict narrative has spread speedily and widely. Even UN Secretary General Ban Ki Moon embraced it in a June 2007 *Washington Post* op ed. In addition to letting the Sudanese government off the hook, the narrative ignores basic elements of Sudanese political economy that helped create and sustain the conflict. These include gross inequalities in wealth and power between the elite in the capital and the rural population; and government agricultural policies that favour large mechanized farms and irrigation schemes over rain fed, small farmer agriculture, causing both political grievances and land degradation. Other factors are forced migration such as the 1990s removal of Nuba farmers from their lands into so-called 'peace villages' where they became a source of captive labour for mechanized farms and what Alex de Waal calls 'militarized tribalism' (de Waal 2007). The recent discovery of a vast underground aquifer underneath Northern Darfur is not likely to diffuse the crisis, but rather to heighten it if the government controls the water for its own interests (Polgreen 2007).

The Darfur narrative draws strength from the continuing uncritical acceptance of the degradation narrative and the associated concept of environmental refugees. On a deeper, subconscious level, it also draws strength from stereotypes of Africans being more naturally prone to violence and savagery. Darfur is just the start commentators warn us; the rest of Africa could soon follow suit, but the threat is not only without, it lies within also. The next section looks at how narratives about Katrina's climate refugees link negative images of Africans and African-Americans.

THE COMING ANARCHY MEETS NEW ORLEANS

When Hurricane Katrina struck New Orleans in late August 2005, most of the world, along with all of America, sat glued in front of the TV set, watching with horror the scenes of flooding streets, flattened homes and floating corpses. If broadcasting these images intended to pull on our heartstrings, the broadcasting of another set of images was intended to have the opposite effect. These were the pictures of young black men out of control, shattering glass and looting stores and later running amok at the Superdome. How similar these visuals and associated commentary were to American TV coverage of African urban warfare.

Others have noted the same parallel. Alex de Waal writes how Robert Kaplan's influential article, 'The coming anarchy', which portrays West African young men as postmodern barbarians in a region rendered hopeless by overpopulation and environmental degradation, served along with 'the imagery of black youth rampaging through a shattered tropical city [as] rich sources of metaphor for New Orleans' (de Waal 2006, p. 7). *The Army Times* newspaper wrote on 2 September 2005, that 'combat operations are now underway on the streets . . . This place is going to look like little Somalia . . . We're going to go out and take the city back' (cited in Rodríguez and Dynes 2006, p. 3).

Later when the waters settled, critiques emerged of the mob and looting stories. Many people looting were actually in a desperate search for necessities like clean water, food and diapers. Moreover there was much less violence at the Superdome than previously reported and the New Orleans murder rate stayed stable during the week after Katrina. The disaster and displacement were very real, but the violent anarchy was a spectacle, an illusion created by the media. As Rodríguez and Dynes (2006, p. 6) note, 'While it is common for rumors of looting and all kinds of anti-social behavior to emerge in most major disasters, the volume and persistence of such rumors on TV in Katrina was unparalleled.' One particularly effective TV strategy was to show the same footage of looting repeatedly and to begin news segments about Katrina with unproven rumours of violent crime.

Another repeated image of Katrina also stands out: Katrina as a swirling mass of clouds on a weather map with Al Gore or another commentator standing in front, warning us that climate change threatens us with ever more Katrinas (Oprah 2006). While many scientists agree that the rise in sea temperatures could cause more damaging storms, there is yet no scientific consensus that global warming caused Katrina. Nevertheless, poor black people displaced from New Orleans are increasingly being depicted as climate refugees.

In the aftermath of Katrina, environmentalist Lester Brown, now

director of the Earth Policy Institute, stated that the estimated 250 000 Katrina evacuees were climate refugees: 'The first massive movement of climate refugees has been that of people away from the Gulf Coast of the United States' (Brown 2006). The progressive magazine *In These Times* carried a story linking Katrina's exiles with displaced Bangladeshis and Tuvaluans: 'Driven from home, history and culture by a warming planet, they also share unofficial status as climate refugees – a category that no international treaties recognize or protect' (Allen 2007).

Even if one could definitively prove that climate change caused Katrina, would it make sense to speak of those internally displaced by the hurricane as climate refugees? The extent of the human disaster in New Orleans has much more to do with race, class and government incompetence than with the strength of Katrina's winds. It is outside the scope of this chapter to describe why Katrina was an unnatural disaster – others have done that well (see Pastor *et al.* 2006). From an explanatory point of view, the term climate refugees does nothing to illuminate why people were forced to flee in the first place and why many of them have not been able to move back to their homes. In fact, the term obscures the role of powerful actors like the Army Corps of Engineers, who despite ample warning did not maintain the levees. Yet, we are not likely to hear the term 'Army Corps of Engineers refugees'.

It is worth considering whether the term climate refugees would have been used for Katrina's victims if they were majority white. There is an implicit connection between the racialized images of looting and anarchy seen on our TV screens and Al Gore's weather map. We are taught to fear not so much global warming as the dark people it will set loose, on the move, whether from across the seas or within the borders of our own nation. This fear helps lay the ground for the militarization of global warming.

HIGH POLITICS OR LOW POLITICS?

The beat is on. Climate refugees, climate conflict, even climate terrorists – we are likely to witness escalating rhetoric about these dangerous threats in the coming months and years, despite the absence of credible evidence. Africans and African-Americans will not be the only scapegoats. A recent article on global warming and sea level rise in Bangladesh in a liberal US environmental magazine paints a lurid picture of millions of destitute Bangladeshi environmental refugees as potential Islamic terrorists (Black 2008). The task now is to examine why, how and by whom are these narratives being strategically deployed.

Presenting issues as security threats in order to garner funding, media attention and political support has long been a favourite ploy of governments around the globe. Climate change is no exception. As journalist Jonathan Freedland writes in the *Guardian*,

The glum reality is that governments tend to take security threats more seriously than any other kind . . . So this makes political sense: cast global warming as an environmental or science issue, and it will be given a budget to match. Cast it as a problem for the big boys, on a par with nuclear proliferation or international terror, and then it should get a big-boy budget and attention (Freedland 2007).

Some environmental groups in Washington DC are now linking climate change to national security in order to persuade conservative members of Congress to pass legislation limiting carbon emissions. Population lobbying organizations may start to employ similar tactics to convince conservatives to support international family planning assistance.⁷ Those who pursue such strategies often claim they are simply being pragmatic and have the best of intentions. Whatever their motivations, their appeals to security and use of fear often have negative consequences, intended or not.

There are a number of stages before a rhetorical appeal to security actually leads to an issue being *securitized*, that is, becoming an actual object of security agencies and policies (Buzan *et al.* 1998). However, rhetorical appeals can perform another vital function by buttressing and expanding already existing security agendas and undermining the role of civilian institutions seeking solutions. How might climate refugees and climate conflict do this? The following suggestions are necessarily speculative, but they warrant close monitoring.

Immigration Enforcement and Military Deployments

The threat of climate refugees, deployed strategically by anti-immigrant groups and government agencies may help to build public support for further crackdowns on illegal immigrants in both the US and Western Europe. In the US, anti-immigrant groups already appeal to environmental arguments – that is, immigrants are the cause of urban sprawl and the destruction of pristine landscapes – to draw liberals into their fold. In January 2007, Kellogg, Brown and Root (KBR), a Halliburton subsidiary, won a contract from the federal government to augment existing Immigration and Customs Enforcement (ICE) detention and removal facilities ‘in the event of an emergency influx of immigrants into the US’. The contract allows for ‘migrant detention support’ to other government

agencies during an immigration emergency 'as well as the development of a plan to react to a national emergency, such as a natural disaster' (Halliburton 2006). This contract generated considerable controversy, including accusations that the government is building concentration camps. Although the concentration camp theory is (hopefully) far fetched, there is the potential that these facilities could be used for internally displaced Americans, such as those affected by Hurricane Katrina (Vlahos 2006).

There are many ways climate refugee/conflict discourses could be useful to the military. For one, they could provide a rationale for greater integration of military agencies in both immigration enforcement and the management of natural disasters. Blurring the line between civilian and military institutions, the US Northern Command and the Department of Homeland Security are currently working to develop a Common Operational Picture framework that links information and data systems for a coordinated response to catastrophic events (Kievit and Elliot 2007). The interoperability of data systems has come under fire by civil libertarians (Hayes and Tassé 2007).

Second, these narratives could justify continued funding of expensive military surveillance satellites and naval remote sensing since the data generated by these technologies can purportedly have a dual use, supporting military intelligence and operations, as well as civilian work on climate change. In the 1990s, the Pentagon and CIA deployed concerns about environmental conflict in a similar manner to justify the maintenance of expensive surveillance systems (Hartmann 2003). The narratives could also justify the development of grandiose and potentially dangerous schemes to regulate the climate. The 2003 Pentagon study for example, recommends that the Department of Defense (DoD) 'explore geo-engineering options that control the climate' (Schwartz and Randall 2003, p. 22). There is a long history of the militarization of weather and climate control in the US and some of the current schemes under discussion are frightening indeed (Fleming 2007).

Third, a focus on climate change could facilitate the military's strengthening of relationships with environmental scientists. In the 1990s, the controversial MEDEA project allowed a select group of environmental scientists to access classified intelligence data on the environment, and in addition environmental scientists worked with both US and British intelligence agencies on early warning systems to identify potential areas of environmental conflict (Hartmann 2003). The recent report on *National Security and the Threat of Climate Change* states in its recommendations that 'Critical security-relevant knowledge about climate change has come from the partnership between environmental scientists and the defense and

intelligence communities. That partnership, vibrant in the 1990s, should be revived' (CNA 2007, p. 47).

Fourth, perceived threats of climate conflict could give the US military additional justification for overseas interventions, especially in Africa. *National Security and the Threat of Climate Change* emphasizes how resource scarcity, environmental degradation and climate change are likely to trigger violent conflict on the continent. According to its recommendations,

Some of the nations predicted to be most affected by climate change are those with the least capacity to adapt or cope. This is especially true in Africa, which is becoming an increasingly important source of US oil and gas imports. Already suffering tension and stress resulting from weak governance and thin margins of survival due to food and water shortages, Africa would be yet further challenged by climate change. The proposal by DoD to establish a new Africa Command reflects Africa's emerging strategic importance to the US, and with humanitarian catastrophes already occurring, a worsening of conditions could prompt further US military engagement (CNA 2007, p. 47).

It is important to bear these cautions in mind, as climate change rightfully becomes a more urgent subject of national and international policy. How we define the threats posed by climate change will help shape how we frame responses. Promoting racialized fears of those who are most vulnerable to global warming strengthens the hands of anti-immigration and national security interests and undermines civilian efforts to find practical and democratic solutions.

CONCLUSION: LIVELIHOOD SECURITY, NOT NATIONAL SECURITY

Today there are many scholars in the field, advocates in the policy arena and activists on the ground promoting a different approach to climate change. That approach puts poverty reduction, equity, human rights and sustainable development at the centre of the debate. How to make vulnerable communities more resilient in the face of climate change; how to ensure that new energy and resource policies raise the living standards of the poor rather than line the pockets of the rich; how early warning systems and disaster response can be organized better to meet the human needs and respect the human rights of those affected: these are the real challenges, both in the global North and global South.

Climate change poses a serious threat, but it also presents an opportunity to rethink development. That rethinking requires that we look

critically at old ideas that restrict our vision. This chapter has questioned the problematic reasoning and racialized assumptions underlying commonly accepted discourses about environmentally induced migration and conflict. All too often these discourses ignore history, power relations and political economy, ascribing to nature what is essentially manmade. They are overly simplistic and the world is, for better or worse, a very complex place.

We need to embrace that complexity to find workable solutions to the multiple problems posed by climate change. Sustainable development should focus on enhancing livelihood security, not national security. In the climate change arena, the appeal to the high politics of national security is low politics. It scapegoats and demonizes the people who bear the least responsibility for global warming and who are the most vulnerable to its effects. Solutions lie not in beating the war drums, but in finding ways to work across borders of race, class, gender, ethnicity and nationality, in peace.

NOTES

1. Betsy (Elizabeth) Hartmann is Director, Population and Development Program, Associate Professor, Development Studies, Hampshire College, Amherst, MA USA. bhartmann@hampshire.edu
2. See Karim (1997) for an analysis of the role of primary stereotypes.
3. For example, Blaikie and Brookfield 1987.
4. While doing PhD research on environment and security in 1997, I was told by someone who was present during the process that the figure was essentially conjured up by clustering groups of refugees and immigrants based on already dubious statistics.
5. Relocated to urban areas, for example, Homer-Dixon's destructive peasants become a 'youth bulge' of young men who are easily mobilized for violence and terrorism. 'Youth bulge' theories and images figure prominently in the current US 'war on terror'. They naturalize political conflict in the Middle East by attributing it to the population pressure of too many young Muslim men on scarce environmental and economic resources. Youth bulge theories also reinforce sociobiological views of young men as inherently more prone to aggression and violence (Hartmann and Hendrixson 2005).
6. For a critique of his model, see Hartmann (2001).
7. See Cincotta *et al.* (2003) for an example of this phenomenon.

10. Rural poverty, cotton production and environmental degradation in Central Eurasia

Max Spoor

The complex relationship between rural poverty, agricultural production and environmental degradation, in transition countries of Central Eurasia (CEA), in particular those where cotton is produced, is the topic of this chapter. In the definition used here, Central Eurasia includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan (Central Asia) and Azerbaijan (South Caucasus).¹ The *cotton–poverty–environment* nexus (see also Spoor 2006b; Opschoor 2007a) is crucial in this large and relatively unknown part of the world, where important links exist between forms of over exploitation of land and (limited) water resources and the poor livelihoods of small cotton producers and cotton farm workers. Within an institutional framework that primarily promotes surplus transfer out of the primary sector, rent seeking by state and private elites and the continuation of resource degradation exists in the absence of proper incentives. Apart from high rates of rural money metric based poverty in some of these transition countries of Central Eurasia, the social infrastructure tends to be weak and deteriorated. Furthermore, environmental degradation of rural resources, such as water and sanitation are severe in exactly those areas where cotton has been long produced, as a near monoculture cash crop, negatively affecting land and water resources.

The vast area of Central Eurasia is densely populated in certain areas. Much of its still predominantly rural population resides in oasis areas, along riversides and in some fertile valleys such as the Ferghana Valley (shared by Kyrgyzstan, Tajikistan and Uzbekistan), where scarce rural resources are contested. Intensive use of the land and limited water resources for agriculture within a post-Soviet institutional framework, has led to resource degradation, expressed in the drying up of the Aral Sea, widespread soil salinization and deteriorating water quality of rivers, just to name a few of the most important phenomena (Spoor 1998). Because of surplus transfer out of the cotton sector, the main cash crop in the region,

and limited investments in rural areas, poverty, primarily rural, emerged in the transition period after these countries gained independence (Spoor 2004a, 2004b). This chapter will analyse empirically the complex linkages amongst cotton production, rural poverty and resource degradation, by focusing on the predominant institutional framework (of resource extraction), which does not seem able to tackle the two main problems of the area, namely rural poverty and continued resource degradation.

The second section of the chapter will deal with the state of income and nonincome poverty. Poverty is analysed and discussed in detail according to its spatial distribution, aspects of child poverty, malnourishment and the gendered face of poverty. The severity of rural poverty in the CEA countries is highlighted along with the relatively limited reduction in response to recent strong economic recovery and sustained growth. The next section will focus on the degradation of rural resources (land and water), while making the link to already well documented processes of land reform in the region, along with the complex policy and institutional environment where the main cotton producing countries remained quite interventionist (such as Tajikistan, Turkmenistan and Uzbekistan). The concluding section explores further the cotton–poverty–environment nexus, based on the empirical analysis presented, while developing some perspectives on possible virtuous, rather than vicious cycles for rural dwellers in this sector.

RURAL FACE OF INCOME AND NONINCOME POVERTY

This section will show that income poverty in the CEA countries is severe (with some exceptions), and that poverty has a particularly rural face. Most countries have predominantly rural populations, while the share of agricultural labour in total employment is still high. In spite of the decreasing importance of agriculture in GDP and exports, the CEA countries have a high degree of rurality. Nonincome poverty is also problematic, because of deteriorated public services (such as health and education) and social infrastructure. There is also a feminization of rural poverty and child poverty is on average higher than overall poverty incidence. Finally, this chapter shows that the effect of GDP growth on reducing rural poverty is much less robust than its effect on urban poverty.

Income poverty, measured by the internationally comparable poverty line of USD 2.15 per day², in the CEA countries (with the exception of Azerbaijan) is quite high. The Kyrgyz Republic and Tajikistan both have poverty levels above 60 per cent of the population – as high as countries of sub-Saharan Africa (Figure 10.1). The CEA countries have the highest

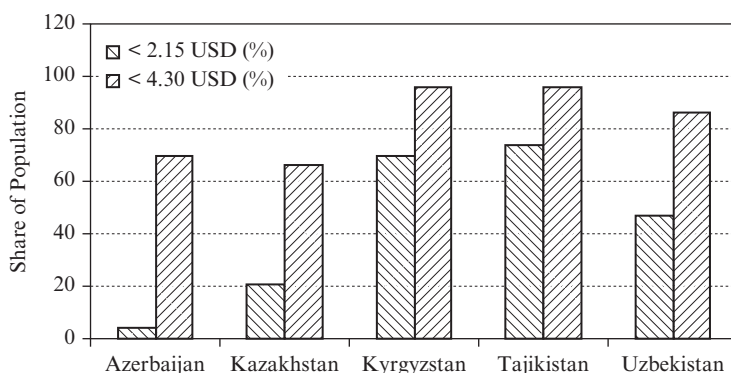


Figure 10.1 Poverty and vulnerability rates

poverty rates in the CIS, with the exception of Azerbaijan. For instance, the European CIS countries of Belarus, Russia and Ukraine showed poverty rates of two, nine and three per cent in 2002 (World Bank 2005a).

Even where the poverty headcount was low, as in Azerbaijan and Kazakhstan, the group close to the poverty line and vulnerable to poverty is still relatively large. In Figure 10.1 (data from World Bank 2005a), 70 per cent of the population of Azerbaijan and 66 per cent in Kazakhstan earn less than USD 4.30/day. In Kyrgyzstan, Tajikistan and Uzbekistan these percentages are substantially higher, namely 96, 96 and 86 per cent, respectively. This is an important phenomenon to note, as this large group is indeed vulnerable to poverty.

In addition it is also useful to analyse the national poverty lines (with respect to income, expenditure, basic needs or food basket), as these provide important additional information for policy analysis. For example while Azerbaijan scores high in the World Bank (2005a) study, the poverty profile made by that same institution for the years 2002–04 (World Bank 2006b) indicates that 49.6 per cent of the population in 2001 were below the nationally defined poverty line, although that share had dropped to 27.5 per cent by 2004. In 2003, an updated poverty report on Kyrgyzstan measured poverty at 50 per cent, with 17 per cent of those categorized as ‘extremely poor’ (World Bank 2005b). In this case, the poverty levels are less than the shares obtained using the poverty line of USD 2.15, while for Azerbaijan this was the opposite.

For most countries under review, the risk of being poor is substantially higher in the countryside than in the cities (Spoor 2004b). National poverty rates can compare urban and rural poverty, though they are not comparable between countries, because national poverty lines differ by country

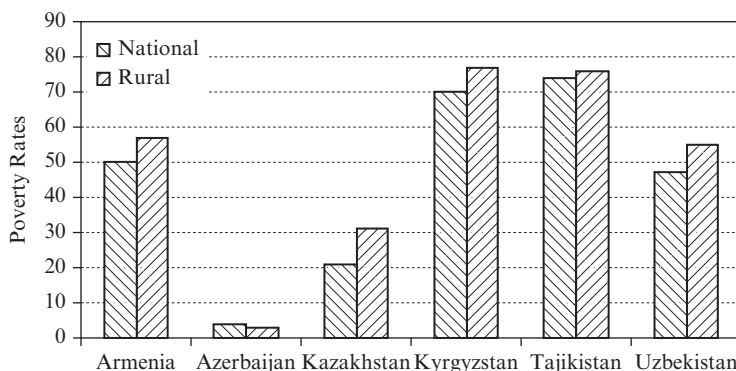


Figure 10.2 Rural and national poverty (2003)

(Figure 10.2; data from World Bank 2005a). The World Bank (2000) explained that there were high urban poverty rates in the early 1990s, because of the consumption buffer that was created for the rural poor with the distribution (and expansion) of subsidiary household plots. However, rural poverty rates by 2003 were higher than national average rates, again with the exception of Azerbaijan. In nearly all cases, poverty incidence is highest among households with many children, youths, single headed households, unemployed and low skilled workers with irregular income. In rural areas agricultural wage earners, those without land, and women are particularly poor.

Why is income poverty higher in the CEA countries and why is it more of a rural phenomenon than an urban one? First, initial conditions on the eve of transition largely determined the relatively disadvantageous position of these countries versus, for example, Russia and Ukraine. Second, throughout the world there is a well known, positive correlation between a higher degree of rurality and low income. As the agricultural sector and the rural economy grow at a far slower pace than urban areas, rural poverty is not reduced adequately, while macroeconomic growth does not trickle down enough to rural areas. The initial conditions in Azerbaijan and the five former Soviet Central Asian states in late 1991, on the eve of their independence, were relatively unfavourable. Some of them indeed had rich endowments of mineral resources, such as oil (Azerbaijan and Kazakhstan), natural gas (Turkmenistan and to a lesser extent Uzbekistan), precious metals (Kazakhstan, Kyrgyzstan and Uzbekistan), and thermal potential (Kyrgyzstan and Tajikistan, although under-utilized). Furthermore all of these countries had relatively high potential human capital, with near full literacy rates, which bode well for development. Yet these countries also

Table 10.1 Poverty incidence in the USSR

	1989
Azerbaijan	33.6
Kazakhstan	15.5
Kyrgyzstan	32.9
Tajikistan	51.2
Turkmenistan	35.0
Uzbekistan	43.6
USSR	11.1

Source: Pomfret (1998).

had a higher degree of poverty than elsewhere in the former Soviet Union (Table 10.1).

The Central Eurasian countries are indeed quite rural. This means that efforts to alleviate poverty would need to be concentrated in rural areas. For example in Uzbekistan, the most populous country of the region, more than 60 per cent of the population resides in rural areas (Table 10.2). Tajikistan has even experienced an increase in its rural population over the past few years. Rural dwellers in these countries are largely dependent on agriculture for their livelihoods. The data on agricultural labour as a share of employment provide an indicator of the relative importance of agriculture in the labour force (Table 10.2). Additionally the shares of Gross Agricultural Output (GAO) in Gross Domestic Product (GDP), and the share of agricultural exports in overall exports are indicators of the rurality of the CEA countries (Lerman 2007).

Concentrating solely on income poverty would contribute to the idea that rural poverty can be resolved only by improving agricultural production and output. However, such a purely money metric approach does injustice to the actual meaning of poverty. Poverty can be defined as living in a state of unacceptable deprivation in well being. Thus problems of deteriorating access to social services, such as public health (medical, water and sanitation services), education and social safety networks (transfers, pensions and unemployment benefits) are fundamental aspects of poverty as well. Collective and state farms used to play an important social role in the lives of rural dwellers. With their dissolution, many social services deteriorated, as local administrations were unable to provide them in the same way as before independence. Local governments often lack financial resources and with decentralization, they were delegated the responsibility for social service provisions, and the option to levy taxes; the tax base in many rural areas remains weak.

Table 10.2 Agrarian profile of CEA countries (2004)

	Share of Rural Population	Share of Agriculture in Total Employment	Share of Agriculture in Overall GDP
Azerbaijan	48.5	40.0	11.3
Kazakhstan	42.9	33.2	7.9
Kyrgyzstan	65.1	51.8	32.9
Tajikistan	73.6	67.6	24.2
Turkmenistan	56.4	–	20.2
Uzbekistan	62.6	–	28.2

Source: Lerman (2007).

Access to Social Services in Rural Areas

Though there is a lack of data on rural–urban differences in terms of hospital access and availability of medicine, available data on clean drinking water (Figure 10.3; data from UNICEF 2006) may provide a good proxy for access to social services. Household access to clean water from pipe connections (in the house or yard) is crucial for public health, although sometimes such services are included under housing rather than health statistics. According to UNICEF (2006), only 19 per cent of the rural households in Azerbaijan had direct access to piped water, while 76 per cent of the urban dwellers had piped water. The difference in access between urban and rural is apparent for all of the countries under review. Of the six CEA countries, Kazakhstan had the highest share of urban households with a connection to piped water, at 88 per cent, while Uzbekistan had the highest share of rural households, at 33 per cent.

Many other factors are relevant in determining rural health conditions, such as air pollution (see Spoor 2006b), which is particularly severe in many of the cotton producing areas of Turkmenistan and Uzbekistan. Notably, these are the same areas where water contamination with nutrient and pesticide residues is higher than in the countries further upstream.

Gendered face of poverty

There is clearly a trend of feminization of (rural) poverty in many of the CEA countries, for which there are at least two explanations. First, to complement rural household income, substantial numbers of men temporarily migrate in search of employment to Russia and those in the poorer countries move to slightly wealthier localities (often looking for jobs in agriculture). Consequently, many rural households encounter a temporary

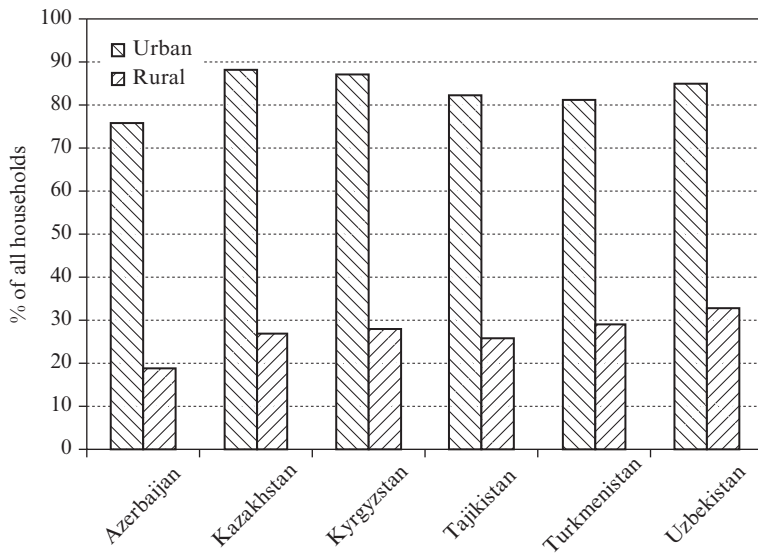


Figure 10.3 House connections to piped water (2002)

absence of male labour. Remittances might well counter some of the effects for these households (Mughal 2006), but the brunt is borne by women. Second, in terms of workload, women are the ones with primary responsibility for the small household plots (to guarantee household food and health). Additionally women tend to be involved in harvesting cotton in Tajikistan, Turkmenistan and Uzbekistan, where they toil under difficult conditions for meagre wages. In the latter two countries, school youths, in particular girls, perform this labour as well.

Food Poverty and Malnourishment

In some countries of the CEA, substantial levels of malnourishment accompany poverty, indicating food insecurity. This link is not necessarily consistent, as can be noted in Table 10.3.

For example, Tajikistan and Uzbekistan both show a strong increase (in the period 1993–2004) in levels of malnourishment, estimated respectively at 56 and 25 per cent of the population. Kyrgyzstan, in spite of high levels of income poverty, shows low levels of malnourishment, possibly related to the early recovery and growth of the agricultural sector. Because of widespread growth of agriculture, Azerbaijan's high levels of malnourishment (early 1990s) had reduced substantially by 2001–03.

Table 10.3 Malnourishment in Central Eurasia, 1993–2004 (%)

	1993–95	2001–03	2002–04
Azerbaijan	34	10	7
Kazakhstan	<2.5	8	6
Kyrgyzstan	21	4	4
Tajikistan	22	61	56
Turkmenistan	12	8	7
Uzbekistan	8	26	25

Source: FAOSTAT (2007).

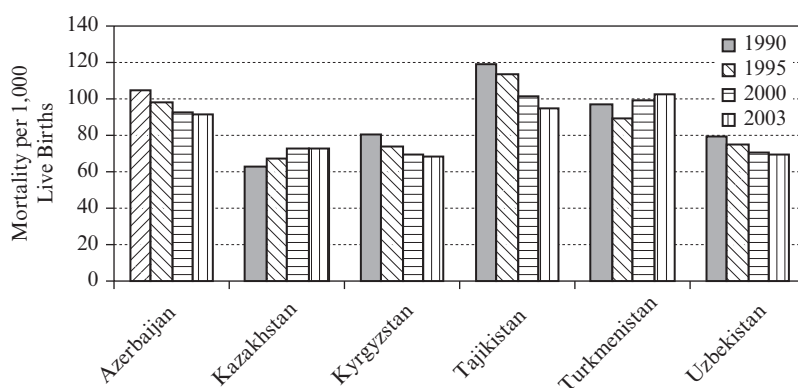


Figure 10.4 Under-5 mortality rate (1990–2003)

Child poverty is severe in the CEA countries under review with regard to insufficient income, but also related to other indicators, such as water, sanitation, clean heating sources, food and health conditions. To compare, the countries of Central Asia, the Southern Caucasus and Moldova, have more than half of their children living in income poverty (defined as <2.15 USD/day) which is ‘ten times higher than in some SEE countries’ (UNICEF 2006). Rural income poverty rates among children are higher than in urban areas and child poverty is substantially higher in those households with three or more children (in both rural and urban areas).

Furthermore under-five mortality rates are still quite high and in 2003, they were even higher in Kazakhstan and Turkmenistan compared to 1990 (Figure 10.4; data from UNICEF 2006). The levels are constant over a ten-year period and, in some cases, under-five mortality rates have even increased. UNICEF (2006) cites examples from Uzbekistan, Turkmenistan, Azerbaijan and Kazakhstan, indicating that rural child

Table 10.4 Stunting (chronic malnutrition), 2000 (%)

Azerbaijan	29	–	–
Kazakhstan	22	8	31
Kyrgyzstan		25	–
Tajikistan		41	–
Uzbekistan		31	–

Source: Rokx et al. (2000).

mortality is twice as high as its urban counterpart. Sustained economic growth has not yet diminished the phenomenon of child labour, which is common in the CEA countries particularly on household plots, but also in cotton harvesting, when schools shut down and children must work in the fields. UNICEF (2006) reported that in a number of transition countries, poverty is more pervasive when the head (taken as the father) of the household works mainly in agriculture and is lower for other professions. It is also higher if he is unemployed. Fathers who migrate provoke higher child poverty rates than for those who work in nonagricultural rural sectors, but the rates are lower than for those households with a father working in agriculture. It seems that remittances indeed play a complementary role in this respect.

Malnutrition has serious effects on the health and future development of children. Chronic malnutrition shows itself through stunting. An early study of Rokx *et al.* (2000) indicated that malnutrition amongst children was serious. In the two countries, which by 2003 had the lowest poverty rates, Azerbaijan had ‘one of the highest chronic malnutrition rates in the region, in particular, in the rural areas where more than one of every four children is too small for their age’ (Rokx *et al.* 2000, p. 61). Malnutrition in Kazakhstan was also found to be high, ‘in particular in the rural areas and among the poor’ (Rokx *et al.* 2000, p. 69). In Kyrgyzstan, Tajikistan and Uzbekistan stunting showed in 25–40 per cent of the children (see Table 10.5). Finally the most preoccupying feature of child poverty is that it is high in most of the CEA countries, mortgaging their future. Even worse in all cases, the child poverty rate (<16 years) is higher than the national poverty rate, sometimes by even 10 percentage points (see Figure 10.5; data from World Bank 2005a).

All six CEA countries went through a deep economic crisis in the early 1990s. This economic trough was accompanied a rapid increase in poverty. The main cause of the sudden emergence of such high levels of poverty is in the shockwave sent by the disintegration of the Soviet economy to the periphery of the system. Many industries were only artificially productive;

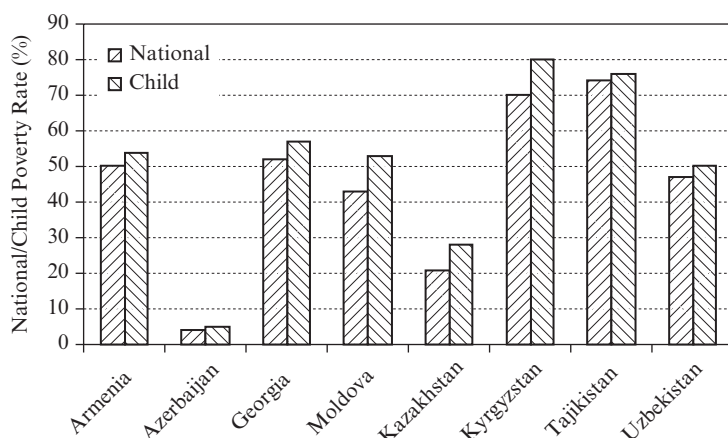
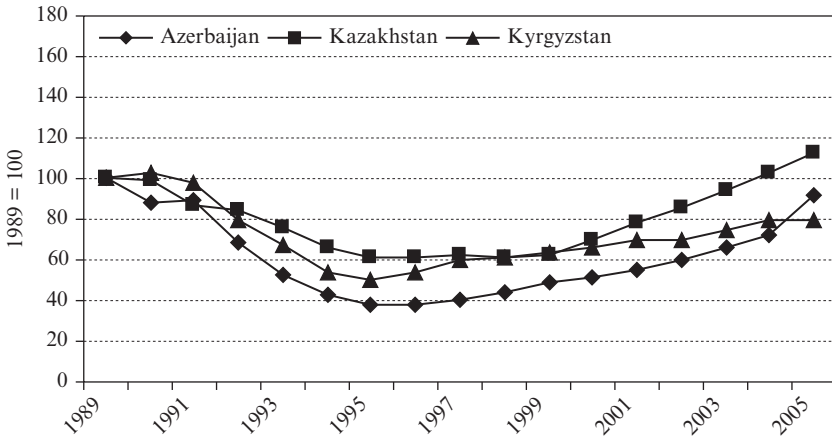


Figure 10.5 Child poverty ($USD < 2.15$)

their *raison d'être* the subsidized transfer price system, which ignored or underpriced transport costs. Furthermore the substantial transfers from the all-Union budget were cut off in 1992–93, worsening the financial crisis in the newly independent states. Hyperinflation, which is always highly regressive, affected those who relied on wage income, without other assets. Finally, wage income itself fell drastically as a main income source, with self employment and informal sector activities becoming predominant, with all their inherent uncertainties.

Macroeconomic stability was reestablished in the latter part of the 1990s, and growth rates became positive, although some southern Caucasus and Central Asian countries received another blow because of the impact of the Russian financial crisis of 1998. However economic recovery started with a much worsened income distribution. After 2000, growth rates reached high levels in countries driven by oil and gas sectors, which later benefited from high international prices and growing demand from emerging and fast growing Asian economies (Figures 10.6a and 10.6b).

How did the strong macroeconomic recovery translate into poverty reduction and how was it spatially distributed? In other words, how high was the poverty reduction elasticity of growth? The latter has been quite impressive indeed, leading to a substantial average reduction in poverty during the period 1999–2003, as evidenced by the World Bank (2005a), which provided spatially differentiated data on poverty incidence (see Figure 10.7 for urban–rural differences in poverty rates; data from World Bank 2005a). What is striking and evident to any regular visitor to these countries is that the fruits of economic development are best visible in the



Source: EBRD (2004, 2006).

Figure 10.6a Real GDP (1989–2006)

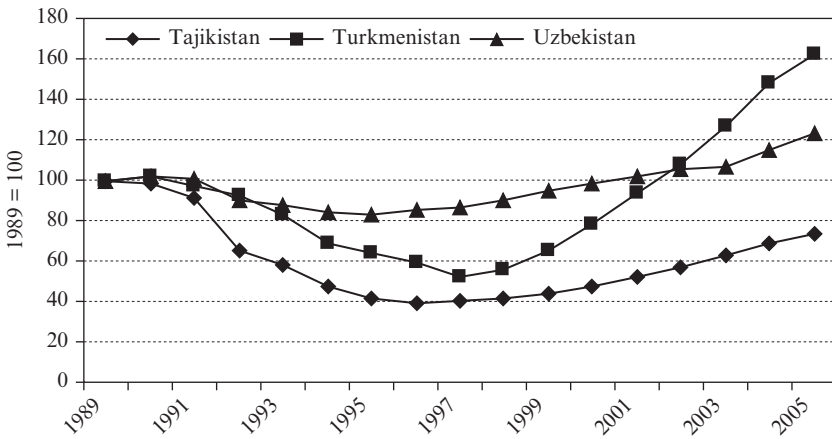
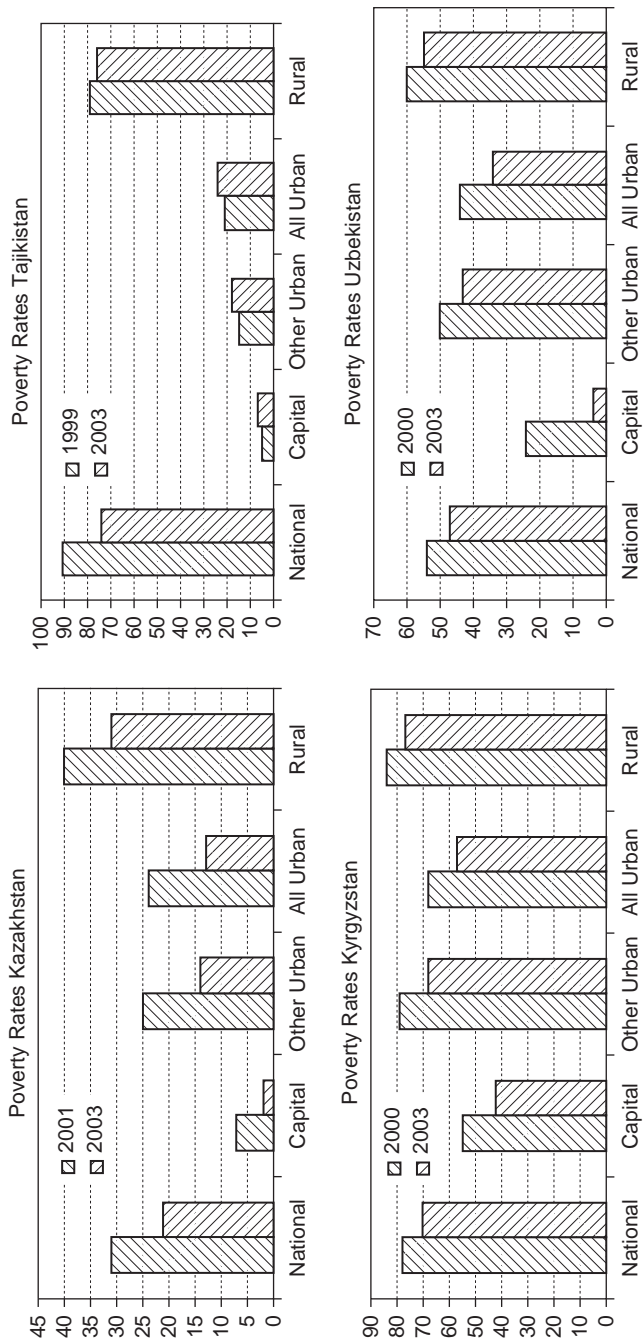


Figure 10.6b Real GDP (1989–2006)

rapid reduction of poverty in large urban centres. For example, while in Astana (Kazakhstan), poverty incidence (<2.15 USD) diminished to only two per cent, in rural areas this is still 31 per cent. In Uzbekistan, the difference is even larger, with a poverty incidence of four per cent for Tashkent and 55 per cent in rural areas. In Tajikistan it is just as striking at seven per cent (in 2003) in Dushanbe and 76 per cent in rural areas, with very little change since 1999 (World Bank 2005a). Comparing these trends with other,



Source: World Bank (2005a).

Figure 10.7 Spatial differences in poverty incidence (1999–2003)

relatively poor CIS-countries, Moldova was the only country able to reduce poverty in rural areas at more or less the same pace as in the capital.

This was partly the consequence of high rural–urban migration, but also because of the positive effects of a late, but comprehensive land reform of 1998–99, which provided access to land (hence food and income) to large numbers of rural poor (Weeks *et al.* 2005). The same holds for Azerbaijan (Sedik 2006; World Bank 2006). In further comparison, Armenia and Georgia initially had lower rural poverty rates than the six countries under review. Both of these countries were more urbanized on the eve of transition, with, respectively 34 and 45 per cent of their populations residing in rural areas, shares that increased slightly thereafter due to some initial reverse migration. Finally, as was shown above, urban poverty has been falling rapidly in most CEA countries, while rural poverty remains a problem. For a larger set of countries, including Hungary, Poland, Romania, Bulgaria, Russia, Kazakhstan, Belarus, Armenia, Moldova, Georgia, Kyrgyzstan, Tajikistan and Vietnam, the World Bank (2005a) has calculated the partial poverty reduction elasticity of growth, showing that this is generally twice as high for urban poverty as for rural poverty. There are two reasons for this. First, there are insufficient linkages between the urban and rural (and industrial and agricultural) economies, and hence less trickledown and multiplier effects of growth. Second, agricultural and agroindustrial growth is insufficient because of incomplete reforms, missing markets and institutions, deficient rural policies and the non-enabling environment provided by the state.

COTTON PRODUCTION, RESOURCE DEGRADATION AND INSTITUTIONAL FRAMEWORK

Extensively documented, in the transition countries that were part of the Soviet Union, including those in Central Asia, land reform stimulated individualization of landholdings and agricultural production, shifting the risks and decision-making away from the state towards the individual producer. The most far reaching reforms took place in Armenia and Georgia in the early 1990s and Azerbaijan, Kyrgyzstan and Moldova in the late 1990s (Lerman 2003, 2007; Lerman *et al.* 2004; Spoor and Visser 2001; Swinnen 2003; Swinnen and Rozelle 2006; Wegren 1998, 2005).

The post-1991 agricultural sector reforms in these countries focused on privatization of assets, in particular of land, and the transformation of the existing state and collective farms. The reforms undertaken were quite diverse in content and implementation. Privatization took the form

of asset distribution to workers or members, restitution of properties to former owners, sales (with a variety of conditions attached) and leasing arrangements (such as physical plot or share distribution). Farm restructuring led to new forms of association, such as cooperatives, joint stock companies, partnerships, associations of peasant farms and individual peasant farms. A comparison of the six CEA countries also points to a diversity of reform processes, sequencing and outcomes. The diverse outcomes can be explained by, among others: (1) Rapid, gradual or slow land and agricultural policy reforms; (2) (Rural) elites that clung to power (such as in the cotton sector); (3) Low incentives to break away from the safe environment of the collective farm; and (4) The link between large farm enterprises and large scale surface irrigation systems. The latter is the case in much of Tajikistan, Turkmenistan and Uzbekistan, which would not break up easily without incurring high costs, as they were not designed to supply water to a large number of small producers.

Land reform, in terms of the formation of private family farms, made considerable progress in Kazakhstan and Kyrgyzstan. Azerbaijan followed in the late 1990s with a redistributive land reform. This group of countries represents medium to advanced level reform. Significantly less reform was implemented in Uzbekistan and very little in Turkmenistan. Since the peace agreement in Tajikistan in 1997, the government has implemented partial land reform. However, land reform and other agricultural policies have provoked nominal or cosmetic changes more often in some of these countries (Sedik 2006; Lerman 2007). In order to provide more structure to our analysis, we introduce a differentiation into two groups. In the following we will concentrate on the group formed by Tajikistan, Turkmenistan and Uzbekistan (low to medium level reform) and, in discussing cotton production, the ruling institutional framework and resource degradation, our focus will be specifically on one country, Uzbekistan.

Cotton is the dominant crop in most of the countries in this group, a crucial foreign exchange earner and employer of millions of peasants and workers (Spoor 1998, 2005). Cotton could have developed much more as a High Value Agriculture (HVA) cash crop in the current agroecological conditions of much of Central Eurasia, but the restrictive institutional environment in the countries of group two has limited such development. There has been little incentive for a strong supply response, despite the increased demand for Central Asian cotton in international markets, such as from China. Lack of public and private investment, poor rural infrastructure and insufficient (or inefficient) marketing and processing facilities hinder this development. Because of the current political economy of cotton, with substantial state and private interests pushing towards surplus extraction, wages of cotton workers and farm gate prices for producers

have remained low. The cotton *kolkhozniki* (agricultural workers) are by far the poorest group in the rural societies of Tajikistan, Turkmenistan and Uzbekistan. While cotton has potential in the region as a cash crop, rural poverty is greatest in the areas where it is cultivated. Cotton production has had significant degrading effects on land and water resources, in particular in the Aral Sea Basin (Spoor 1998, 2005). This has accelerated the deterioration of livelihood conditions in this area.

TAXATION AND STATE PROCUREMENT: PROVIDING DISINCENTIVES TO AGRICULTURE

Taxation, as part of an institutional environment in which individualized and corporate farms function in the countries of this group, has a complex history. During the Soviet era, prices were accounting prices; they bore no relation to scarcity or surplus. Taxes were paid, mostly, by collective and state farms in the form of a turnover tax. Agricultural output was taxed implicitly through the overvaluation of the exchange rate, but this price discrimination was partly compensated by large subsidies on inputs. Because of the nonconvertibility of their exchange rates, some countries, even after independence, continued this creaming of their agricultural sectors, in particular in the cotton sector (see below for detailed analysis of Uzbekistan). In recent years, however, there has been more convergence of domestic and world market prices, reducing the implicit tax. Many of the agricultural product markets in most of the countries under review have been liberalized and state procurement has disappeared. However, this is not the case for wheat and cotton in Turkmenistan, Uzbekistan and, to some extent, in Tajikistan.

If we take the example of Uzbekistan, the largest producer of cotton in the region (a similar situation exists in Turkmenistan), at the start of transition, in 1993, the estimate was that taxation (land tax, procurement pricing and overvalued exchange rate) on cotton production was USD 1362 million, while subsidies (water, energy, inputs and finance) represented USD 561 million. This meant a net outflow of USD 801 million (World Bank 2005d). At the level of the cotton farm, this implied that only 20 per cent of farm income could be held, while 80 per cent was taxed as government revenue. In Uzbekistan's chosen macroeconomic model, which was a gradual import substitution strategy, this forced resource flow was seen as the best option for financing the start up costs of energy independence.

In 1998, the net transfer was still substantial, estimated at between USD 500 and 600 million (Kandiyoti 2003). Farm incomes suffered, which, in the end, exerted strong disincentives for cotton production. By 2000, taxation

had fallen (including debt write offs, a common form of implicit *ex post* subsidy) to USD 770 million, while subsidies to the sector were estimated at USD 486 million, leaving a net outflow of USD 284 million (some 35 per cent of the 1993 level). As a percentage of farm income, this was around 50 per cent (down from 80 per cent in 1993). At the macroeconomic level this transfer represented 4.7 per cent of GDP, although without debt write offs this would have been USD 572 million (9.5 per cent of GDP), which is still sizeable. This picture fundamentally changed by 2003. Net transfers had fallen to only USD 150 million, representing 1.5 per cent of GDP (2.4 per cent without debt write offs). The situation in terms of farm income versus government revenue, had reversed (80–20 per cent) compared with a decade earlier (World Bank 2005d). In 2004, taxation increased somewhat, as official prices continued to lag behind improved world market prices, but did not fundamentally change the trend that remained clearly visible. Output prices improved again in 2005–06.

Institutional Environment

There are also serious payment problems for farm enterprises and the emerging private farms, in terms of arrears, lack of cash and under-valuation of quality. This is the case in all countries of group two, although no specific data is available for Turkmenistan. In Tajikistan the debt problem of the large farms (something that inspired the Uzbek move towards medium size farms), has now been redistributed to the small leasehold farms, who are currently confronted with completely unsustainable debts towards the futures holders, large companies in wholesale and exports of cotton (Shagaida 2006).

The state procurement system that is still partly in force in all three countries was and is still clearly open to rent seeking behaviour. In the cotton sector, in particular, this has led to a political economy captured by important interests that keep the status quo largely intact, despite some improvement in the past few years. Uzbekistan retains obligatory nominal procurement quotas (before for the *shirkats* and now for their offspring, the individual farms, the so-called *fermer*) for cotton and wheat (see Spoor 2005). In practice, these quotas are higher because of existing trade monopolies, which make it difficult to sell anywhere else than to the state (or a parastatal) agent. In Turkmenistan, the situation is reformed even less, while in Tajikistan the state monopoly has been replaced with a small group of futures holders, which have a tight grip on cotton trade.

The institutional environment remains characterized by the existence of informal taxation and bribes. These substantially increase transaction costs in various markets, with prohibitively high transaction costs often

leading producers and traders to decide not to participate in the market. In the countries of group two, there is insufficient attention to establishing a rule of law. Although the legal framework is nearly complete, legislation is often erratic and sequences of many laws have not contributed to increased trust in the state. Furthermore with the centralization of power structures and the unclear separations between the executive and legislative power, there are regular cases of abuse, despite illegality (Cornia *et al.* 2005).

Property rights are not secure, while political interference, for example from the district or regional governors (*hokims*), makes the business climate more difficult (*ibid.*). Access to markets often depends on political connections and transparency is minimal. An early study by the World Bank (1999) investigated how rent seeking by state officials affected enterprises in Uzbekistan. It concluded, based on a survey, that 65 per cent of the firms reported having to pay bribes. However, the institutionalized bribes also provided substantial security that the service was delivered or licence obtained without further due, a phenomenon that is well known in all the CEA countries. Nevertheless, it is clear that this is highly detrimental for private enterprises and for domestic and foreign investment. It cannot be eliminated overnight, and not simply by instituting repressive measures, as the origin lies in the extreme low remuneration of civil servants, and the many options for rent seeking that omnipotent state interference, non-transparent subsidies and taxation provide. The cotton sector is ideal for this situation to develop.

Cotton Supply Chain

In the most important agroindustrial sector in the CEA countries, namely that in which cotton is produced, ginned, processed and exported as lint, three pathways of reform are in evidence, with various outcomes (Sadler 2006). First, in Kazakhstan and Kyrgyzstan, the supply chain has been liberalized and deregulated, leaving producers, whether individual or corporate farms, to contract inputs, services, processing and output channels freely, with a substantial degree of competition. Second, in Tajikistan, with the emergence of futures holders export companies, the market has changed, but there are varying degrees of official and unofficial state intervention, in particular at the regional level. Third, in Uzbekistan and Turkmenistan, there is still a high degree of state procurement and monopsonic state companies dominate export.

In Uzbekistan, state administered prices have risen to near border price levels, but much of the market remains controlled by state companies or others with special permission to trade. With the liquidation of the large *shirkats* during 2004–06, and the formation of medium sized individual

farms, the latter brought under the still existing procurement quotas for cotton and wheat. The same is true for the leasehold peasant farms in Turkmenistan. According to Sadler (2006), producers in these various institutional frameworks have little negotiation power and are in a dependency relationship with cotton gins and suppliers of inputs and services. This is contrary to the central position in the supply chain of cotton producers in some Western economies.

In those CEA countries where state intervention is still substantial (Turkmenistan and Uzbekistan) or hidden through a whole range of regional controls (Tajikistan), the producers are strongly dependent on finance through the gins. In Turkmenistan and Uzbekistan, the gins are largely state owned, while in Tajikistan they were privatized, but producers are not free to choose their own gin. Finance in Turkmenistan and Uzbekistan comes from the gins and producers are unable to access other financial resources. In the other countries where production, processing, trade and exports were liberalized (Kazakhstan and Kyrgyzstan), and production is mostly undertaken by small farms (in South Kazakhstan and South Kyrgyzstan), the power of the gins (and large trading companies) is just as large.

Producers' bargaining power remains limited. In Kazakhstan and Kyrgyzstan, producers benefited from higher prices and reduced market margins brought about by competition between cotton gins. This led cotton to be smuggled from Uzbekistan into Kazakhstan and Kyrgyzstan, in search of higher prices. Nevertheless, in the past few years, many private gins have run into financial trouble, which has reduced market competition. It is interesting to note that under privatization, quality-grading systems disappeared, remaining in existence only in the heavily state intervened system of Uzbekistan. Hence privatization, deregulation and liberalization have not led to altogether good results.

Agricultural Production and Resource Degradation: Cotton and Environment

There are a whole series of environmental problems in the CEA countries, caused by the gross mismanagement of natural resources, such as water, land and forest resources. The latter has led in many places to environmental degradation and the qualitative worsening of rural livelihoods (through air and water pollution or lower yields and hence incomes). Focusing again on the agricultural sector and its relation to sustainability, the largest environmental disaster of them all is the drying out of the Aral Sea and all the accompanying features of land degradation, water problems and diminishing biodiversity in the Aral Sea Basin, formed by its two main rivers, the

Amu Darya and the Syr Darya. The environmental problems in the Aral Sea Basin are substantial. Soil degradation is observed in a relatively large and growing proportion of irrigated land in Central Eurasia. The main cause should be sought in the lack of crop rotation, since in most places cotton has been a monoculture for many decades. Furthermore there is over irrigation and the inadequate and archaic drainage systems cause serious water logging and upward flow of minerals. Soil salinity is widespread, which reduces agricultural yields and increases water consumption, since farmers get into the habit of water leaching to rinse the soil. This practice consumes large quantities of water at the start of the season.

Salinity is even more severe in the downstream areas of the basin, since drains often flow back into the rivers. The upstream countries, Kyrgyzstan and Tajikistan, have lower rates of salinization, while severe soil salinity is seen in the lower reaches of the Amu Darya (Khorezm, Karakalpakstan, and Kashkadarya in Uzbekistan and Turkmenistan), the Syr Darya (Southern Kazakhstan), and the Zerafshan (Bukhara in Uzbekistan). The regional disparities are quite wide, with 90–94 per cent of land in the Karakalpakstan, Khorezm and Bukhara provinces of Uzbekistan salinized, compared to 60–70 per cent in Kashkadarya province, and only 5 per cent in Samarkand province. These are partly soil-type differences and in part caused by irrigation related salinization (Spoor 2006b).

There was a marked increase in soil salinity in the downstream user countries in the 1990s, the first decade of transition. This increase was estimated at 30 per cent for Uzbekistan, 24 per cent for Turkmenistan and 18 per cent for Kazakhstan, while in Kyrgyzstan and Tajikistan, soil salinity diminished (Spoor and Krutov 2003). Soil salinity is not merely a technical problem; it has major social and economic consequences. Because salinity reduces crop yields, it depresses the income of farm households, which forces them to find different survival strategies. Only tolerant plants grow satisfactorily on soils with moderate salinity. On severely saline soils, only a few highly tolerant plants can flourish. If soil salinity is above a certain threshold value, yield losses can easily range between 10 and 50 per cent.

Water, Conflicts and Loss of Biodiversity

Spoor and Krutov (2003) extensively analysed the problems of the upstream versus downstream countries in Central Eurasia. The upstream countries (primarily Kyrgyzstan and Tajikistan) are using water resources for hydropower generation. The downstream countries need the water for irrigation of agricultural land, particularly, in the summer, when the upstream countries tend to hold water in storage and release it through

power turbines to generate electricity. Azerbaijan has the same problem, as it is a downstream country and its water streams through Armenia and Georgia. This adds an extra dimension to the political problems among the Caucasus states.

Lack of sufficient drainage has salinized water in rivers downstream. However, water pollution is caused not just by salt but also by nutrients. The intensive use of fertilizers and pesticides in cotton production, which did diminish during the 1990s, though mainly for reasons of finance, severely polluted the rivers in the basin with high concentrations of several toxic chemical substances (Spoor 1998). Furthermore the smaller quantities of water that actually flow as far as the deltas of both main rivers and the aforementioned increased water salinity in those areas have devastating consequences for biodiversity. Part of the rich flora and fauna of these wetlands, the breeding grounds for many birds and fish in the basin system, has disappeared. In the Amu Darya delta, the unique *tugai* forests suffered enormously (Spoor 1998).

UNESCO estimated that some 30 000 hectares of lakes and bogs in this delta have almost entirely dried out. Much of the fish population in the Aral Sea itself has died out. This has had dramatic consequences for the populations of the surrounding towns, which were largely dependent on fish. This loss of biodiversity has had negative impacts in terms of employment, income generation and health, making it a very concrete and pressing issue in the CEA countries.

Shrinking of the Aral Sea and Effects for Regional Climate

There is a rapidly expanding area of exposed seabed in the Aral Sea. This is visible on the shores, as well as in the exposed seabed that separates the deep western and shallow eastern sea and consists largely of salt. The desert storms that blow there approximately three months per year dislodge and deposit large quantities of this salt onto the surrounding agricultural lands. Furthermore because of desertification, windstorms are moving increasing quantities of salt in Central Asia, especially near the Aral Sea. Some 1.5 to 6.5 tons of particles per hectare, of which 260–1000 kilograms per hectare is toxic salts, is transferred annually from the dried seabed (which itself consists of an estimated 1.5 billion tons of salt covering 3.5 million ha) to an expanding area in its surroundings.

Wind erosion also carries salts in regions of Central Uzbekistan. Bukhara province in Uzbekistan receives a total 300–400 kilograms per hectare of salt-laden aerosols annually, of which 40–50 per cent comes from the dried bed of the Aral Sea some 300 kilometres distant. This salt pollution not only has a negative effect on agricultural production, it also affects human

health. The number of cases of respiratory disease is relatively high, especially in the downstream areas close to the Aral Sea.

The shrinking of the Aral Sea also contributes to climate change in the surrounding areas. Previously, the huge size of the Aral Sea helped to regulate temperatures and its drying out has reduced this effect. The planting season has shortened, the number of frost-free days has decreased and summer temperatures (in the desert) are slightly higher.

Environmental Degradation and Rural Poverty

Using again the example of Uzbekistan, where environmental factors originating from cotton production negatively affect many people, although no recent data was available, even data for a year as distant as 1998 shows a devastating picture for the population affected by water and air pollution (see Table 10.5). ADB (2004) gives estimates from the National Environmental Action Plan (NEAP) of Uzbekistan for that year, which indicates around one quarter of the total population affected by water and air pollution, surprisingly, not from living in those areas that are downstream of the Amu Darya, such as Karakalpakstan, Bukhara and Khorezm, in the North or the densely populated and intensive cotton producing areas such as Ferghana, in the East.

Table 10.5 Population affected by water and air pollution in Uzbekistan (1998)

(x 1000 persons)	High		Very High		Total	
	Water	Air	Water	Air	Water	Air
Karakalpakstan	82	537	1191	–	1273	537
Andijan	80	–	–	–	80	–
Bukhara	409	–	883	–	1292	–
Djizak	50	–	–	–	50	–
Kashkadarya	106	235	–	–	106	235
Navoiy	112	200	97	–	209	200
Namangan	–	–	132	–	132	–
Samarkand	167	77	589	–	756	77
Surkhandarya	62	–	104	–	166	–
Syrdarya	69	–	105	–	174	–
Tashkent	257	295	–	–	257	295
Ferghana	831	830	298	–	1129	830
Khorezm	331	136	113	–	444	136

Source: ADB (2004, p. 9), citing the NEAP, Uzbekistan 1998.

To see if this picture has been worsening since the late 1990s would require data that is more recent. Nevertheless, it can be hypothesized here that this is indeed the case as soil degradation has worsened, drainage canals became more polluted and the drying out of the Aral Sea has continued to have negative effects on its environment through sand storms.

CONCLUSIONS

This chapter shows that rural poverty in the transition countries of Central Eurasia links closely with agricultural household incomes, growth in the sector's output and productivity, agriculture's linkages with other sectors and resource degradation. We have shown that the trickle down of growth towards rural areas is limited and the rural poverty reduction elasticity of growth is low. This chapter also shows that with the transformation from large farm enterprises, which were also social units, towards individualized forms of agricultural production, rural social services have weakened, as local administrations have not been able to fill the gap. Access to piped water and other public services is highly unequal, comparing rural with urban areas. It is, furthermore, striking that child poverty is still severe in the CEA countries and stunting is widespread, signalling malnutrition, with rural households having more than two children, little or no land, and/or in mountainous areas, belonging to the poorest stratum of the population.

This chapter also highlights that with cotton, the most important crop in the region, the intimate relationship between rural poverty and resource degradation (in particular land and water) is most salient. However, rather than seeing cotton as a curse (ICG 2005), this strategic crop can become a high income generator for farmers (and indirectly for farm workers). Currently it seems to be mostly profitable for the processing and trading sector in the supply chain and state officials involved in the regulatory framework, rather than for the producers themselves. This is especially the case in Tajikistan, Turkmenistan and Uzbekistan.

In these countries sustainable resource management has not been a real priority, in spite of considerable public discourse. To reduce rural poverty and improve the quality of rural livelihoods this is however of crucial importance. There are inadequate irrigation and drainage practices and a decaying infrastructure, which contributes to environmental degradation (salinization, water logging, soil nitrification). The introduction of more economic incentives through prices and taxation (rather than only command and control policies) could contribute to both an improvement of income and provide better incentives for more diligent use of the scarce

resources, in particular water. However, the institutional framework is still very authoritarian and bureaucratic, providing producers with little incentives to save water and to use it more efficiently. Although water user's associations were introduced, in cases such as Uzbekistan, they seem to be absorbed and integrated into the existing top down institutional framework, rather than functioning as the seeds of a new one. Moreover the severe resource degradation in the region, in particular in the Aral Sea Basin (see also Spoor 1998), has neither been halted nor reversed.

NOTES

1. Following the Food and Agricultural Organization.
2. The 2 USD a day international poverty line is normally used for Eastern Europe and Central Asia, as it is closest to the national poverty lines. We use the World Bank standard of 2.15 USD in 1993 purchasing power parity (PPP) prices, which has been standard in many studies on poverty. The original 2 USD was measured in 1985 PPP prices. Inflation explains the difference.

11. Spatializing development and environmental discourses: The case of sustainable development and globalization¹

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This chapter, inspired by recent geographic research, makes a case for spatializing development and environmental discourses. It focuses on sustainable development and globalization and shows that space is central to these two concepts. Its main assumption is that an aspatial analysis of sustainable development and globalization is very limited, whereas a space sensitive and interconnected assessment may yield profound insights into how different societal forces operate to produce and oppose the production of spaces along with related socioeconomic configurations. This chapter provides a few examples from the literature on how the complex interactions and processes leading to sustainable development and globalization may be spatialized in research.

Shakespeare's Juliet asked, 'What's in a name?' We may extend this question to development and environmental research and ask, 'what is in the growing list of concepts and discourses on environment and development?' We have closely followed these discourses as researchers interested in development and the environment. If asked to characterize the essence of development and environmental concepts over the last three decades, we would not hesitate to answer that there has been a kaleidoscope of ever changing vocabulary, terminology and discourses. One of the issues that contemporary development and environmental researchers and practitioners have to contend with is whether any substantial change in the essential discourse and/or improvement in the human conditions in different parts of the world have really emerged after so much theorizing. The growing list of concepts is a vital aspect of intellectual activity and is evidence of the fact that reflection and the search for solutions to development and environmental issues are ongoing. However newcomers to the field of development

research and practice soon realize that there is not just a growing list of concepts but also a vast spectrum of concepts and discourses, which are sometimes competitive and contradictory; these same newcomers become increasingly concerned with theoretical outcomes and outputs. Chambers (2005) succinctly summarized the changing vocabulary in development:

. . . additions to the common lexicon of development have been prolific. New words have been added faster than old have fallen in disuse. Some such as integrated, coordinated, planning and socialism have peaked and passed into decline. Others in the eclectic and perhaps ephemeral language of post-modernism, such as deconstruction, narrative and meta-narrative, text and subtext, have largely languished in academic and literary backwaters. Others, such as equity and poverty, have been robust and resilient. Yet others, some old, some new, which have come close to the mainstream of much development discourse during the past two decades include: accountability, capabilities, civil society, consumer, decentralization, democracy, deprivation, diversity, empowerment, entitlement, environment, gender, globalization, governance, human rights, livelihood, market, ownership, participation, partnership, pluralism, process, stakeholder, sustainability, transparency, vulnerability, well-being (Chambers 2005, p. 186).

Evidently there is an impressive development and environmental landscape of concept constructions, reconstructions, revisits and rebuttals. The dilemma is not so much with the concepts per se, but rather with whether the seemingly new concepts may actually lead to changes in the framing of academic and practical programmes, and whether these conceptual discourses may be effectively translated into actions, which will improve the environment and the human condition within different spatial units. The generalized scenario is the following.

While the development and environmental community grapples with the conceptualization and seeks to implement recommendations of one discourse, still another discourse begins and the community has to tackle the new one. Therefore, the existing research and policy programmes are continually being restructured to fit the new concepts. This phenomenon partially explains why, of late, a number of academic and policy programmes have begun to realign themselves to priorities articulated in the Millennium Development Goals (MDGs), globalization and climate change, casting aside their prior orientation around sustainable development. Of even greater concern is the apparent dichotomy between the articulation of academic and scientific discourses, and the actual reality of what is taking place in different spaces of the world, ranging from local communities to larger districts, villages, cities, nations and entire continents (*The Ecologist* 1993). Yet it is within this context that we find there is a need to spatialize development and environmental discourses. Our focus is on two such discourses – sustainable development and globalization – and we provide a few examples of how the

complex interaction and processes leading to these discourses as well as the positive and negative effects experienced may be spatialized in research.

SUSTAINABLE DEVELOPMENT, GLOBALIZATION AND SPACE

The extensive sustainable development and globalization literature is informed by transdisciplinary research that synthesizes and applies a wide range of theories and methods (Kaplinsky 2005; Mebratu 1998; Pezzoli 1997). On 27 October 2007, while preparing this chapter, we typed the concepts, *sustainable development*, *sustainability*, *globalization* and *global* into the Google search engine, and received 79 300 000 hits on sustainable development, 38 700 000 on sustainability, 28 400 000 on globalization and 595 000 000 on global. Researchers examine these concepts from diverse perspectives such as political economy–ecology, social justice and inequality, dependency and underdevelopment, cost–benefit analysis, global governance and cultural interaction. This rich transdisciplinary diversity has not only led to important insights but has also generated differences in perceptions and sometimes tensions in claims about the impacts of sustainable development and globalization. In addition, related concepts, indicators, theories and methods are also often fraught with tension and dispute. This should not necessarily be considered negative or undesirable, but rather as an indication that there is room for further theoretical and methodological exploration within the different disciplines engaged in this polemic.

In 2003, Professor J.B. Opschoor contributed a chapter to a book edited by Darkoh and Rwomire, in which he argued the case for North–South dialogue on sustainable human development (Opschoor 2003). He singled out the losses the South incurred with regard to unsustainable development and globalization as the basis for this dialogue and negotiation. In recognition of Opschoor's articulation of a sense of space and place, and the importance we accord to maintaining a dialogue with regard to these two concepts, we advance the argument that consideration of space is important; not only for theoretical and analytical purposes, but also when undertaking the measurement and implementation of sustainable development and globalization activities. This enables us to address two crucial questions:

1. Where are the different issues, activities and objects affiliated with a specific location in time and space, in relation to sustainable development and globalization?
2. What factors have led to the existing state of sustainable development and globalization at a specific location in time and space?

Probing these two questions evokes a conceptual framework for examining not only the outcomes of unsustainable development and globalization but also the complex interactions between a set of agents, institutions, activities and negotiations (including contestation and resistance) in different parts of the world. This framework allows us to examine how these cumulative interactions have led to different outcomes, and their subsequent contextualization and translation at different spatial scales: local community, district, province, nation, continent and globe (Woods 2007; Massey 2006; Mansfield 2003; Soja 1980). Our framework reveals that we are dealing with a nested set of issues, actors, decisions and actions that may bring benefits to some places and social groups in time and space, while at the same time dispensing costs and losses in other contexts.

SPATIAL DIMENSION OF SUSTAINABLE DEVELOPMENT AND GLOBALIZATION

Conceptualizing Sustainable Development and Globalization as Spatial Processes

This section briefly discusses the significance of conceptualizing sustainable development and globalization as spatial issues. A number of authors have sought to conceptualize sustainable development and globalization, including Mebratu (1998) and Pezzoli (1997), who provided a comprehensive review of the literature on this concept. A widely used definition of sustainable development is based on a book by the World Commission on Environment and Development (WCED), *Our Common Future*, which states that ‘Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (1987, p. 43). In this book the emphasis was on the need for action to focus on two key concepts in the definition – needs and limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs. It should be noted that sustainable development has come to mean many different things to different people within different settings, partly because the concept is vague and partly because of the need to use the concept for different purposes and within different situations.

Broadly speaking the concept of sustainable development involves socio-economic as well as ecological, ideological and political considerations (Eden 2000) and generates great interest at international, national and local levels around the world (Pezzoli 1997). As noted by Mebratu (1998), though *Our Common Future* constituted a major political turning point for

the concept of sustainable development, it was neither the starting point nor the end of the conceptual development process. Humankind has been concerned about its social and physical environment for a long time and its activities have shaped and been shaped by this concern for many years.

Like sustainable development, globalization also means many things to different people, but it can broadly be defined as ‘a dynamic and multifaceted process of integration and interaction that enrolls localities into networks of interconnectivity organized at the global scale and facilitating the global circulation of people, commodities, ideas and representations’ (Woods 2007, p. 487). The extensive literature on globalization is helpful in clarifying and even correcting a number of key premises. The following is a summary of some of the key conceptualizations.

1. Globalization is a dynamic process that stretches centuries into the past and will continue for centuries into the future. Hence, there is a need to trace and carefully delineate different waves of the process and avoid focusing only on globalization of the late twentieth and early twenty-first centuries, as has often been the case (Woods 2007; Imade 2003; Ramsaran and Price 2003; Amin 2001; Frank 1998).
2. The growing list of metaphors for contemporary globalization requires careful conceptualization in relation to experiences and realities in different parts of the world. Global village, time–space compression, elimination of distance and space, shrinking world, speed up, overcoming spatial barriers, disruption of the horizon, and global/local dichotomy are a few of these metaphors (Massey 1994). For some, space has shrunk and there is greater mobility, but for others this is not the case.
3. Globalization has a number of dimensions (economic, political and cultural), which need to be looked at in their entirety, even if the focus is on only one dimension (Kose *et al.* 2007; Levy 2007; Kaplinsky 2005; Ramsaran and Price 2003).
4. Globalization is not a free flowing stream, engulfing and swallowing up all objects in its way. If anything, globalization has emerged over the years as a controversial and sometimes contentious process, subject to resistance in some settings (Clark and Themudo 2006; Mitchell 2002; Amin 2001; Herod 2001; Saul and Leys 1999; Rodney 1972).

The brief conceptual clarification presented in the preceding, on both sustainable development and globalization, reveals that space is central to these two concepts, whether one is looking at how the present generation is to meet its needs without compromising the ability of future generations to meet their needs, or at patterns of integration and/or convergence in

various social, economic and political spheres. This is because both involve activities and efforts spread over the years and which take place in different settings. We argue that space is less a static given and much more a dynamic reflection of human imprints and actions, and that the spatialization of the concepts of sustainable development and globalization entails a study of essential human agencies, decisions, politics and activities at different times and in different spaces on our planet. Scholars such as Woods (2007), Massey (2004, 2006) and Soja (1980) argued for an analysis of the social production of space. Massey has aptly summarized this approach as follows.

If space is a product of practices, trajectories, interrelations, if we make space through interactions at all levels, from the (so-called) local to the (so-called) global, then those spatial identities such as places, regions, nations, and the local and the global, must be forged in this relational way too, as internally complex, essentially unboundable in any absolute sense, and inevitably historically changing (2004, p. 5).

The examples presented in the next section reveal various aspects of sustainable development and globalization on different spatial planes (international, national and local) and illustrates the social construction of these concepts. In essence we argue the case for undertaking a relational, spatial analysis of sustainable development and globalization.

Examples of how Sustainable Development and Globalization may be Spatialized in Research

A synopsis is provided here of studies that illustrate how sustainable development and globalization may be spatialized in research. Since many different scholars examined these two concepts, it would be impractical to summarize all the studies with a spatial component done by geographers and by researchers with other specializations, in such a short chapter. A comprehensive review of the available literature is desirable, but would constitute another study in itself, which should be undertaken in the future, by ourselves or other researchers. The concern at this stage is to illustrate how sustainable development and globalization may be spatialized in research.

SUSTAINABLE DEVELOPMENT

A spatial study of sustainable development should not only organize and/or describe political, social, economic and environmental issues at different spatial scales but also consider how other processes, such as politics, interact and influence one another at local, national, continental and international

levels. In other words, a local study of sustainable development should not lose sight of the interaction between the local setting and national or international contexts. This chapter identifies two insightful studies that sought to spatialize sustainable development or issues related to sustainable development. The first study is by Simmons (2004) who looked at the role of hierarchical forces interacting across local, sub-national, national, continental and international spatial scales in creating and dealing with land conflict in the Eastern Brazilian Amazon. The second study is by Munton (1997) who provided an excellent analysis of political engagement with sustainable development in the UK. This chapter highlights key issues from the approaches and findings of these studies.

Simmons (2004) examined land conflict in the Eastern Brazilian Amazon. This study highlights a number of issues relevant to sustainable development such as distribution and access to land, factors underlying access to land, the role of the state, efforts to deal with the issues of access to land and conflicts over access. Simmons situates his study in a dynamic, spatial model that takes into account the interplay of different factors at different periods and at different spatial scales. At the global level, the study looks at how a conflict between economic development (livestock and mining) and concern about the environment and indigenous rights influenced the pattern of land distribution in the Brazilian Amazon. At the national level, the key forces were in the form of agroindustrial programmes, land reform initiatives and conservation/indigenous policies. At the regional (subnational level), illustrated by a case study of Para State, the main issues were related to large landholdings, economic reserves, spontaneous in-migration/smaller farmer settlement and conservation/indigenous reserves. At the local level illustrated by a case study of the county of Eldorado do Carajas, the above forces led to resource scarcity and competition, social and political mobilization, and eventually conflict over land. Through detailed analysis at these different spatial scales, Simmons reveals that '... conflicting national development policies, influenced by global concerns and interregional effects of development, have resulted in increased land concentration and resource scarcity within the region' (2004, p. 187).

This study reveals how conflicting environmental, economic and political interests negotiated and contested at different spatial scales manifest themselves at the local scale in the form of expansion of large ranching operations, creation of conservation units and demarcation of indigenous reserves. Simmons shows that these processes constrained the pool of land available for small farmer settlements. This study therefore looked at land resources in space not just as a given but as a product of evolution within a context of competitive and sometimes contradictory environmental,

economic, social and political interests that played out in time and space, and led to land conflict in the Eastern Brazilian Amazon.

Munton (1997) provides a detailed examination of the UK's national and local government response and actions on sustainable development. The importance of this study lies in demonstrating the role of the government in translating the principles of sustainable development into the policy agenda and plans of action of the national and local level governments. This study depicts the response of the UK government in international initiatives and activities such as the G7 and European Union.

Munton shows that the UK responded to its Rio commitments by pressing the G7 group and her European Union partners to prepare national strategies by the end of 1993. The UK strategy was produced in January 1994. Munton argues that the quick response by the UK government is due to the high priority it had given to environmental issues in the 1980s, when parliament produced and endorsed a series of documents on sustainable development. Munton shows that enthusiasm at the national level did not translate into significant progress addressing or initiating measures to tackle economic, political and environmental issues related to sustainable development at the local governmental level. Munton shows that although a number of local authorities got involved in developing strategies and plans for local Agenda 21, their degree of commitment varied. Through a detailed analysis of documents, actions and behaviour of both national and local governments, Munton notes:

... the UK government's response to the Rio declaration demonstrates faltering purpose, reinforcing and reflecting public distrust of government and those commercial interests that benefit from the status quo. Only very modest comfort can be taken from its limited initiatives which range from the greater dissemination of information to the setting of some environmental targets. The unwillingness of government to promote major fiscal or financial reforms, or significantly to decentralize power and initiative, or to recognize the limitations to scientific knowledge when seeking the bases to "rational" decision-making in the face of uncertainty, reveal the inadequacy of the steps so far taken (1997, p. 147).

Munton's (1997) study helps to grapple with questions related to the appropriate scale of governance at which policy and actions on sustainable development need to be developed and reveals that political and economic interests may stand in the way of sustainable development in both national and local governments.

What these two studies reveal is the complexity of issues and forces operating at different spatial scales and contributing to the polemic surrounding sustainable development issues. There is an emerging body of literature focused on the spatial dimension of sustainable development (see, for instance, Purvis and Grainger 2004; Heuberger *et al.* 2007; Braun 2007),

that will help with operational issues and translating concepts into effective programmes and actions adapted to different settings around the world.

GLOBALIZATION

Note that there is impressive effort to spatialize globalization and this chapter illustrates this with respect to a few topics. This effort has come from the perspective of different disciplines, including anthropology, history, sociology, political science, economics, geography, international relations, development studies and many others.

Research that has integrated a time–space perspective when dealing with issues of globalization reveals that it is a long, complex process going on for several centuries. Related studies demonstrate that the process has been gradual, characterized by different phases of dominance by some nations or groups, leading to movements of expansion and contraction. Such an analysis helps unravel the reasons prompting human beings to stretch beyond their immediate environments and brings to the forefront issues related to population migration, empire building, the scramble and competition for resources, the struggle for control and dominance, along with myriad of other issues emanating from the political, economic, social and physical environment. Historically, the human race has seen the rise, fall and resurgence of empires and civilizations such as Mesopotamia, Egypt, China, Babylonia, Assyria, Rome, Ottoman, British, Islamic and Christian.

Researchers such as Dunklin (2005), Imade (2003), Ramsaran and Price (2003), Amin (2001) and Saul and Leys (1999) indicate that the late twentieth and early twenty-first centuries of globalization, sometimes referred to as neoliberal globalization, are part of the European capitalistic expansion that started in the fourteenth and fifteenth centuries. That saw the conquest of the Americas; colonization of Africa, Asia and the Middle East, and led to the great dominance and control of the global economy and rivalry of the nineteenth and twentieth centuries. These studies also show that globalization has not just been a strong flowing stream, sweeping all obstacles in its way. Rather it has been resisted, negotiated and reworked from time to time, through the struggle by peoples of the developing world for political independence in the twentieth century. To cite an example, Andre Gunder Frank (1998) provided a detailed and comprehensive assessment of human civilization, tracing the different phases of dominance. He predicts that the twenty-first century will see the rise and dominance of Asia, especially China and India, as global economic powers.

What is the utility of analyses that situate trends in changes in human organization of socioeconomic activities in time and space? Perhaps a

major lesson to be learned from this kind of analysis is that an assessment of the late twentieth and early twenty-first centuries' globalization needs to be broadened beyond a narrow focus on rapid changes in communication, economy and politics to a deeper analysis of how these changes have affected different groups, in different places and at different times. Whether looking at a major component like economic development or a subcomponent like communication of neoliberal globalization, it is important for researchers to probe deeper into the complex processes that led to the creation of different places and spaces in the world now and in the past, which have brought the world to its current state, termed by some, *a global village*. As pointed out by Birdsall (2005), economic growth due to globalization has not created a level playing field. We turn to the issue of the spatial distribution of the benefits of globalization in the following paragraph.

A spatial perspective tends to dominate the examination and analysis of the contribution of globalization to the improvement of the human condition. While on the one hand, there are those who argue and provide evidence about its benefits by offering economic growth and prosperity, through expanded market outlets and opportunities for the acquisition of new technology and ideas (Kose *et al.* 2007; Dollar and Kraay 2001), on the other hand, there are those who demonstrate that it has had negative effects, including the loss of financial resources and political power (Prasad *et al.* 2007; Imade 2003; Ramsaran and Price 2003; Amin 2001).

Dollar and Kraay (2001) analysed trade, growth and poverty among 24 post-1980 globalizing nations, including: Argentina, Bangladesh, Brazil, China, Côte d'Ivoire, India, Malaysia and Rwanda, and came to four major conclusions.

1. Per capita GDP growth rate increased from 1.4 per cent a year in the 1960s and 2.9 per cent a year in the 1970s to 3.5 per cent a year in the 1980s and 5.0 per cent a year in the 1990s.
2. Inequality had not increased systematically, whereby they found no evidence of a systematic tendency for inequality to increase when international trade increases.
3. Poverty declined in countries such as Malaysia, where the average income of the poorest fifth of the population grew at a robust 5.4 per cent annually and in China, where incomes of the poorest fifth grew at 3.8 per cent annually.
4. The gap between rich and poor narrowed.

Based on this analysis, Dollar and Kraay concluded that:

The experiences of the post-1980 globalizers show that the process can have great benefits, contributing to rising incomes and falling poverty and enabling

some of the poorest countries in the world to catch up with richer countries. The real losers from globalization are those developing countries that have not been able to seize the opportunities to participate in this process (2001, p. 19).

This study reveals that globalization has benefited the newly industrializing countries including China and India. The conclusion about failure of some developing countries to seize opportunities to participate in globalization opens up another important question for debate, which these authors did not consider. That is, what deters the other countries from seizing these opportunities? A number of other studies have shed light on this issue, showing that African countries have not benefited from globalization largely because of such factors as unfavourable terms of international trade, geopolitics and political instability. One of the initiatives pursued under neoliberal globalization was structural adjustment in Africa, which involved, among other things, trade liberalization, removal of protection for the agricultural sector and a reduction of government expenditure on public services. There are a number of studies on structural adjustment in Africa and most of them reveal the negative effects, which include aggravation of poverty, increasing foreign debt, declining agricultural production, deagrarianization, depeasantization, low share of the global commodity market, and low economic growth (Bryceson 2003; Mkandawire and Soludo 1999).

Though it is clear from research that income poverty is declining in Asia and Latin America, and rising in sub-Saharan Africa (Birdsall 2005), there is need for continued spatialization on a number of questions, including: (1) Is the income threshold of USD 1 per day a realistic measure in different parts of the world, both rural and urban? (2) How do different communities define and measure wealth and poverty? (3) How do local and global factors contribute to poverty? (4) How realistic are the poverty reduction measures being advanced by local, national and global players? Whether in those regions that benefited or those that lost from globalization, it is apparent from the existing literature that there is a social group (sometimes referred to as the global elite) that benefited in both of these regions. For example in Botswana, which is widely acclaimed in Africa as one of the success cases of globalization, a study by Darkoh and Mbaiwa (2002), on globalization and the livestock industry, has shown that national success conceals hugely different outcomes among the local population. The real beneficiaries are a handful of elite farmers, many of them government officials, who control the major share of the national cattle herd. The continuing globalization of the beef industry in Botswana promoted a growth in the skewness of livestock holdings to the extent that people without cattle in the traditional sector grew from 33 per cent in 1981 to 49 per cent in 1995.

Poorer households in rural areas are rapidly losing access to cattle. This suggests that there is social differentiation among actors in globalization, and raises questions about the credibility of the underlying social mechanisms, which benefit some groups while working to the detriment of others. These additional issues of globalization merit further in depth spatial analysis at regional, continental and global scales and insights drawn from different theoretical, conceptual and methodological perspectives.

CONCLUSION

The concepts of sustainable development and globalization have developed and been given increasing importance across diverse political, economic, social, environmental and academic domains both as rallying calls and as part of initiatives to address critical developmental and environmental problems facing humanity. The main challenge is not to develop the concepts themselves, but rather to operationalize them and to translate them into practical programmes delivering tangible solutions to developmental and environmental issues at different spatial scales – community, national, continental and global. This chapter has provided examples of how to integrate a relational, spatial analysis with these two concepts.

Overall, this chapter points out the drawbacks of elaborating and attempting to implement concepts on sustainable development and globalization without an appreciation of the vital importance of a relational, spatial analysis. What are the reasons for this vast landscape of discourses, which overlook the value of a spatial analysis? Though there is no substantial literature on this, some writers such as Hancock (1989) and Chambers (1983, 1997) postulate the following explanations.

1. Frequent elaboration and discussion of new discourses and concepts or, perhaps more correctly, of new nomenclature for already well known concepts seem to be related to the need to mobilize stakeholders around a rallying call, but these eventually reveal themselves to be short lived, fashionable trends or mere fads.
2. Incompleteness of existing discourses with respect to the development of relational, spatial analyses.
3. Gaps in logic, realities and even objectives between those who elaborate, those who will implement and those supposed to benefit from or bear the final impact of these concepts.
4. Relationships of power between those who elaborate discourses and those who appear to buy resemble an emperor's new clothes relationship. Instances include global governance versus national

governments, national governments versus citizens and grant makers versus researchers.

5. The covert intention by different centres of power to use discourses differently for specific – even potentially noncooperative purposes – while remaining under the auspices of the broader discourse. This may be seen in debates over global issues such as security, disarmament, new economic order, trade, Kyoto Protocol, poverty alleviation and structural adjustment with a human face. In such instances, various stakeholders may use specific discourses or concepts to defend their own interests.

In summation, this chapter asks what might be the role of researchers and practitioners who wish to carry out an analysis of sustainable development and globalization building on the theoretical tradition of scholars such as Opschoor and others. Some concluding thoughts from the foregoing is that there is need for scholars and practitioners to spatialize these concepts, thereby helping to assess and apply them operationally to practical situations. Giving the analysis a spatial dimension may be helpful to researchers and practitioners interested in addressing criticisms of the concepts of sustainable development and globalization for being too vague and weak when transposed to situations of practical implementation.

NOTES

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12. Digital dematerialization: Economic mechanisms behind the net impact of ICT on materials use

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Hans Opschoor was interested in conceptualizing the environmental impact of economic activities. He regarded the measurement of the material scale of such activities and related flows as a relevant research approach. In this setting, he developed the notion of material-product chains. Here we consider the influence of a widespread use of ICT on material flows.

In 1987 Nobel laureate in economics, Robert Solow noted an apparent paradox:² ‘You can see the computer age everywhere these days, except in the productivity statistics.’ This chapter offers a framework for understanding the total, direct and indirect, impact of Information and Communication Technology (ICT) on materials use. Due to the introduction of the Internet, Information and Communication Technology (ICT) has become an integrated element of the economy and society in the last decade.

It is evident that the implementation of ICT technology can contribute to increases in productivity of production factors, such as labour, capital and natural resources. A logical question in the context of environmental studies then is whether improved resource productivity in turn implies beneficial impacts on material and energy use and, indirectly, a reduced pressure of economic activities on the environment. So far, no clear trend of dematerialization in absolute terms has been found at national levels (Ayres *et al.* 2004). In the context of the impact of the Internet on sustainable consumption, Reisch (2001) argues that growth and rebound effects will outweigh resource efficiencies. Moreover, Park and Roome (2002) argue that ICT may have both positive and negative consequences for the environment.

Intuitively, one would say that application of ICT in economic activities would have as a direct effect, a reduction of natural resource inputs or use

of materials. One can think here of such different examples as ecoefficient services (e-commerce), computerization of production processes (robots and computer-aided design) and virtual mobility (videoconferencing and telecommuting). Next to direct effects, however, indirect effects should be accounted for as they may lead to an increase in the use of materials, due to, among others, use of materials in the production of ICT and various rebound effects (income, price and macroeconomic effects), as suggested by Hertwich (2005). The net effect on material use is unclear.

This chapter aims to offer a systematic framework and qualitative analysis of these various effects of ICT on the use of materials in the economy. The originality of the contribution does not lie in case study details of direct dematerialization due to ICT. The originality is in the analysis of the indirect effects resulting from a range of economic mechanisms and subsequent dematerialization or rematerialization effects. This covers the material intensity of ICT equipment and services, substitution effects at various levels, interactions between economic sectors and effects on transport and economic growth. This chapter thus differs from, and is complementary to, other studies in providing a much more detailed and systematic account of the relevant economic mechanisms behind indirect effects. The resulting general, nonpartial perspective is relevant for arriving at robust policy insights. Because of this approach, there are few details of single case studies, for two reasons: relevance is limited as they often focus on direct effects only; moreover, there is insufficient space to illustrate the wide range of economic mechanisms with concrete cases as this would require a book format. Nevertheless, where possible and relevant, these new insights link to empirical cases. However this analysis is of a qualitative nature, as it is impossible to offer a general quantitative analysis that covers the wide range of possible ICT investments, equipment and services, as well as their various indirect economic and (de)materialization effects.

Most available studies focus on specific cases and direct dematerialization effects, so that they are incomplete with regard to indirect and rebound effects. This direct effect is a productivity or efficiency gain due to less input needed per unit of output. Inputs may cover time (labour), space, materials (waste, pollution) and energy. This choice to focus on direct effects is often because of limited data availability (Erdmann *et al.* 2004; Fichter 2003) or lack of understanding of indirect effects operating through various economic mechanisms. An exception is Berkhout and Hertin (2001), who present a classification of possible effects of ICT on dematerialization. In comparison, this chapter goes beyond their analysis in that it offers insight into the relevant economic mechanisms underlying the various effects classified by them.

The study of the material dimension of economic systems has its roots in the late 1960s and early 1970s. Ayres and Kneese (1969) offered a first

theoretical framework to combine economic and physical flow accounting. Other early important contributions to the study of economics and material flows are Georgescu-Roegen (1971), Ayres (1978), Daly and Umaña (1981), and Faber *et al.* (1987). Ruth (1999), Kandelaars and van den Bergh (2001), and van den Bergh and Janssen (2004) all offer surveys of this research area.

Opschoor introduced the notion of material-product chain (M-P chain) to integrate physical flow and economic analyses (Opschoor 1994). Kandelaars (1999) subsequently elaborated on this subject. An M-P chain indicates a network of coupled flows of materials and products that connect activities in a chain – extraction, production, consumption, collection, reuse, dumping and combustion of waste. An M-P chain analysis is suitable for the study of economic aspects of M-P chains, as opposed to lifecycle analysis (LCA), which the researchers regard as suitable to perform an environmental analysis of M-P chains. M-P chain analysis typically adds specific economic features to an M-P chain, like economic agents, scarce factors (capital, labour), substitution of inputs in production and the structure of demand and markets. The chain becomes dynamic by adding investment and technological innovation to it. Finally, by extending it with environmental policy instruments, M-P chain analysis can be directed at questions of cost effectiveness of chain control, or of the impact of economic growth or environmental policy on substance flow.

The remainder of this chapter is as follows. The next section demarcates ICT and offers a brief review of ICT classifications found in the literature. This is followed by an analysis of the impact of ICT on the economy through a number of economic mechanisms, briefly noting the most important implications for the use of materials. Subsequently the net impact of ICT on the use of materials is examined, giving attention to dematerialization and factor X, product innovation, micro/macro level effects and rebound effects. A final section offers our conclusions.

DEFINITION AND CLASSIFICATION OF ICT

Although everyone is familiar with the term ICT, there is little consensus in the literature on an exact definition. Brynjolfsson and Kahin (2000, p. 2) define information economy as the long term trend of expansion of information and knowledge-based assets and value relative to tangible assets and products associated with agriculture, mining and manufacturing. They further note that the digital economy relates to the recent transformation of economic activities into a form that is heavily based on computer enabled or digitized information. In the economic literature, Shapiro and

Varian (2000) define information as, ‘essentially, anything that can be digitised – encoded as a stream of bits – is information’. ICT can then, be defined as the total technical equipment, products and services needed to digitize, save, process, distribute and communicate information. A somewhat broader interpretation also includes products integrated with ICT and services based on ICT.

It is possible to distinguish different activities related to digital information. First, analogue information can be converted into digital information. For example, with the help of a scanner, text can be converted into digital information. With the help of word processors, thoughts can become digital text stored in a computer. A second activity is saving and storing digital information on a hard disc, floppy disc, CD-ROM or memory stick. Third, digital information can be processed. Different examples are the CD player, which converts digital information into music (analogue information) and database management software to systemize, restructure or select information. Finally, digitally stored information is communicated easily via electronic networks such as email or the Internet.

Given that ICT is such a broad concept it is of little surprise that the literature offers quite different classifications as shown in Table 12.1. Many statistical agencies within the European Economic Community employ a classification of ICT equipment based on the Statistical Classification of Products by Activity (SPA) (see CBS 2002). To classify the ICT industry the ISIC revision 3.1 classification of the United Nations is used (see unstats.un.org/unsd/cr/registry). ICT equipment consists of computers and electronic parts, related equipment such as screens, keyboards, computer mice, printers, scanners, wires and cables, networks, telecommunication equipment and computer software. ICT includes services such as telecommunications, postal services and computer related services. These typologies of ICT are incomplete for two reasons. One is that new applications of ICT, such as email, the Internet and mobile telecommunication are often excluded because related services, such as e-commerce, do not show up in

Table 12.1 Typologies of ICT in the literature

Source	Basis for ICT classification
Statistical Classification of Products by Activity (SPA) (CBS 2002)	ICT equipment
<i>ISIC revision 3.1</i> (UN)	ICT industry
Brousseau and Rallet (1998)	Network connection in ICT systems
Schienstock (2002)	Functions of ICT in business activities
Reijnders (1996)	Reduction of material use

current economic statistics (Fraumeni 2001), alternatively simply because economic impacts of ICT are still considered insignificant or not measured (Oliner and Sichel 2000). Another reason is that ICT is integrated in already existing products and services so a sharp distinction with a new ICT component is not always feasible. For example, computer technology has been incorporated in many different products, notably electronic appliances and cars. Additionally, many services, such as processing of financial transactions are automated with the use of computers (Peters 2002).

Three other ICT typologies mentioned in Table 12.1 are as follows. Brousseau and Rallet (1998) present an ICT typology for business purposes based on the network connection of ICT systems, distinguishing three types of ICT: isolated computer systems, telecommunication systems (person-to-person communication) and telematic systems (unit-to-unit communication). Isolated computer systems can be divided into computer systems isolated at the work place level (neither internal nor external connections) and systems isolated at the organizational level (internal but no external connections). This classification only focuses on network connections and is less useful when focusing on the use of materials, as is our purpose. Schienstock (2002) conducted a survey on the use of ICT by firms. He then divided ICT into seven function classes based on the function and aim of ICT applications: support of work processes, automation to eliminate human labour, production process control, surveillance devices, information supply, coordination of work processes and communication. Finally, Reijnders (1996) suggests a classification focused on the potential for reducing the use of materials: greening products, greening production processes and ecoefficient services. The combination of the classifications of ICT equipment (SPA) and industry (ISIC) seems most useful here as it leads to the most detailed typology.

This variety in classifications of ICT is common for a new and rapidly developing technology. One disadvantage is that it may hamper the (quantitative) assessment of a correct relationship between ICT and material use.

ECONOMIC MECHANISMS OF IMPACT OF ICT ON MATERIALS

In order to assess the impact of ICT on material use, we examine the potential economic consequences of ICT. For this purpose, we identify relevant economic mechanisms, such as production of ICT, efficiency gains and price effects in production, price and income effects in consumption, information effects, R&D and education, changing

preferences, appearance of new products and services (or markets), substitution and complementarity, economic growth, and international communication and trade. The fundamental economic mechanisms are substitution and complementarity (composition effect), economic growth (scale effect) and changing preferences (new products and lifestyles). These three mechanisms, often ignored in empirical case studies as the effects appear at higher levels of aggregation, are highly uncertain or are visible only over longer periods. The first mechanism has a secondary (rebound) effect through changes in prices and incomes. The other two mechanisms create real dynamic effects, and involve R&D, education and long (Kondratieff) waves.

Production of ICT Itself

Since the early 1970s, many industrialized countries have seen significant growth in their ICT sector. Moreover the expansion of the ICT sector has also induced economic growth in other economic sectors, particularly services. Usually the ICT sectors in the National Accounts only reflect the manufacturing of ICT equipment (hardware) and related services (software), but not applications such as electronic trading or communication. This is illustrated by the SPA classification by CBS.

The manufacturing of (personal) computers, notably semiconductors, involves huge amounts of materials and energy. The reason is that the fabrication of computer chips is one of the most complex processes found in current industrial activity. The various phases of the production sequence use many chemical processes, which involve a large number of acids, solvents, bases, neutral gases and very large amounts of purified water and air. Williams *et al.* (2002), calculate that for each kilogram of silicon wafer input, 161 kg of other chemicals, excluding air and water, are used and discarded. They note appropriately, 'In short, the micro-electronic products that are commonly cited as examples of dematerialization are really illustrations of quite a different and less favorable trend: namely, a sharply increasing ratio of process wastes to finished goods'. In addition, Kuehr *et al.* (2003) and van Drunen and Olsthoorn (1999) argue that discarded personal computers have limited recycling potential, although other authors (see Klatt 2003) believe the opposite, as the recycling potential of computers is not yet fully understood. Due to rapid technological changes, user demand for computing power increases as newly developed software requires up-to-date hardware. This implies that the technical and economic lifetime of computers is short. Williams and Sasaki (2003) argue that the extension of the lifespan of computers by upgrading computers would be a favourable strategy in terms of dematerialization. Note

that this does not mean that the production of computers becomes more sustainable.

Efficiency Gains in Other Production Processes and Implications for Costs and Prices

ICT plays a crucial role in production processes of products and services as it induces efficiency gains in factor inputs (labour, capital or natural resources). With ICT, all stages of production ranging from the design stage to marketing can be monitored in a more systematic way. The stages of the production process might have different locations, or might even be different companies. In particular, with electronic networks and equipment, management of multinational companies has become easier. If the information provided by ICT is input for general business management, control and logistics, strategic planning and total quality management the result will be lower costs and (supply) prices.

Berkhout and Hertin (2004) distinguish four stages of the production process where ICTs lead to efficiency gains. First, ICT allows the systematic collection of information on the use of scarce resources and costs. Second, it aids in the design of products (CAD software). Third, it allows for the optimization of subsequent stages of the production process. Matthews and Hendrickson (2003) argue that centralized stock keeping results in economic and environmental benefits due to lower warehouse expenses despite higher transportation costs. This latter development is termed, computer integrated manufacturing (CIM) or virtual manufacturing (Mansell and Wehn 1998, p. 91). Finally, optimizing the distribution (logistics) of products and services, by allocating production facilities and taking into account transport costs and constraints. The latter two elements of process optimization contribute to lower costs and higher profits. The resulting efficiency gains have implications for material, labour and capital inputs alike. Additionally, Reijnders (1996) denotes that the optimization of the subsequent production stages contributes to what he calls the 'greening of the production process'. This may be especially effective in material intensive industries like metals processing and chemicals. Monitoring of production processes allows for quick discovery of errors in production and minimizing waste generation.

ICT also influences single stages of production processes in three ways. Computers directly control multifunctional machine tools in production cells due to sensor technology, among others. This concept is termed, direct numerical control (DNC) or computer numerical control (CNC). Advances in CNC have led to flexible manufacturing systems (FMS), in which movements between production stations are computer controlled as well. For

instance, different production stations of the production process are integrated through computer controlled assembly lines. Finally computer aided manufacturing (CAM) incorporates robotics in all kinds of stages ranging from material handling machines to assemblers to taking over human labour tasks. In the financial industry for example, computers process large numbers of financial transactions efficiently (Peters 2002). Examples from other industries are the electronic spraying of pesticides in agriculture and climate control with computers in horticulture. The material use per unit of output declined due to the implementation of ICT, although the demand for material intensive ICT equipment and services itself increased.

Computers, digital information and digital communication (email) have allowed efficiency gains in administration, organization, planning and personnel units of businesses as well. This has not yet led to the paperless office, but doubtlessly it has reduced the direct use of materials per unit of output (in monetary terms). Muizer and Hospers (2000) argue that the main advantages of automated business administration are cost reduction, uniformity in information, and faster processes with respect to business administration. For small and medium entrepreneurs (SME), cost reduction might consist of hiring an intermediary (outsourcing). The automation of business administration would imply less paperwork, but the output of business administration would be the same. However the process of automation also implies that the output of this sector increases as well. Moreover the automation process induced large demands for ICT equipment such as PCs, printers and electronic networks (cables and wires).

The influence of ICT on transport is both direct and indirect. It is direct in the sense that mobile telecommunication (including SMS) and the Internet (including email) are new communication channels and electronic networks. It is indirect in the sense that these new communication channels can replace ordinary, physical transport, even though Mokhtarian (2003) found evidence for a net increase in passenger travel due to ICT. On the other hand, computer support can optimize route planning such as the global positioning system (GPS), freight transport planning and traffic management (Mansell and Wehn 1998). Additionally, virtual mobility such as telecommuting and teleconferencing are easier (Arnfolk 2002). The spectrum of technologies for communication has thus widened and partly replaced physical contact.

ICT influences government in many different ways. As in the case of private enterprises, internal processes of the government can improve with the use of ICT products and services. Electronic networks and mobile communication speed up communication. Additionally public services provided by the government, at both national and local levels, partly operate through the Internet.

Price and Income Effects on Consumption

Efficiency gains realized in production processes due to the implementation of ICT will give rise to lower market prices of commodities. This in turn has consequences for consumption. One should distinguish here between price and income effects. The price effect is the decline in expenditures due to lower market prices. The income effect is the shift in expenditures because with lower prices, for particular goods or services, more income is available for the remaining consumption categories. Both effects may stimulate consumption, which is likely to create a positive direct impact on material use.

Jacobs (2000) and CBS (2002) argue that market transparency increases due to the availability of business specific information about products, suppliers, competitors and purchasers on the Internet. These developments make the potential customer more aware of products and services, with the consequence that they will be able to make more conscious and well defined choices. Purchase failures are less likely then, which may mean reduction in waste, in terms of materials and transport.

Income effects also occur through lower transaction costs for consumption. Households undertake labour market and leisure activities. With the advent of the Internet, systematic and quickly accessible information has become available to a large audience. This covers news (e-newspapers), job vacancies, education (e-learning), travel and leisure opportunities. Due to the Internet, searching for a school or job has moved beyond the regional horizon. This broadening of the horizon may induce commuting and international travel, with negative consequences in terms of energy and material use.

Information Effects of ICT

ICT allows more availability of, better access to or easier processing of information, in both production and consumption. Note the positive impact of these information aspects on (profit or process) optimization above. Additionally these consequences facilitate the search for products and services by consumers, leads to a reduction of monetary and time costs and may stimulate expenditures on certain goods or services. Consumers can use Internet search engines to obtain product information from different suppliers and make a systematic product and price comparison. In a way, this comes close to the ideal of the perfect market in economic theory. Online comparison test sites offer a comparison of phone rates, energy services, electric appliances, plane tickets and the rest. ICT mediated services such as online travel agencies expect to stimulate expenditures

on travel and tourism. The net impact of all information effects on material use is thus uncertain.

ICT has influenced the relationship between citizens and the government as well. Governmental information on policy issues, legislation and income taxation as well as official forms are digitally available online. In public sectors such as health care, digitizing and centralizing administrative activities such as patient databases and appointment planning, has begun, so that information is consistently available to all relevant personnel upon request. Similar advantages are evident for the police and justice system, where information exchange is required quickly and telecommunication is widely used by local police forces to fight crime. Moreover ICT lends itself well to assess particular crimes such as fraud.

R&D and Education

Research and development is an essential part of ICT technology from which is derived new products and markets. R&D processes and activities have largely benefited from ICT. Indeed this has been so effective that positive feedback has identified that new ICT is used almost immediately to generate innovations in ICT. This phenomenon is unprecedented in technological history (although a similar process may apply to biotechnology). ICT aids R&D in various ways: storing and systemizing information, processing (statistically or otherwise) information, quick access and search through large databases and sharing information from high priced digital academic journals to gratis Internet information.

Focusing attention on scientific research, it is evident that conceptualization, design, information processing and communication has improved at all levels, from word processing through complex computer modelling to database management and email. ICT has allowed the use of sophisticated software to deal with data collection and search, statistical data analysis and other types of numerical and analytical computer modelling. Presentation styles and contents also improved due to new information technology, notably laptops and projectors in combination with presentation software. Overall, new communication technology creates the opportunity to speed up progress in research and development. To date, nearly all journal articles have become available in electronic format for virtually all main academic journals.

Closely related to R&D is education. Here ICT has positively influenced information and services. The Internet contains information on educational institutes (schools, universities and other institutes) and the training and courses they supply. Market transparency in education has thus increased. In particular information is often publicly accessible and comparable.

Additionally, education, training and courses are often computer supported ranging from Blackboard types of digital learning environments, to teaching using laptops with a projector and completing exercises with particular software (simulation games). Self education or learn-at-home is facilitated with computer support, because study materials can be digitized. This in itself reduced the need for passenger transport.

Particular elements of R&D and teaching contribute to reducing environmental impacts and the use of materials. Reijnders (1996) mentions access to databases on materials and their properties. Because of email and the Internet, international collaboration between researchers at universities, public institutes and businesses has been stimulated. R&D on ICT based technologies, such as GPS, lasers, mobile telecommunication and nanotechnology (miniaturization) are relevant here as well.

New Products, New Markets and Changing Preferences

Successful greening of a product is an important factor of dematerialization. It means dematerialization at the lowest level of aggregation, products. There are adequate examples for many industries and sectors. Digital photography has the potential to reduce the use of chemicals with fewer ordinary photographs printed. Car fuel efficiency increases due to automated fuel injection. In agriculture, electronic spraying replaces old techniques, leading to more efficient pesticide use. In the electronic components industry, the miniaturization of ICT implies that the volume and energy use of electronic appliances can be reduced (see Mansell and Wehn 1998).

At a more fundamental level, ICT has induced new developments in products and services. This has to do with the change over to digital information and relates to products with extra features and functions for consumers. Different examples are a shift to digital music (CD, MP3), digital photography, video recording, computers and the Internet in the home environment, and car sharing systems supported by ICT (see Meijkamp 2000). These new commodities replace old ones, which were generally more material intensive, of poorer quality, or associated with less efficient use of energy and materials such as, private car use versus car sharing.

Although the expectation is that new, ICT-induced commodities will replace old ones, such as the cell phone versus the traditional landline phone; this is often not the case. Mokhtarian (2003) illustrates this point for telecommunications and passenger travel. Some commodities allow for new functions and satisfaction as well as creation of new preferences, which enlarges existing markets. ICT has further been responsible for the creation of entirely new markets on the Internet, such as business-to-business (B2B) or the business-to-consumer (B2C) markets (Náray-Szabó 2000). These virtual markets

can replace physical marketplaces or shops. As a result the organization of logistics and transportation including that of customers visiting shops, could change drastically in the long run (Heiskanen *et al.* 2001, p. 136).

Another new phenomenon is e-auctions (consumer-to-consumer or C2C), like eBay, where consumers buy and sell products via the Internet. This is a virtual second-hand market at which unwanted products are purchased by other consumers. Consequently, the economic lifetime of products is extended, which is one of the strategies to improve resource productivity (Ayres and Ayres 1996).

The development of ICT is still in a phase of exploring its opportunities. Although the cell phone was introduced to consumers in 1973, it did not become widespread until this past decade. In fact, today, most people cannot imagine life without one. This also holds true for several other ICT mediated products and services, such as PCs, laptops, CD players, and the Internet. New ICT mediated products and services introduced new habits and needs, such as video games, quickly changing fashions and the already rapid pace of technical innovations, which stimulate short product lifetimes, contribute to waste and use of materials and energy. In addition, certain product innovations increased the demand size of the market. For example before the introduction of the cell phone, households had a regular phone (in The Netherlands about 6 million), while today many persons aged 12 and older have a personal cell phone (in The Netherlands about 11 million). The number of phones has thus increased substantially, with associated direct consequences for material use.

ICT affects social activities as well. Cultural and sports events, for instance, are advertised on the Internet and ticket purchases can be completed via the Internet or by mobile phone. Leisure communication between people has been facilitated with the Internet (chatting and email) while games for relaxation are also offered online. The cost of sending an email to relatives or friends in Australia equals the cost of sending an email in The Netherlands. This may mean either that the need for visits declines, which implies that the demand for transport declines as well, or that people communicate more intensively.

ICT induces new or revised products and services that relate to transport. Indeed, vehicles nowadays are filled with ICT applications, including electronic fuel injection, GPS systems and radio data signal-traffic message channel (RDS-TMC). Fuel efficiency means less fuel use per kilometre, but only if the fuel efficiency is not offset by an increase in distance driven. Finally, ICT has contributed to the popularity of car sharing in The Netherlands and other countries. It allows direct contact between cars, central organizations and home, thus stimulating efficient planning and use as well as optimal availability of cars (Meijkamp 2000).

The public sector benefits from new products and services due to the use of ICTs. For instance, ICT allows for advanced policy instruments, such as road pricing, video security systems for public safety, laser techniques for fining and registration of waste transportation. An important public sector that benefits much from ICT is health care. This is partly due to the application of new technologies such as laser techniques, advanced microscopes and robotic surgery appliances.

Finally, the government can use electronic networks to improve external communication. Governmental information is available on the Internet or can be distributed electronically via email to citizens and firms. Additionally the government provides ICT mediated services: forms can be downloaded from the Internet and elections can be carried out electronically. The impacts on materials use are not clear overall as it depends on whether the frequency of certain governmental activities responds positively to the implementation of ICT such as more intensive monitoring of traffic control.

Substitution and Complementarity

In a list of economic mechanisms, it is important to remember the notion of substitution. It is perhaps not a completely independent mechanism as it relates strongly to some of the aforementioned mechanisms. Income effects due to lower prices induced by ICT, for instance, are a particular case of substitution. In addition, changing preferences in combination with new products and services imply substitution, in both physical terms (replacing outdated products) and mental terms (shifting the preference from one product to another). Substitution due to ICT plays an important role in production factors. In particular, ICT services may reduce the need for certain types of capital or labour inputs, as well as energy and material inputs. Changing patterns in international trade due to ICT often imply substitution in one way or another. Note that the distinction between efficiency gains and substitution is not always immediately evident, even if defined in a precise manner (van den Bergh 1999).

Interaction between product and factor markets is one particular expression of substitution. The fact that markets are not isolated but interacting means that changes in one market due to ICT will extend to other markets. This may cover both product and factor markets. In product markets cost and price change will affect imperfect substitutes in other markets. An important example is passenger and freight transport, which will respond to ICT innovations and applications that will stimulate telecommunication and telecommuting. In factor markets the implementation of ICT in production activities will, aside from affecting material and energy use directly,

affect the prices of labour and capital, which in turn (if significant) will affect supply and demand in markets for materials and energy. Mokhtarian (2003) found evidence that passenger travel in addition to telecommuting is complementary to telecommunications.

Complementarity and substitution both occur at the level of sectoral restructuring. Since the 1950s, the process of deindustrialization has restructured the economy towards a larger share of production services (see Verbruggen 1999; RIVM 2002). The share of the service sector (including financial services, insurances, education, healthcare and transport) in GDP, increased while the shares of the agricultural and manufacturing sectors fell. Being part of the manufacturing sector, the ICT sector increased drastically due to widespread adoption of ICT technologies. There is more about specific sectors in the next subsection.

Economic Growth

Through its positive impact on labour-use efficiency, capital and materials in production, on innovation of products and services and on the efficiency of markets, ICT contributes to economic growth and may at the same time reduce material use or at least keep its growth rate under that of income.

In economic literature the impact of developments in ICT on economic growth is usually analysed within a growth accounting framework (Jorgenson and Stiroh 1999; Oliner and Sichel 2000; Gordon 2000; van der Wiel 2001). Economic growth is then disentangled into the contribution of labour productivity, capital productivity and a residual, the so-called Total Productivity Factor (TPF). An important question is whether ICT enhances substitution processes or technical advances in the sense of more output produced with the same amount of inputs. Until the 1990s, ICT primarily replaced older technologies (substitution) at least in most industrialized countries. Jorgenson and Stiroh (1999) argue that the residue of TPF growth quantifies the spillovers of ICTs and others. Since the early 1970s, the residue of TPF growth slowed down considerably, while investments in ICTs increased at the same time. This is the Solow paradox.

Since the introduction of the Internet in the early 1990s, the production of ICT products and services has significantly influenced the rate of economic growth (technical change). Oliner and Sichel (2000) argue that the technical changes are largely due to growth in the ICT sector. In contrast, Gordon (2000) and Litan and Rivlin (2001) argue that the impact of ICT on US economic growth is particularly large. This contradiction is rather curious because Oliner and Sichel (2000), Gordon (2000) and Litan and Rivlin (2001) all used the same data source. Litan and Rivlin conclude

that the benefit of the Internet shows up in consumer convenience and expanded choices, rather than higher productivity growth. Van Ark (2000) presents results on the contribution of the ICT sector to economic growth for The Netherlands, which correspond with the findings of Oliner and Sichel for the US. Bartelsman and Hinloopen (2000) conclude that the contribution of ICT investments to economic growth in The Netherlands is substantially lower than in the US because The Netherlands has a relatively small ICT sector.

International Communication and Trade

Finally ICT may contribute to foreign trade, communication and market liberalization. The causal relationship between ICT development, liberalization and internationalization processes has been debated (see Jacobs 2000). ICT technology has clear opportunities to facilitate international trade. In particular, the introduction of electronic networks provides more international market transparency due to product information and marketing via the Internet. The ICT industry itself is subject to internationalization or even globalization (OECD 2002; Park and Roome 2002). International trade in ICT goods and services of OECD countries has grown at a higher pace than GDP. E-markets are international in scope as the Internet is a worldwide network, without national boundaries. Producers and consumers can search and compare products and services supplied anywhere on the Internet. In e-markets producers and consumers are likely to search for commodities with minimal total costs (including purchase price, search costs and transportation costs) and best quality, regardless of the origin of the supplier. Moreover electronic networks facilitate communication between economic agents (producers or consumers). This has repercussions for freight and passenger transport, as well as associated environmental externalities.

NET IMPACT OF ICT ON MATERIAL USE

After the broad sketch of impacts of ICT on the use of materials, through various economic mechanisms and sectors as discussed in the previous section, this section will address total, net effects. To this end, this chapter considers the debate on dematerialization and factor X, the role of product innovation for dematerialization, the distinction between micro versus macro effects, and the magnitude of rebound effects. The latter two issues will bring together many of the specific economic mechanisms discussed in the previous section.

Dematerialization and Factor X

A highly investigated relationship between the economy and environmental pressure is the Environmental Kuznets Curve (EKC). The EKC hypothesis reflects the idea that economic growth and environmental quality are compatible, because the relationship between economic performance – usually measured, for good or for bad, as GDP per capita – and environmental quality has an inverted U shape. Cleveland and Ruth (1999) summarize empirical studies on the EKC hypothesis for material use. They conclude that most studies do not reject it, which supports the hypothesis of decoupling. Absolute decoupling occurs when material use declines in times of economic growth, while relative decoupling occurs when material use grows at a slower pace than the economy (OECD 2000; Moll and Gee 1999). In the context of material use, these notions translate into dematerialization and achieving factor X (see Table 12.2).

The factor X concept reflects optimism about the options to reduce simultaneously total material use and increase welfare (see the summary in Reijnders 1998). Von Weiszäcker *et al.* (1997) suggest that a factor four reduction is feasible, meaning a halving of material or energy use and a doubling of welfare. Realizing a reduction, by half, of material/energy use is possible by technical means only. ICT applications play an important

Table 12.2 Summary of the factor X debate

Factor X	How to achieve factor X	Timeline	Reference
Factor 4	Doubling welfare, halving energy use by technical means for 50 different economic activities	Not mentioned	Von Weiszäcker <i>et al.</i> (1997)
Factor 10	Reduction of material flows per unit of service by technical, financial and lifestyle changes	30–50 years	Alt (1997)
Factor 20	Technical changes and setting requirements for environmental improvements (food production, building production and use of chemicals, mobility and water management)	50 years	Jansen and Vergragt (1992)
Factor 50	Much improved technology	100 years	Jansen and Vergragt (1992); Reijnders (1996)

Source: Reijnders (1998).

role in these. However the authors only take into account the direct effects of technology. Moreover, alternative options are implicitly assumed to be identical in terms of functionality, profits or welfare rendered. Alt (1997) suggests that not only technical but also financial and lifestyle changes are required to achieve a factor 10 reduction of material and energy use over a 30–50 year period. Others suggest that factors 20 or 50 over a 50-year period are possible (Jansen and Vergragt 1992; Reijnders 1996).

Based on Cleveland and Ruth (1999) and Náráy-Szabó (2000), it is possible to distinguish two dimensions of dematerialization. The first is relative versus absolute dematerialization (see Cleveland and Ruth 1999; Heiskanen *et al.* 2001; Ayres *et al.* 2004). Relative dematerialization is the decline in the level of material use relative to the level of another indicator over time. Absolute dematerialization is the decline in the level of material use over time. Ayres *et al.* (2004) studied relative dematerialization of the US economy. They concluded that it has not dematerialized at the macro level in the twentieth century because total material use in the US economy has grown. However, material use per capita has declined, so there was relative dematerialization.

Micro Level, Macro Level and Rebound Effects

Figure 12.1 shows the causality of dematerialization of ICT equipment and applications at a micro level.

Micro level assessments tend to ignore indirect, namely economic effects and the material use of ICT equipment and its production.

Research using the method of decomposition analysis suggests one classification of indirect ICT effects on material use (Rose *et al.* 1996; Hoekstra and van den Bergh 2002, 2004). It distinguishes scale or volume, composition and technique (substitution and behavioural) effects, and subtle disaggregated effects within each of these. Fichter (2001) and Berkhout and Hertin (2001) adopted a particular categorization of resource consumption due to the implementation of e-business. They make a distinction between primary, secondary and tertiary effects of ICT, as shown in Table 12.3. These categories cover both positive and negative effects on resource consumption, also indicated Table 12.3. Erdmann *et al.* (2004) use this classification for building scenarios of ICT applications in a number of sectors to analyse future environmental sustainability.

Primary effects of implementing ICT application refer to the use of materials and energy for the production of communication infrastructure, such as the production of PCs, mobile phones and physical infrastructure of communication networks (see EC 2002 for a categorization of physical infrastructure of communication networks). These primary effects can have both positive and negative elements in resource consumption. A

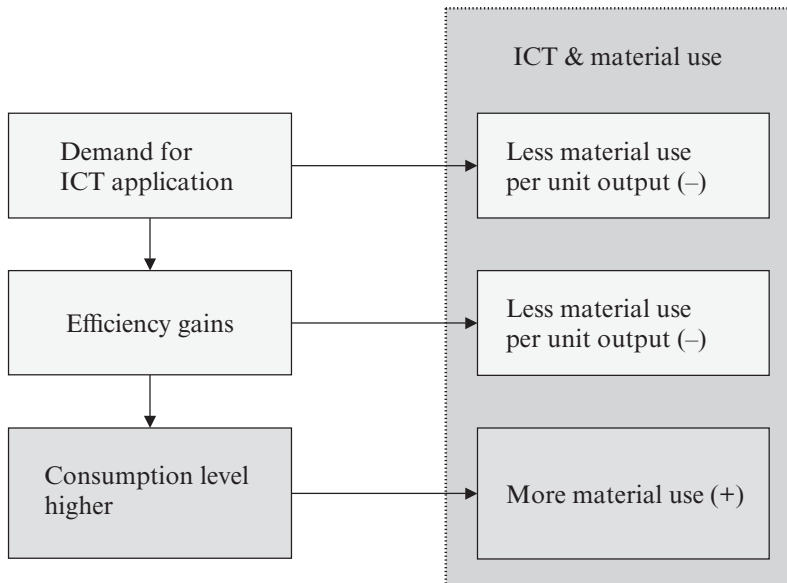


Figure 12.1 Micro level impact of ICT on materials use

positive effect results when the demand for communication infrastructure replaces the demand for other types of infrastructure, such as buildings and transport. A negative effect results when the demand for communication infrastructure increases. The production of microchips is very material intensive (see Ayres *et al.* 2004; Williams *et al.* 2002). Secondary effects derive from the use of ICT mediated products and services or the avoided use of non-ICT mediated products. Consider the case of e-commerce as an example. Finally, tertiary effects result from changes in consumption patterns due to changes in relative commodity prices. These changes are due to changes in product prices, time spent on activities and the introduction of new products such as video games and mobile phones.

Similar to the analysis of the indirect effects of ICT on material use is its effect on electricity use (see Mitchell-Jackson *et al.* 2002; Romm *et al.* 1999; Laitner 2003). These studies suggest a negative rebound effect, but indicate as well that future electricity intensity of the US economy may decline due to developments in and spread of ICT through the economy. Williams *et al.* (2002) show that 80 per cent of the total energy consumption of computers is in the production stage and the rest is associated with the use of the computer.

When indirect effects reduce the net effect of ICT on dematerialization, they are called rebound effects. Note that this covers much more than the material efficiency gains being offset by volume increases due to market

Table 12.3 Typology of indirect impacts of ICT on material use

Category	Effect on material use	Caused by	Examples of causes
Primary effects	+	Increased demand for ICT equipment	ICT equipment in production and consumption
	-	Reduced demand for infrastructure, buildings and vehicles	Roads, cars and trucks; railways and trains; buildings (offices); conventional photo cameras, mechanical machinery
Secondary effects	+	Increased use of ICT applications	More use of computers, mobile phones, etc., more energy use
	-	Reduced use of own appliances and vehicles	Less transportation in order to reduce energy using appliances and vehicles
Tertiary effects	+ or -	Changes in consumption patterns, economic restructuring	Change in consumption patterns due to changes in relative prices of products and services and the implementation of new products. Increase of material and energy consumption due to behavioural changes

Notes: Based on Fichter (2001) and Berkhout and Hertin (2004).

price reductions, which seems to be an alternative, more narrow interpretation in the literature (Plepys 2002; Ayres *et al.* 2004). In line with the categories of effects discussed in the previous section (see Table 12.2), the following count as rebound effects.

1. Effects from price changes, which in turn result from efficiency gains. The effects are usually negative in terms of dematerialization. That is to say efficiency gains induce lower prices, which increase demand and thus ameliorate the original direct gains.
2. Income effects on consumption, which result from the lower prices. Alternatively changing preferences in combination with new products or services, or improved information, both due to ICT, can have a similar effect. The result can be either more material-intensive consumption or more material-extensive consumption.
3. Dematerialization at the level of single products, through product innovation, often implies changes in the stages of the product lifecycle, which in turn may induce increases in material use elsewhere.

4. Indirect effects occurring through coupled markets or products, notably of imperfect substitutes (transport and telecommunication) and of production factors (labour, capital, materials and energy), which in turn lead to increases in material use.
5. Sectoral restructuring may occur, which can change communication, transport and international trade patterns, with increases in material flow.
6. ICT may stimulate economic growth, which itself may undo many of the micro level savings in material use.

Rebound effects of type 1, 3 and 6 seem especially significant.

Rebound effects have been widely discussed in the energy efficiency literature (Greening *et al.* 2000; Berkhout *et al.* 2000; Plepys 2002; Arnfalk 2002). One finding is that the micro level, rebound effects of energy efficiency are moderate. Nevertheless aggregating these micro level rebound effects to total energy consumption and investments by consumers and producers, the adjustments of quantities and prices on energy service markets can be significant (Greening *et al.* 2000). Hertwich (2005) proposes that rebound effects from an industrial ecological perspective might entail different kinds of materials as well as pollution. This makes the identification of rebound effects from an industrial ecological perspective much more difficult.

Finally we can present an overall view of the impacts of ICT on dematerialization by combining the mechanisms discussed in the previous section.

Table 12.4 shows that the impact of ICT on absolute dematerialization is ambiguous. For four economic mechanisms, namely production of ICT, changing preferences, pure economic growth (in terms of volume units)

Table 12.4 Economic analysis of ICT impacts on dematerialization

Economic mechanisms	Dematerialization effect
Production of ICT	–
Efficiency gains and price effects on production	–/+
Price and income effects on consumption	–/+
Information effects	0/+
R&D and education	–/+
Changing preferences and new products/services	–/+
Substitution and complementarity	+
Economic growth	–
International communication and trade	–/0

and international communication and trade, the impact is clearly negative. The more ICT products and services demanded, the more material inputs required. Changing preferences are closely related since new products and services are ICT mediated (electronic driven devices replacing mechanical products). Finally pure economic growth results in increased material use. In the case of international communication and trade, ICT facilitates international trade and associated passengers and freight transport. On the other hand, the information effect, substitution and complementarity have a positive (or at least non-negative) effect on dematerialization. More information leads to more well considered choices on natural resource use in production and consumption activities. For efficiency gains in production and consumption, the impact on dematerialization is ambiguous, because production costs and market prices decline while the level of production and consumption increase due to lower costs and market prices. Ultimately, the impact of ICT on dematerialization depends on many different factors, even from an economic perspective, and remains therefore ambiguous.

CONCLUSIONS

Applications of ICT embody many opportunities for absolute dematerialization at the micro level. However, this does not necessarily lead to absolute dematerialization at the macro level of the economy, because various economic mechanisms come into play when changes associated with implementation of ICT occur at the micro level. One aspect often neglected in micro level case studies is the production of ICT itself, which uses many materials and energy. This may have considerable impact on the net effect of ICT on material use. Furthermore, due to efficiency gains in terms of material and energy use in production and consumption incorporating ICT, production costs and consequently commodity prices are declining. This, together with information effects and interaction between related markets, may stimulate consumption, with evident implications for material and energy use. Moreover, new applications of ICT technology stimulate new preferences, activities and consumption patterns. These generally have an ambiguous impact on material use. Indirect effects further occur due to economic growth, research and education, substitution processes, international communication and trade effects. Table 12.4 summarizes the main findings. For the moment, there is no reason for optimism about the material saving net effects of widespread use of ICT in economic production, goods and services.

NOTES

1. The first author is ICREA Professor at Institute for Environmental Science and Technology & Department of Economics and Economic History, Autonomous University of Barcelona, as well as professor at Vrije Universiteit, Amsterdam (VU University Amsterdam); the second author is Dean of the Faculty of Economics and Business Administration, VU University Amsterdam; and the third author is researcher at Agricultural Economics Research Institute, The Hague.
2. *New York Review of Books*, 12 July 1987.

13. Ecological cities, illustrated by Chinese examples

Meine Pieter van Dijk¹

A number of ecological initiatives have received support from the Chinese government. They range from alternative building methods (emphasizing the need to insulate the house better) to using alternative ways of dealing with drinking water and sanitation. The question considered in this chapter is, to what extent these disjointed initiatives also contribute to building the much-needed ecological city of the future. Ecological initiatives can be undertaken at three levels – city level, neighbourhood level and individual initiatives – spontaneously, triggered by incentives or price increases.

This chapter will first review the reasons behind the concern about more ecological cities (ecocities). Subsequently, we introduce the approach of the Switch project, which embodies an increased ecological attitude towards water and environmental issues.² This will also mean a discussion about sustainability and following an integrated approach to the problems mentioned. Kenworthy (2006) mentions ten dimensions for sustainable city development in the developing world. They will be presented as a possible analytical framework to decide whether certain initiatives qualify for the ecological city label. An overview of how China deals with these issues will be given. Examples of some Chinese ecocity and ecoprovince initiatives will be studied, before formulating some conclusions. The question will be asked whether China is heading, with ecological cities, only for more ecological urban water systems or for a very different, more integrated approach to a number of related environmental issues.

SUSTAINABLE URBAN DEVELOPMENT AND ECOLOGICAL CITIES

The purpose of the chapter is to explore what ecological cities in China would look like. Kenworthy (2006) lists ten dimensions for sustainable city development in the Third World, which is useful as a reference framework.

Sustainable development is a normative concept. In 1987, the World Commission on Environment and Development provided a definition of sustainability that is still often used. Brundtland (1987) defines sustainable development as development that meets the needs of the present generation without compromising the needs of future generations.

The literature struggles over what to put into the sustainability concept, while the environment continues to degrade. Mohan Munasinghe, vice-chairman of the UN Intergovernmental Panel on Climate Change (IPCC) tried to bring together the economic, human and environmental aspects of development. His analytical framework is called sustainomics (Munasinghe 2007). Through sustainomics he offers alternative mechanisms to help us bring environmental degradation and social cost into the analysis and applies his methodology to greenhouse emissions and the transport sector in Sri Lanka. At the same time, he criticizes the traditional cost-benefit analysis, a reason why Opschoor (1974) used already the so-called 'damage functions' as a possible alternative approach.

We suggested letting the weight of the issues (determined by a panel of local experts) play a role in the definition of urban sustainability (van Dijk and Mingshun 2005). According to van Dijk (2006), urban management should help take steps towards more ecological cities. One definition of a more ecological approach to urban development would be a strategy combining:

1. Integrated water resources management: closing the water cycle
2. Energy management, reducing greenhouse gases
3. Waste minimization and integrated waste management
4. Integrated transport policies
5. Objectives concerning justice, for example, promoting an equal distribution of the benefits
6. Integration in the framework of urban management, while also managing urban risks.

There are definitional problems as shown in the literature (Finco and Nijkamp 2001). One can find very idealistic, very sectoral, or issue-based definitions of ecological cities and sometimes values play a role such as the distributional issue: should the Chinese be denied the level of energy consumption of average US citizens?

REASONS FOR MORE ECOLOGICAL CITIES

Not only higher energy prices, but increased emissions of CO₂ force a reconsideration of the priorities for the future in developing countries.

Besides traditional urban environmental issues such as urban pollution, traffic congestion and inappropriate waste collection, the results of rapid urbanization and of climate change force cities to think more about their future.

There is water stress in many countries (Seckler *et al.* 1998). A deteriorating environment accelerates the trend towards a gradual shortage of fresh water. While freshwater supplies are clearly limited, for most people water scarcity is caused by competition between water uses and by political, technological and financial barriers that limit their access to water (Falkenmark and Lundqvist 1998). The Switch program intends to generate new efficiencies from an integration of actions across the urban water cycle in order to improve the quality of life in cities.³ It also promotes urban agriculture projects, as part of the integrated approach to water use and reuse.

UNESCO-IHE carries out a European Union supported Switch project on ecological cities that defines sustainability as the process and the ecological city as the result. Global changes such as climate change and volatility, urbanization and industrialization, population growth, urban sprawl and rural–urban migration put pressure on cities. A sustainable urban water system is a basic feature of an ecological city, but is it enough? The Switch project, according to the proposal, intends to improve water governance and to translate scientific innovations into improvements of day-to-day management of urban water and sanitation. The approach focuses on closing the urban water cycle, defined as the link between the resource, its use for drinking water and eventual reuse to allow the water to flow back into the resource. From the literature, we know that reuse is currently at a price of 30 to 40 euro cents per m³, while desalinated water may cost around 1 euro per m³. Unfortunately the latter is always produced at sea level, implying transportation costs in most countries.

The Switch approach has three characteristics:

1. It relates storm water to drinking water and water treatment
2. It emphasizes a more ecological approach and
3. It emphasizes a more integrated approach to the different water related issues.

Integration could take place in the framework of urban management as discussed in van Dijk (2006). Issues discussed in that book are the integration of the different sectoral interests, the role of planning and management, the importance of economic, financial, social and environmental criteria (and how to combine them), who are the decision-makers and how do we deal with the strict and the loose meaning of sustainable urbanization.

ACHIEVING SUSTAINABLE URBAN DEVELOPMENT

Achieving sustainable urban development may also be phrased in terms of considering water and sanitation integral parts of urban infrastructure planning. The Switch vision emphasizes three unique aspects:

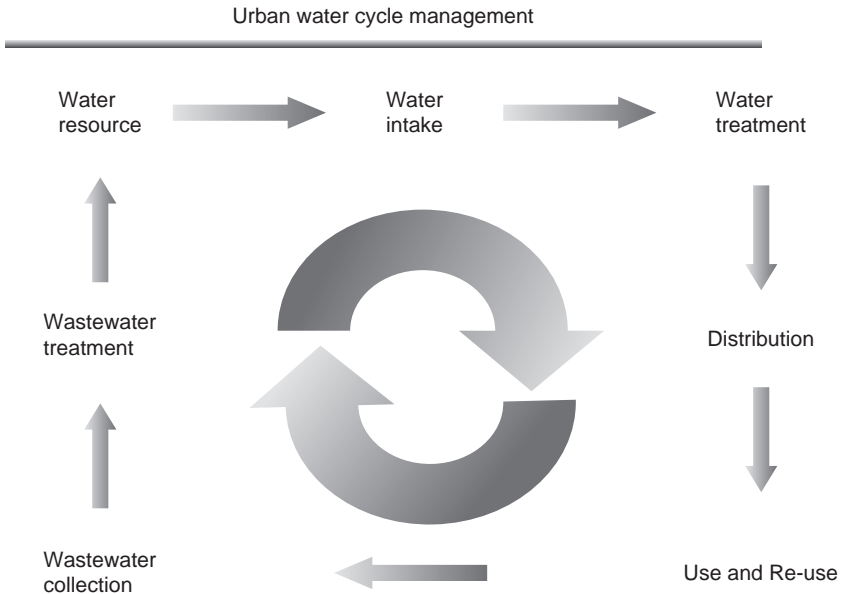
1. Thinking in terms of systems of interrelated components (system engineering)
2. Emphasis on a more ecological approach to sustainable urbanization and
3. Emphasis on a more integrated approach to different water related issues.

Part of the first approach would be developing indicators to monitor constantly our status with the aquatic urban environment and to take corrective actions if certain variables reach threshold levels. Modelling the system and emphasizing decision support systems is inherent to this vision.

A more ecological approach to sustainable urbanization implies moving from traditional environmental technologies to more ecosan options in the ecological city of the future (van Dijk 2007b). It will be necessary to focus more research on the topic of ecological cities, to study certain phases in the process of becoming more environmentally conscious as well as how to interest some of the major urban actors in these issues. However, the coordinating role of local governments and urban managers should not be underestimated. In fact, it is their task to coordinate a multiplicity of actors. Such is the essence of urban management: participatory, inclusive and with all actors concerned taking into consideration equality, the environment and economic development.

In the case of an integrated approach, it needs to be clear what will be integrated, how and by whom? Integrated Urban Water Management (IUWM) is achievable in each of the cities, if we work towards a plan. A major assumption of this approach is that if we follow a holistic approach we will have better results. We assume that policy will be the result of scientific research, rather than consultancy reports. Such plans may be too ambitious for big cities like Beijing and we may have to content ourselves with providing strategic direction for moving towards a more ecological city.

Strigl (2003) stresses that a real improvement in ecoefficiency requires a fundamental change in culture, structure (institutions) and technology. Switch intends to develop, apply and demonstrate a range of scientific,



Source: van Dijk (2007a).

Figure 13.1 A picture of the water cycle, showing where costs and revenues can be expected

technological and socioeconomic solutions tested to determine their contribution to the achievement of sustainable and effective urban water management schemes. It implies a multidisciplinary approach for Switch that is the integration of the technological means, socioeconomic aspects, environmental concerns and health considerations.⁴

How do we hope to achieve this in the Switch project? Learning alliances have been created consisting of interested stakeholders to discuss the issues and to identify directions for research. The researchers hope to provide a broader perspective to the members of the learning alliance and to increase the range of options between which they can now make an informed choice. Why is Switch different? Because the project promotes sustainable and integrated urban water management, to make the city a better place to live. It is closing the urban water cycle for the city of the future. With theme six on institutional and financial issues, we hope to link governance and finance issues strategically to other more technical research activities undertaken in other themes. The idea is that if the other work packages (each theme has four to six work packages) have a problem

with the institutional context or financing they would ask them six what the governance structure could be and how to get to a structure that would work, also in a financially sustainable way.

Our point of departure is closing the urban water cycle. In Singapore, no water gets lost between the resource, the use for drinking water, the treatment and reuse. Figure 13.1 illustrates this. Each flash in the figure represents a point where costs are made and revenues can be obtained. It is also possible to deal with the process in an integrated way, as they do in Singapore. In that case, the costs and charges could be integrated in one exercise (for the costs) and one bill for the customers.

BOX 13.1 RESEARCH UNDER SWITCH BY WORKING PACKAGE 6.4

Working package 6.4 explores the social, economic and environmental implications of alternative technologies in urban water systems. It intends to make estimations of the efficiency and sustainability of the alternative technologies. Cost–benefit analysis and lifecycle analysis are methods used for the evaluation. Wuhan, China is one of the cities under study, in particular a neighbourhood where wastewater treatment and reuse in the neighbourhood will take place. A comparison will be carried out between the *new* technology (decentralized wastewater treatment) and the *old* technology (centralized wastewater treatment system) to help decision makers develop and select efficient and sustainable technologies for their water systems.

The research under Switch working package 6.4 is summarized in Box 13.1, focusing in particular on a case study undertaken in Wuhan in November 2007 with a doctoral student, Mrs. Xiao Liang.

A THEORETICAL FRAMEWORK FOR SUSTAINABLE CITY DEVELOPMENT

Kenworthy (2006, pp. 67–86) lists ten dimensions for sustainable city development in the developing world, which give a good impression of the issues at stake. His list is comprehensive because Kenworthy considers a sustainable city as one characterized by:

1. A compact, mixed urban form that protects the natural environment, biodiversity and food-producing areas
2. The natural environment permeates the city's spaces and embraces the city, while the city and its hinterland provide a major proportion of its food needs.
3. Freeway and road infrastructure is de-emphasized in favour of transit, walking and cycling infrastructure, with a special emphasis on rail. Car and motorcycle use are minimized.
4. There is extensive use of environmental technologies for water, energy and waste management – the city's life support systems become closed loop systems.
5. The central city and subcentres within the city are human centres that emphasize access and circulation by modes of transport other than the automobile and absorb a high proportion of employment and residential growth.
6. The city has a high quality public culture, community, equity and good governance. The public realm includes the entire transit system and all the environments associated with it.
7. The physical structure and urban design of the city, especially its public environments are highly legible, permeable, robust, varied, rich, visually appropriate and personalized for human needs.
8. The economic performance of the city and employment creation is maximized through innovation, creativity and uniqueness of the local environment, culture and history, as well as the high environmental and social quality of the city's public environments.
9. Planning for the future of the city is a visionary debate and decision process, not a predict and provide computer driven process.
10. All decision-making is sustainability based, integrating social, economic, environmental and cultural considerations as well as compact, transit oriented urban form principles. Such decision-making processes are democratic, inclusive, empowering and engendering of hope.

We would like to use this list of characteristics to find out if certain initiatives in Chinese cities qualify for the label *ecological city* or ecological neighbourhood. These principles are quite broad and come from someone with a transport background (points 3, 5, 6 and 10). Kenworthy looks at the world from a transport sector perspective. Further there is a vision behind it and an integrated strategy is necessary to implement the solutions to the implicit problems. Finally, the importance of appropriate technologies for water and sanitation is only mentioned under point four.

AN OVERVIEW OF THE ISSUES IN CHINA

There are numerous examples of problems with the water cycle in China. Just to mention some examples: the impact of climate change on water resources and development in China (*China Daily*, 2 July 2004), as well as the risks linked to the current practice of water management for Chinese rivers (CICED 2006). Flooding is common, just like pollution, but the river is also important for irrigation, drinking water, transport and fishing activities. In the northern port city of Tianjin, the river became polluted and consequently the population could not drink the water for weeks. This is a big city and the impact of upstream pollution was enormous. The risks this time are not so much the risks of flooding, but of not supplying clean drinking water to the big cities on the coast (Pahl-Wostl and Kabat 2003). There were reservoirs to serve Tianjin and Beijing, but the water was not available at the crucial moment. Currently, the city is using a desalination plant, but it will also benefit from the south-north river linking programme, which connects the northern Yellow and southern Yangtze rivers.

In the integrated urban water cycle, managing water resources, drinking water supply and wastewater treatment are three important stages, each with specific problems in China. The water situation in China can be termed, water scarcity. Particularly in the north, there is not enough water for the different types of use and for the big cities, which have high per capita consumption figures, probably due to substantial water loss. For that reason, China has embarked on a number of river linking projects (WWF 2005).

The main problems with water and pollution in China are as follows.

1. Water prices are not realistic (*Financial Times* 20 March 2003), but efforts to increase water prices by 30 per cent have not been approved by the Municipal Commission of Development and Reform (*China Daily* 2 July 2004)
2. The river transfer project is extremely costly (*Financial Times* 20 March 2003)
3. Pollution has led to algae in the Yellow Sea (*NRC* 17 June 2004)
4. The risks in the water cycle are substantial
5. The emphasis is on the hardware and not enough attention is paid to managing the systems in a more optimal way
6. Even the Three Gorges Dam may cause serious ecological risks.

There is a trend to focus on obtaining the most advanced technology for China and on counting that to be sufficient. Not enough attention goes to managing existing water supply and treatment systems properly. Hence

many water resources are polluted, drinking water is scarce and the quality of the water produced by the water treatment plants is not always appropriate. Environmental norms have gained a high level in China; though, unfortunately, not always applied seriously. The State Environmental Protection Agency (SEPA) is not very powerful, compared to the Ministry of Construction, which is responsible for the construction of water and sanitation facilities. Recently, the SEPA obtained the status of a Ministry, which will make it easier to deal with the environmental issues, in different Chinese provinces.

The goals to be achieved, in the water sector according to China's 11th five-year plan are ambitious. The planners want to reduce, for example, water consumption per industrial unit by 30 per cent and to increase the coverage for water and sanitation facilities in line with the Millennium Development Goals (MDGs). The governance structure to achieve this is relatively simple (centralized through the role of the Ministry of Construction and the corresponding line offices at the city and district level), but also excludes broader participation of all stakeholders. Water and sanitation facilities are, for example, not owned and managed by local authorities, which makes ownership vague and hinders innovative local solutions, innovative ways of financing (there are some Build, Operate and Transfer [BOT] projects in this sector) and means achieving very little cost recovery. This makes it possible to recover the cost for water treatment through the drinking water bill, however. The current price per m³ is only 3.5 yuan, of which 0.5 yuan is for wastewater treatment, which is much too low.⁵ Unfortunately, in the case of ecological initiatives taken at the neighbourhood level to recuperate grey (lightly polluted) water, the treatment charge will not be repaid to the inhabitants, while they do pay the 0.5 yuan for large scale treatment.

WATER STATUS OF CHINESE CITIES

Beijing is the capital of the People's Republic of China, lies in the northern part of the country and is geographically on the edge of a desert. Because of its geography, Beijing has low average rainfall. Beijing's average precipitation is 640 mm per year, 80 per cent of which is concentrated during the period of June to September. The population of Beijing is 15.38 million, of which 3.2 million people reside in the periurban districts and counties of the metropolitan area. Because of the dramatic economic development during the last 20 years, Beijing has been urbanizing rapidly, with an average annual official population increase figure of 2.48 per cent. Ground water is the primary source of water for agriculture and industry and, recently, has

shown a gradual decrease. Water scarcity, depletion of underground water stocks and environmental degradation are the main problems faced by Beijing. Given the negative effects on the environment, Beijing has decided to direct businesses, which utilize large amounts of water, out of the city (*China Daily* 10 April 2004).

Wuhan is also one of the largest cities in China, with total area of 8494 km² and a population of 8.3 million. Unlike Beijing, Wuhan has much richer water resources, ranking first among the largest Chinese cities. Called *water city* in China, Wuhan is located about halfway along the several thousand kilometre reach of the Yangtze River and has nearly 200 lakes of various sizes. The water area makes up 25.8 per cent of Wuhan's entire territory. Although Wuhan has abundant water resources, the Yangtze River and many lakes suffer from serious pollution. In 2000, Wuhan's wastewater discharge totalled about 2 million cubic metres per day of domestic sewage and about 25 per cent of that was industrial wastewater. Water quality in Wuhan has significantly decreased over the last 15 years, making the concern for sustainable urban water management in these cities greater than in other cities.

In 2003, an environmental study of Tai Lake near Shanghai carried out by a Dutch consulting firm together with UNESCO-IHE showed the seriousness of pollution on the water resources and the need to introduce wastewater treatment plants. What has been done so far and to what extent the risk of pollution of the water resources have been limited by treating used water properly is not clear. It is our experience that the Chinese started building water treatment plants before the feasibility study was finished. Now they are not always working at full capacity nor turning out the expected quality of water. Recently another effort to clean Tai Lake was announced. Ten billion euros will go into cleaning it (*De Pers* 29 October 2007). According to these plans, it would take five years to clean the lake while the problem will be gone in eight to ten years.

In the example of Tianjin in the north, where the river became polluted, because of an upstream industrial accident, there was no riverbank infiltration system to mitigate the negative effects of the pollution. In addition constructed wetlands, which help to clean the water, were not used as this approach required too much land use. Riverbank infiltration projects may be an alternative for constructed wetlands, which require much space, while riverbanks are available for this purpose. Moreover, the model of Singapore closing the urban water cycle completely may also be an appropriate option.

Thus Chinese cities are facing the pressure of a water crisis. More than 400 cities are lacking enough water resources and more than half the rivers are polluted. In 2004, 5.548×10^{12} m³ water was used for agriculture,

industry and domestic activities. Meanwhile $6930 \times 10^8 \text{ m}^3$ wastewater was discharged from Chinese cities, but no more than half the amount of wastewater is subject to secondary treatment (China Bulletin of Water Resources 2004).

INITIATIVES AT DIFFERENT GEOGRAPHICAL LEVELS

First, many initiatives are taken at the level of the city. In China, the real promotion of ecological neighbourhoods comes from the national level through subsidies, like 30 per cent of the construction cost in the case of Wuhan. Rotterdam is also an example of a city trying to become more ecological. It took part in the Clinton initiative and is currently considering storing CO_2 in its port area (van Dijk 2007a).

Even provinces want to get the label ecoprovince and take initiatives to achieve this. In China, this usually means competition and a prize given to the most ecologically friendly province or city.

Finally, individual initiatives can be noted, spontaneously or triggered by incentive of price increases. Environmental awareness may not yet be very developed in China and more time and policies that raise the consciousness of the people may be needed to achieve more activities at this level. People may save energy and tend to use less water than in developed countries, but this is partly due to the level of development, availability and price. Individual households usually install water heaters on the roofs of houses. In certain cities this is becoming a trend; the question is whether the systems are efficient enough to convert large numbers of people.

THREE APPROACHES TO URBAN WATER MANAGEMENT IN ROTTERDAM, THE NETHERLANDS

A city needs enough water for its population and industries, so it needs water resources. However, a city also needs institutions that secure good use of the water. The current setup in The Netherlands is complicated and the fragmentation of institutions makes integrated water management at the city level difficult. Given the need for a city like Rotterdam to deal with the risks involved in urban water management, we will now suggest three alternative approaches.

The first option is an integrated approach to water management, combining drinking water and surface water management perspectives, which

are currently separated, institutionally, in The Netherlands. However, for such an approach, the current institutional context is too complicated and not appropriate for the problems Rotterdam is facing. Integrating the production of drinking water with surface water management was the option chosen by the city of Amsterdam. The authorities announced a merger between the water board and the municipal water company, which would lead to water chain management, where the customer would eventually pay only one bill for all water related services.

The second alternative is closing the water cycle to deal with water in a more efficient way. Closing the water cycle means not losing any of the scarce resource and controlling the quantity and quality constantly. Such an approach would favour integrating the management of the whole water cycle. Singapore has managed, for example, to close the water cycle and in principle, no water gets lost between resource and users. All of it is cleaned and made available for reuse. In the Dutch context, it would mean a closer cooperation between the water utilities and the water boards. It would also imply a different role for the municipalities. However, this may be easier than continuing to clean dirty water from the rivers to discharge it again after treatment to the North Sea.

The third option is to strive for a more ecological city, where integrated water management would be part of a broader approach to the urban environment. The term ecological city could be used for an approach to urban management that combines water with environmental management and focuses on long term urban sustainability (van Dijk 2006). The perspective is broader than just water related environmental issues. Examples in the European context are Hanover and Hamburg, which invite debate on the ecological city of the future.

Considering these options, a more effective management of the water system and making it more sustainable is needed. Water management can be undertaken by central government or by communities. In Europe, typically, the task is allocated to the city level, which makes it interesting for Rotterdam as they develop plans to deal with water in a different way (van Dijk 2007a).

CHINESE ECOCITY INITIATIVES

There are a number of Chinese ecocity initiatives. There are a large number of similar initiatives, ranging from simple water and sanitation technologies for the western part of the country (through a project financed by The Netherlands) to sophisticated ecological projects in the framework of the 2008 Olympic Games in Beijing. The Chinese authorities exhibit a

preference for large modern high tech solutions; even if they know they cannot always manage the technology properly. They are less willing to pay for management support, training or software; while given the high energy use per unit of Gross Domestic Product (GDP) and the huge water consumption in per capita terms, there is scope for improvement on the efficiency of the system through better management.

Shanghai plans to build on an island at the mouth of the Yangtze River the city of the future (*Economist* 23 September 2006; *Trouw* 9 November 2007; *Financial Times* 15 September 2006). The idea is that the city will be self sufficient in energy and water and will generate almost no carbon emissions. Petrol and diesel vehicles will be banned in favour of solar powered boats and fuel-cell-driven buses, according to the *Economist*. The city should number around 500 000 inhabitants in 2040 and will house an agro park of 27 km² to grow food in a sustainable way (*Trouw* 9 November 2007). Finally, the *Financial Times* describes energy conservation at the level of the house and shows the use of water conservation (rain water harvesting). The houses will use only one-third of the energy consumed by a normal house, while the energy will be renewable, for example, through windmills. The project received attention and press coverage, but the question is what happens to diminish pollution in neighbouring Shanghai city, with 20 million inhabitants and many polluting industries.

THE CASE STUDY IN WUHAN: AN ECOLOGICAL NEIGHBOURHOOD

The case study in Wuhan concerned a project of about ten buildings with seven or eight floors per building. The project would receive a 30 per cent subsidy for using energy saving techniques, but one of the conditions was that the project would also recycle its grey water.⁶ Energy savings were based on double-glazing and the use of ground source heat pumps. The geothermal heat pump uses a system of pipes absorbing latent heat from the ground and transferring it to the home's heating and hot water systems.

The Taiyue-Jinhe (Tai) project is about establishing an ecological residential area with low energy consumption and a water recycling system. It is located in Jinyin Hu district, which is a suburban area of Wuhan city. Because there are two big lakes: Jin Lake and Yin Lake, the district is called Jinyin Hu (lake). Jinyin Hu district was an agricultural production field 20 years ago, mainly for rice production. Presently Jinyin Hu district is under development as a residential space and ecological park.

Table 13.1 Space distribution in the considered housing project

Land use	Area amount (m ²)	Percentage
Residential buildings	51400	49
Green area	23800	23
Paths	8800	8
Artificial lakes and rivers (include wetland)	12100	11.6
Total	104500	100

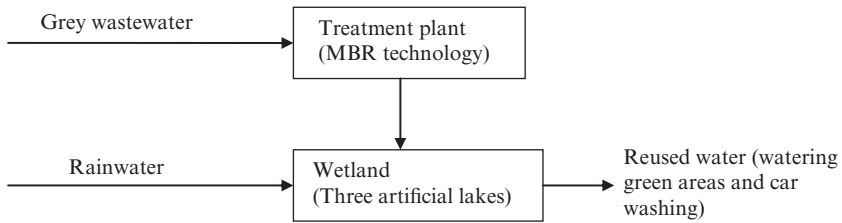
Source: Tai project introductory document.

The Tai project began in 2006 and the residential building was completed and sold in 2007. The water recycling system was due to be completed in 2008. The Tai project is involved in a national level energy saving programme (initiated by the Ministry of Construction) on the condition that energy saving and water recycling systems are included. This programme was organized by the Chinese Ministry of Construction, which also issues permits to build water recycling systems. Moreover, the Tai project could get a subsidy from the Ministry of Construction. At present there is no policy on water reuse system construction in Wuhan.

In all there are 6970 m² areas with 1162 households (around 3253 residents) in the Tai project, and all buildings are equipped with energy saving facilities. The space distribution of the project is shown in Table 13.1, which reveals that half of the area is for residential buildings and the green and lake areas account for 35 per cent. Due to financing issues, only ten buildings are involved in the water recycling system. They are the No. 5 building to the No. 14 building, including 228 households with approximately 1140 people.

There are two main parts to water recycling: water reuse and rainwater harvest. The water reclamation technology used by the Tai project is Membrane Bio-Reactor (MBR) with wetlands. Two pipes are constructed in the residential buildings to collect wastewater: one for grey water and another for black water. Only grey water is recycled, the black water goes directly to the municipal sewage system. The MBR method is the first step and wetlands is the second step for wastewater cleaning. Rainwater is collected through drainage pipes in the buildings and beside the paths. After the rainwater is collected, it moves directly into the wetlands. Finally, the reused water is pumped from the wetlands and used to water the green areas and wash cars.

Figure 13.2 depicts the water recycling system for the Tai project. The



Source: Interview with the manager of the Tai project.

Figure 13.2 Water recycling in the Taiyue-Jinhe project

information on the wastewater treatment plant is represented in Table 13.2, which shows that the capacity of the wastewater treatment plant is 10 m³ every hour. If the plant works 14 hours continuously every day, the amount of reclaimed water produced could be 140 m³ each day. As mentioned above the Ministry of Construction will subsidize 30 per cent of total investment in the water recycling system (wetland excluded).

Table 13.2 illustrates the investment funding distribution. The initial investment amount for the wastewater recycling system covers the design fee, equipment installation, plant construction and pipe construction costs.

Table 13.2 Information on the wastewater treatment plant

Capacity	10 m ³ /hour
Occupied area	80 m ²

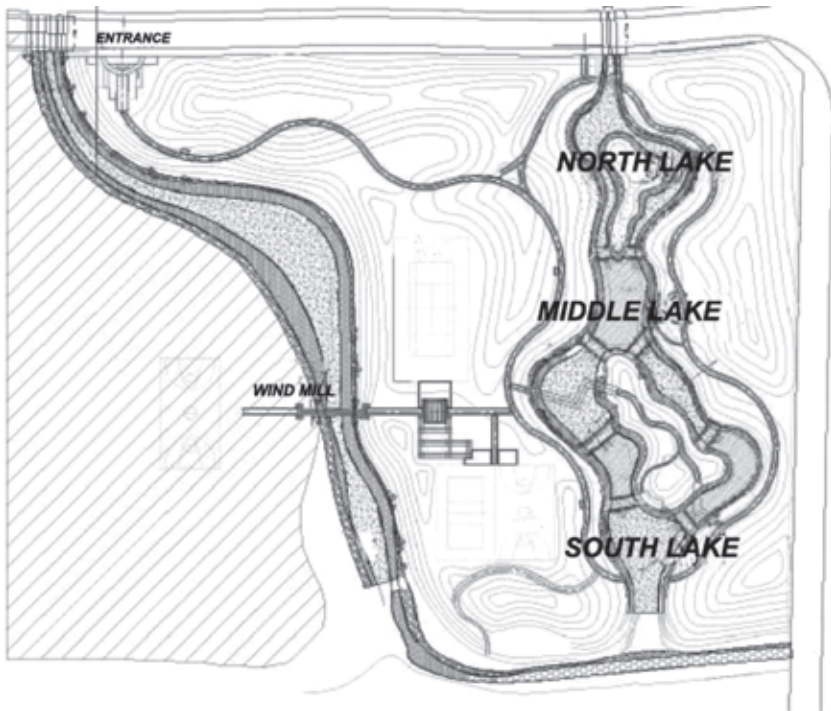
Source: Interview with the Tai project manager.

The wetlands consist of three lakes: North Lake, Middle Lake and South Lake, which are shown in Figure 13.3. The water moves from the south to the north due to water level differences. In the middle is a windmill, which transfers the water from outside the lake into the wetland in order to keep enough water in the wetland. There are several pumps in the northern lake to transfer reused water. Unfortunately, we found, during our fieldwork in October 2007, that the houses were almost finished (to be occupied in December 2007), but the grey water treatment facility was not yet built. The question is whether this will still happen, since the project developer considered thermal isolation more important and expected to get the subsidy anyway. When we checked in the summer of 2008, it had still not been finished. For the apartment buyers, thermal isolation is an asset, but they were not very interested in separating grey and black (heavily

Table 13.3 Investment funding distribution (million yuan)

The initial investment on water recycling (excludes land fee)	Real estate company (70%)	Government subsidies (30%)
24	16.8	7.2

Source: Interviews by Xiao Liang with Tai project manager.



Source: Tai project introductory document.

Figure 13.3 The wetland

polluted) water, since this would incur additional cost and they would not get their money back.

The Xiao Liang study aims at completing financial and economic analyses on the alternative decentralized system in urban water management (also Zhang 2006). The expected outcome of the research may contribute to developing and selecting sustainable plans for urban water management, by:

1. Determining costs and benefits for the alternative systems from the point of view of social economics
2. Financially appraising the alternative systems
3. Exploring the sustainable financing plans
4. Comparing the economic competitiveness of the alternative systems with that of the existing centralized system

CONCLUSIONS

There is currently no definition of what an ecological city would really be. We need to agree on what we consider the important criteria for sustainability and we would go for stakeholder planning to assure that all partners will work together for the common future of the city.

Stating that it requires an integrated approach is not enough, because one could integrate the analyses of the issue (look at them in relation to each other), the approach chosen to deal with the issues and finally the activities undertaken to solve the problems.

In Beijing there are about 30 000 ecological initiatives and other Chinese cities are also trying their best. The question is whether this is enough to counter a looming environmental crisis. Praising sustainable development is a beginning, but not enough. Private developers are looking for new ideas, but they are mainly interested in cost savings and attractive alternative options for their projects. Given that a number of the problems relate to water governance, an institutional analysis is required to identify the different bottlenecks.

The urban agriculture projects mentioned have a very specific background and the question is, which elements can be repeated and to what extent. These projects are an example of ecosanitation and elements of an ecological city. The six principles for a more ecological approach mentioned above could also include the promotion of urban agriculture.

Ecological cities are more than ecologically managed closed urban water systems. Sustainable urban water management is just the beginning. Changes in the behaviour of consumers will be required, just like a combination of better water management, collection and treatment of solid waste and striving towards integration (Van Dijk and Oduro-Kwarteng 2007). Water demand management may be a good start at the household level, just like separation at source and composting at home is a good start for ecologically friendly solid waste management.

In China, the initiatives are broken into three distinct levels, but there is no real integrated approach at the provincial⁷ or city level.⁸ The institutional framework of provinces taking the initiative, provincial

capitals trying to do something and a state level Ministry of Construction to approve projects are in place, while the state level Environmental Protection Agency that does the regulation, does not function properly at the moment.

Consultancy firms claim that sustainable urban development starts with integrated design (DHV 2007). However what's important is convincing people that it is essential to do something to improve one's environment. As the Dutch government claimed in a media campaign: The environment starts at home. More is necessary than consultancy reports. Good research showing what works and why would help to come up with realistic suggestions for ecological cities of the future.

JOURNAL ARTICLES

China Daily 27 August 2002

China Daily 10 April 2004

China Daily 2 July 2004

Economist 23 September 2006

Financial Times 20 March 2003

Financial Times 15 September 2006

NRC 17 June 2004

Trouw 9 November 2007

NOTES

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2. The Switch project (Sustainable Water Improves Tomorrow's Cities' Health) with support from the EU is seeking a paradigm shift in urban water management. Its purpose is to make water treatment more sustainable and protect the quality of drinking water sources. In addition it wants to reduce risks such as water related diseases, droughts and flooding.
3. Nine cities around the world serve as demonstration cities and a learning alliance framework will be established in each demo city. Through the learning alliance platform, the barriers to information sharing are broken down and the process of technological and institutional innovation is speeded up.
4. The research project WP 6.4 is part of Switch. The emphasis is in particular on the financial and economic analysis of urban water management in demo cities, an important topic that often requires more attention.
5. The current rate is 11 yuan to the euro.
6. Grey water is wastewater generated in households, excluding water containing human excreta or urine, but including water from kitchens, bathrooms and laundry rooms.

7. Fujian province for example wants to develop into an ecological province (*China Daily* 27 August 2002). Wang (2006) describes a case study of Hainan ecoprovince planning. There are also initiatives in Zhejiang and Shandong provinces (China.org.cn, 26 August 2003).
8. Foshan (Guangdong province) is another ecocity.

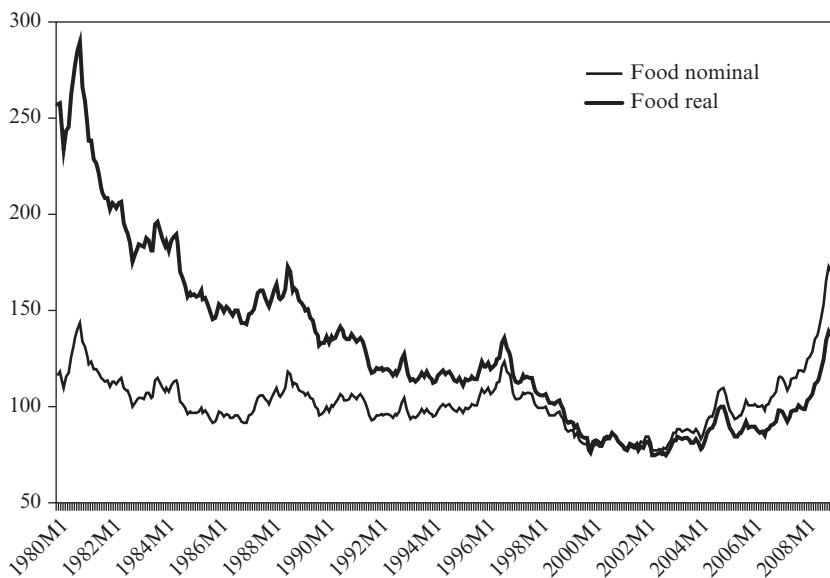
14. Green or mean: Is biofuel production undermining food security?

Rob Vos¹

Potentially conflicting new driving forces are redefining the world food situation. Since 2006, there has been a surge in food prices worldwide. Average agricultural food prices increased by 80 per cent and the prices of some basic grains, such as maize and wheat doubled or, as in the case of rice and soybeans, tripled. The surge follows a prolonged period of declining food prices. By mid-2008 world food prices corrected for dollar inflation were still well below what they were in the 1970s and early 1980s (see Figure 14.1). For the world's poor however, it does not feel anything like a period of cheap food. Not only did the recent surge in food prices seriously threaten their food security, but also reduced access to food.

Much of the recent surge in food prices is related to a series of compounding short and long term factors. After a slump in the developing countries during the first half of the 1980s, agricultural investment recovered somewhat but did not return to the levels seen in the 1970s (FAO 1999). Additionally, growth rates of yields for major cereals (wheat, maize and rice) slowed since 1960 in the developing countries (World Bank 2007). Although the average yield for coarse grains increased from 1.4 million to 3.2 million tons per hectare from the 1960s to the present, productivity growth decelerated from 2.6 per cent per year in the 1960s to 1.6 per cent per annum over the past decade.²

Growth in supply has not been enough to meet accelerating food demand. Stocks of cereals have declined steeply since around 2000, caused in part by a longer term trend of rising food demand in some developing countries, especially China, on the back of continued high economic growth, an accelerated pace of urbanization and a related shift in consumption patterns towards higher value food products, such as meat. This has increased the demand for animal feed, including grains, which are also the main ingredients for staple food. These trends, compounded by the recent surge in oil prices and related concerns about energy security, as well as



Note: World food price index comprises weighted price indices for cereals, vegetable oils, meat, seafood, sugar, bananas, and oranges. Real food index is nominal US dollar price of food deflated for dollar inflation (US consumer price index).

Source: UN, Department of Economic and Social Affairs and IMF, commodity price data.

Figure 14.1 Nominal and real world market price of agricultural food products (Index 2005 = 100)

growing awareness of the threat of climate change are leading policymakers, especially in the rich countries to promote the production of renewable energy, which competes with food agriculture. There has been an explosive growth in the demand for biofuels based on cereals, sugar or oil seeds. In 2006 and 2007, for instance, almost half the increase in the demand for major food crops in the United States was for corn-based ethanol production (IMF 2008), while almost all of the increase in global maize production between 2004 and 2007 went for biofuel production in the United States alone (World Bank 2008). This has pushed prices for basic grains up, with spillover effects on prices of other staple foods (such as rice and wheat) because of substitution effects. Recent global macroeconomic conditions also had a compounding effect, including the weakening US dollar since 2002, which has increased the international trading prices of all food products; the sharp increase in the price of oil, which has increased

the cost of transportation of food commodities and the costs of fertilizers; and financial speculation in world commodity markets partly driven by the turmoil in financial markets, which manifested itself in 2007 and has pushed investors into higher yielding commodity futures (see United Nations 2008a).

The focus of this chapter will be on the apparent trade off between the push for energy security, preserving global food security and the MDG of eradicating hunger. The main thrust is that subsidy policies on biofuels in rich countries have been ill conceived, as they are not cost effective from an economic perspective, contribute little to energy security and climate change mitigation and jeopardize food security and poverty reduction goals.

Growth of Biofuel Production

The production and use of biofuels – mainly consisting of ethanol based on cereals and sugar crops, and biodiesel based on vegetable oils such as rapeseed or canola oil – has grown rapidly recently and is expected to double in the decade to come. The US and Brazil are the largest ethanol producers with 48 per cent and 31 per cent of global ethanol output in 2007, respectively, while the European Union accounts for about 60 per cent of global biodiesel production (see Table 14.1). A large number of other countries have begun, or are considering, promoting biofuel production and use.

In the US ethanol production surged in recent years, the result of tax incentives, mandates and growing demand for ethanol as a gasoline blending component. In Brazil, production of ethanol, entirely based on sugar cane, peaked in the 1980s, then declined, as international oil prices fell back, but has been increasing rapidly since the beginning of the century. Falling production costs, higher oil prices and the introduction of vehicles that allow switching between ethanol and conventional gasoline led to this renewed surge in output. Production of biofuels in Europe is also growing rapidly owing to strong government incentives. The bulk of EU production is biodiesel, which in turn, accounts for almost two thirds of world biodiesel output. Elsewhere China and India are major producers of ethanol, whereas Malaysia and Indonesia have started substantial biodiesel programmes.

Almost all biofuels go in to cars and trucks, although small quantities find use as railway and aviation fuel. In 2007, global production of biofuels served to meet the demand of about 1.8 per cent of total global transport fuel consumption in energy terms. The share of biofuels in total transport-fuel demand in 2007 was about 20 per cent in Brazil. While in the US biofuels represented about three per cent of transport fuels, the share of biofuels in EU transport-fuel consumption was less than two per cent for

Table 14.1 Global biofuels production by country, 2007

	Ethanol Litres (mln)	Mtoe	Biodiesel Litres (mln)	Mtoe Litres (mln)	Total	Mtoe
United States	26 500	14.55	1 688	1.25	28 188	15.8
Canada	1 000	0.55	97	0.07	1 097	0.62
European Union	2 253	1.24	6 109	4.52	8 361	5.76
Brazil	19 000	10.44	227	0.17	19 227	10.60
China	1 840	1.01	114	0.08	1 954	1.09
India	400	0.22	45	0.03	445	0.25
Indonesia	–	0	409	0.30	409	0.30
Malaysia	–	0	330	0.24	330	0.24
Others	017	0.56	1 186	0.88	2 203	1.44
World	52 009	28.57	10 204	7.56	62 213	36.12

Source: OECD (2008).

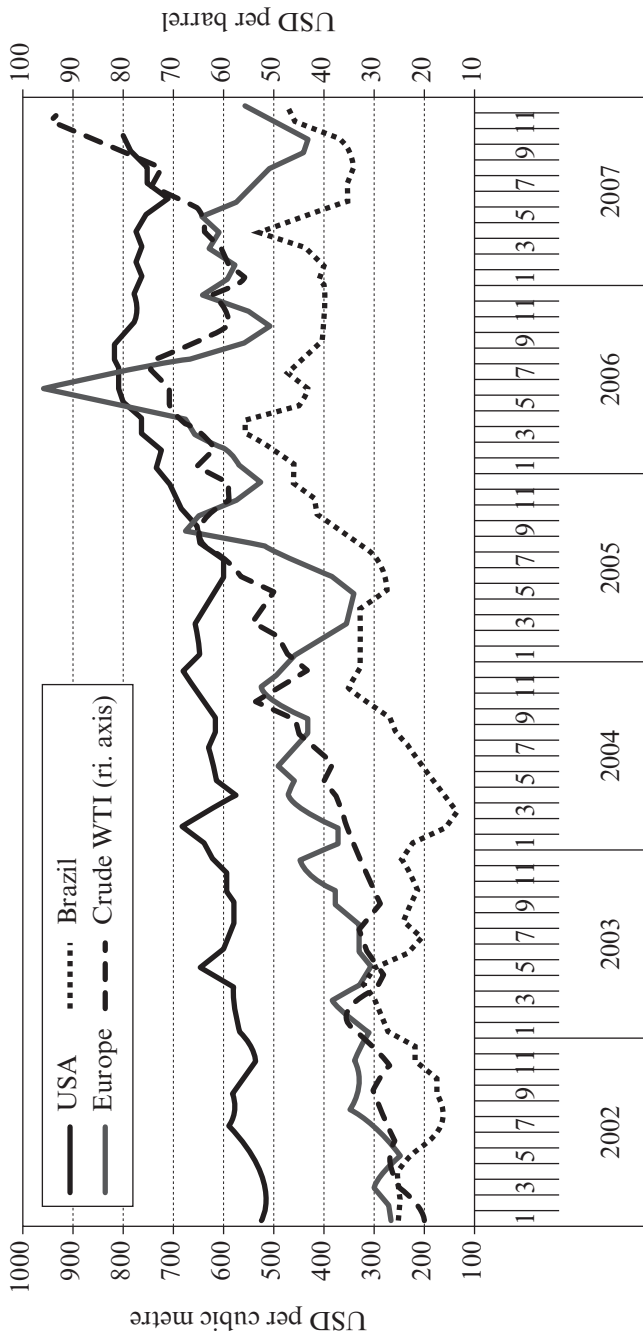
the region as a whole. The shares are nonetheless growing rapidly as new capacity is created in many countries.

Economic Viability of Biofuel Production

Apart from short term fluctuations, international ethanol prices tend to follow the trend of prices of fossil fuels and crude oil (see Figure 14.2). Despite higher prices for crude oil and fuels, the economic viability of biofuel production has not improved much. According to a recent OECD study (OECD 2008), this is due to higher feedstock prices (world prices for maize, wheat and vegetable oils increased by 86 per cent, 110 per cent and 91 per cent, respectively between 2004–07), biofuel production costs increased in most OECD countries. Furthermore the study shows that in many cases the gap between biofuel production costs and the energy value of the final fuel actually widened. The much lower competitiveness of wheat and vegetable oils as feedstocks for biofuel production when compared to maize, sugar cane and sugar beet remained unchanged and indeed became more pronounced in 2007 (OECD 2008).

Public Support

In most countries, therefore, growth of biofuel production enjoys heavy government support. A mixture of motivations justifies this support.



Source: OECD (2008), based on data from F.O. Licht.

Figure 14.2 Fuel ethanol prices in Brazil, United States and Europe and international crude oil price, 2002–2007

These include environmental concerns and beliefs that use of biofuel can make important contributions to climate change mitigation. However, the support has also been argued on economic grounds (contributing to lowering energy costs and farm income improvement) and on the basis of political motives (energy independence).

Government support in the OECD countries takes the form of fiscal incentives at various stages of the chain of production, including tax concessions for biofuel producers (refineries), retailers or users, or as direct support to biomass supply, biofuel production capacities, output, blending, specific infrastructure or equipment for biofuel users. Such fiscal incentives total an estimated budgetary cost of about USD 11 billion in the European Union, US and Canada in 2006. Support also comes in the form of blending mandates, which require biofuels to represent a minimum share or quantity in the transport-fuel market. These measures generally do not entail a fiscal cost, but the higher production costs of biofuels result in increased fuel prices for the final consumer. Governments also imposed trade restrictions, mainly in the form of import tariffs, to protect the less efficient domestic biofuel industry from competition from lower cost foreign suppliers. While supporting producers these measures punish consumers in the form of higher domestic biofuel prices.

In Brazil, tax reductions support ethanol use and despite some lessening of such support, ethanol still benefits from advantages in a complex tax system, both on federal and state levels. Also mandates in the blending of ethanol to gasoline fuels with a required ethanol content of between one fifth and one quarter. Additionally, Brazil applies an import tariff of 20 per cent on ethanol products. Other developing countries, including China, introduced blending targets for the use of biofuels and in varying degrees are providing direct or indirect support to their production through subsidies and/or import tariffs.

At present biofuel production would not be economically viable without these forms of government support and even with higher oil prices it has not become more viable. Hence the gains might, and the interventions would, need to find justification in other motivations, such as contributions to addressing environmental concerns.

Biofuels and Climate Change

A main motivation for the promotion of biofuels is the potential contribution to climate change mitigation by reducing greenhouse gas (GHG) emissions from transport. Existing studies show that several biofuel chains show a reduction of net GHG emissions with respect to conventional transport fuels. However these benefits vary strongly, depending on what

happens in the chain of production and there are increasing concerns about the environmental sustainability profile of biofuel production. The worries relate to the impact of biofuel production on land use, carbon stock decrease, water depletion, water pollution, biodiversity losses and air quality degradation. Such concerns, next to the trade off created by biofuel production between energy and food security, are feeding the controversy of whether the use and production of biofuels should be stimulated in the first place.

The main sources of GHG emissions link to the use of fossil fuel energy in the industry, building and transport sectors, agricultural production and deforestation (IPCC 2007b). According to the Stern report (Stern 2007), at the global level deforestation is a more important factor than emissions from transport. The production of biomass for energy (whether for transport fuels or other purposes), therefore, is closely associated with land use. Converting arable land for energy crops can change its carbon storage significantly, depending on previous land use. Further, the production of biofuels itself contributes to GHG emissions through the high energy intensity of the inputs used. Other important environmental concerns relate to the impact on biodiversity and the claim on water resources. Hence, the impact needs to be assessed by looking at the entire production chain.

Based on a review of a large number of studies, an OECD study (OECD 2008) concludes that ethanol from sugarcane is generally found to contribute significantly (more than 70 per cent) to GHG emission reduction compared with use of conventional gasoline. Ethanol from wheat or corn and biodiesels tend to reduce GHG emissions by much less. Corn-based ethanol for instance, generally allows for emission reductions of less than 30 per cent. Available estimates for biodiesel vary by a wider margin; especially to the extent increased N₂O emissions from fertilizers and GHG emissions in the processing phase or land use changes are considered. A European study on the greenhouse gas emissions found that 'well-to-wheel' CO₂ emissions of biodiesel from seed crops such as rapeseed could be almost as high as fossil diesel. It showed a similar result for bioethanol from starch crops, which could have almost as many CO₂ emissions as fossil petrol (VIEWLS 2005). In the case of palm oil, for instance, Beer *et al.* (2007) found that after considering the loss of carbon stock from previously noncultivated areas (rain and peat forest), the use of the crop for biodiesel production would contribute to a net increase in GHG emissions of 8 to 20 times compared with conventional diesel. The general message from this case is clear; taking into account land use change from grassland or forest can radically affect the net GHG balance of biofuel chains. When using UK default values for grassland to cropland conversion, all biofuels would emit more than conventional fuels (OECD 2008). In recognition

of this, the new EU Directive on Renewable Energy (DRE) proposes to exclude biofuels made from raw material obtained from land with high carbon stock, which is wetlands (including pristine peat land) and continuously forested areas. Further, one needs to consider indirect land use effects. Searchinger *et al.* (2008), for instance, estimate that without land use change in the US, corn ethanol would reduce GHG emissions by 20 per cent with respect to gasoline. However, with the substantial increase of ethanol production in the US, 10 million hectares of additional land would need to be taken into cultivation elsewhere to compensate for the loss in production of food crops. The authors argue that this could lead to very high land-use change related emissions. If spread over a period of 30 years, this would result in GHG emissions from ethanol being 93 per cent higher than for gasoline per unit of fuel energy.

Overall the OECD estimates that government support in developed countries for biofuel production might help reduce net GHG emissions by less than one per cent of total emissions from transport. Even this may be optimistic given the potential offsetting effects of indirect land use changes. These relatively modest effects come at a projected cost equivalent of USD 960 to USD 1700 per ton of CO₂ equivalent saved, or of roughly USD 0.80 to USD 7.00 per litre of fossil fuel not used (OECD 2008).

In sum, biofuel production, thus far, has not proven economically viable, despite high oil prices. Most production chains for biofuels have costs per unit of fuel energy significantly above those for the fossil fuels they aim to replace. Despite the rapid and substantial increase in crude oil prices and, hence, in the costs for gasoline and fossil diesel, the cost disadvantage of biofuels widened in the past two years as agricultural commodity prices soared. Government support for biofuel production does not appear to contribute in a very cost effective manner to reducing GHG emissions.

Second Generation Biofuels

More R&D efforts are currently being put into the production of second generation biofuels from nonfood crops, crop residues and waste. Biogas and Biomass To Liquid (BTL) fuels from organic waste or other biomass and cellulosic ethanol from crop and forest residues are options with potentially much less feedstock costs than first generation biofuels. Commercial production on a large scale probably requires much more sustained R&D effort over time. On a per unit basis, these advanced fuels have the potential to affect agricultural commodity markets much less than ethanol and biodiesel from cereals and oilseeds. Yet, when taken into production on a large scale, there likely will be strong impacts nevertheless. Much will depend on how the production of feedstock biomass is affected

to grow these new biofuels. If large quantities come from cropland, these will compete with food and feed commodities and may have similar market effects as current production chains. On the other hand, biomass production on land other than current cropland will significantly expand total production area. Policies will then need to ensure the protection of sensitive areas and high carbon soils to avoid negative environmental effects, including increased greenhouse gas emissions.

BIOFUELS, THE FOOD CRISIS AND POVERTY

Rising food prices put biofuel production and government support for it further into a controversial spotlight. Clearly the increased production of cereal-based ethanol and of oilseed-based biodiesel causes prices for grains and vegetable oils to be higher than they would be without this support. For livestock products, the price effects differs between grain-based ethanol (resulting in somewhat higher meat and dairy prices) and oilseed-based biodiesel (lowering livestock prices) as the former creates an additional net demand for feed products while the latter increases supply of protein feed. The implications for food prices and particularly for food security and poverty are, however, much more complex than those for basic commodity prices.

At this point, it is time to address the possible impact of higher food prices on poverty and, in particular, how much comes from rising demand for biofuels. Next, a discussion of whether there is a prospect of win-win options where biofuel production might no longer compete with food security and new farm income and employment opportunities might contribute to poverty reduction, will be conducted.

Impact of Biofuel Production on Food Prices

The surge in food prices during 2007–08 visibly affected poor people in developing countries, facing higher cost of living and reduced access to food, in some cases – such as in Haiti – leading to major explosions of social unrest. Estimates regarding the impact of rising demand for biofuels on world food prices vary widely. A World Bank study suggests that the increased use of feedstocks for biofuels explains 70–75 per cent of the recent hike in food prices, with the remaining 25–30 per cent caused by higher oil prices and dollar depreciation (Mitchell 2008). The impact of biofuels is mainly because of increased demand for cereals and vegetable oils. Brazil's sugar cane-based ethanol has not raised sugar prices significantly.

Estimates by Mark W. Rosegrant of the International Food Policy

Research Institute (IFPRI) suggest that increased biofuel demand during the 2000–07, compared with previous historical rates of growth, would have accounted for 30 per cent of the increase in weighted average grain prices. The biggest impact was on maize prices, for which increased biofuel demand accounts for an estimated 39 per cent of the increase in real prices. Increased biofuel demand accounts for an estimated 21 per cent and 22 per cent of the increase in, respectively, rice and wheat prices (Rosegrant 2008).

A study by the OECD (2008) equally concludes that the impact of biofuel demand (and of biofuel policies in the developed countries) on agricultural commodity prices are important, but that their role should not be overestimated. In agreement with the World Bank study, it concludes that the price effects derive largely from increased demand for grains and oil seeds. Singling out the effect of biofuel-support measures, the OECD study estimates that government support may explain the increase in average wheat, maize and vegetable oil prices by 5, 7 and 19 per cent, respectively.

Impact of Food Price Increases on Poverty

The impact of the rise in food prices on living standards will differ across countries and population groups. At the country level countries that are net food exporters may benefit from improved terms of trade, although some of them are missing out on this opportunity by banning exports to protect consumers. In contrast, net food importers likely will struggle to meet domestic food demand. Countries in Africa will be hard hit, as most are net importers of cereals. At the household level, surging and volatile food prices hit those who can afford it the least – the poor and food insecure. The few poor households that are net sellers of food will benefit from higher prices, but households that are net buyers of food – which according to data from the World Bank, represent the large majority of the world's poor – will be harmed (see Table 14.2). Adjustments in the rural economy, which can create new income opportunities, will take time to reach the poor.

Further, also in contexts where the rural poor are net sellers of food, they often do not (immediately) benefit from higher food prices as local farm prices often do not tend to rise commensurately to world market prices; for instance, when small holders do not have direct access to markets and are dependent on intermediaries.

What impact the recent food price surge may have on poverty is difficult to estimate, as it will not only depend on the effect of the price increase itself and whether people near the poverty line are net buyers or net sellers of food, but also on government responses, wage adjustments and economy-wide effects. Lacking comparable information about such responses and appropriate models to assess the interaction effects we defer to a simpler exercise.

Table 14.2 Most rural poor are not net sellers of tradable food staples

	Bolivia 2002	Ethiopia 2000	Bangladesh 2001	Zambia 1998	Cambodia 1999	Madagascar 2001	Vietnam 1998
Share of internationally traded staples in food consumption of the poor (%)	25.5	24.1	41.2	40.4	56.3	62.7	64.4
Distribution of poor (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Urban (buyers)	50.9	22.3	14.9	30.0	8.4	17.9	6.1
Rural landless (buyers)	7.2	–	53.3	7.4	11.5	14.8	5.8
Smallholders net buyers	29.1	30.1	18.8	28.8	25.8	18.9	35.1
Smallholders self-sufficient	7.1	39.5	4.6	20.8	18.0	27.3	19.4
Smallholders net sellers	5.6	8.0	8.4	13.0	36.3	21.1	33.6
Share of net purchase/sale of staples by groups of poor (% of total expenditures of group)							
Purchase of net urban buyer	12.0	9.4	22.7	11.5	5.9	4.8	13.1
Purchase of net rural buyer	12.9	28.4	27.3	18.9	20.8	10.7	19.9
Sales per net seller	37.6	35.1	39.7	21.0	39.0	70.3	37.4
Share of net purchase/sale of staples aggregated across all poor (% of total expenditures of poor)							
Purchase by all poor net buyers	11.3	10.2	22.0	10.3	8.1	3.6	8.8
Sales by all poor net sellers	1.4	2.8	4.0	2.3	14.4	18.4	12.5

Source: World Bank (2007), Box 4.7, p. 109.

Table 14.2 above presents results of a simple simulation exercise that only takes the food price increase into consideration and assumes (possibly correct by large numbers, but likely with large margins of error for specific country cases) that the poor and those near the poverty line are net buyers of food and, hence, directly adversely affected by higher food prices.

Next we have to form a picture of the relationship between the rise in agricultural commodity prices and food prices for consumers in different countries and regions. This relationship tends to be unclear. Basic food commodities make up only a small share of value added in retail food. For instance, milled field corn only makes up less than two per cent of the costs of a box of corn flakes cereal, despite being 70 per cent of the volume (JP Morgan, Global Data Watch, 15 February 2008). The remainder goes into labour costs, transportation, packaging, advertising and so on. Regressing the 12-month change in food prices on the 12-month change in the agricultural commodity price index (lagged 12 months),³ JP Morgan (ibid.) estimates that in developed countries the pass-through effect of world market commodity prices on consumer inflation is rather modest, though varying across countries. For developed countries, a 1 per cent increase in the commodity price index would raise consumer food prices by only 0.03 per cent. The effect is a bit more than twice as large (0.07 per cent) in emerging Asian countries and three times as large in Latin America (0.09 per cent). In the poverty simulations presented below we use these estimates on the pass-through effects for Asia and Latin America. In the case of sub-Saharan Africa, a substantially higher pass-through effect is assumed (that is of 0.27 per cent for each increase in the agricultural commodity price index) given that those countries typically have a much larger share of agricultural commodities in value added in food consumption.

Between 2006 and 2008, expectations were for world market prices for agricultural food commodities (composite index) to increase by 69 per cent, according to estimates and forecasts of the United Nations' *World Economic Situation and Prospects* (United Nations 2008a). This would translate into average food price increases for consumers in the various regions of, respectively, 5 per cent in East and South Asia, 6 per cent in Latin America and 19 per cent for sub-Saharan Africa. The poverty line of USD 1 per day (which is assumed to reflect, in Purchasing Power Parity (PPP) terms, the cost of the basic food basket for the poor) is increased by those corresponding percentages for a large sample of countries in the indicated regions.⁴ Re-estimating the poverty incidence was subsequently necessary, after considering the presumed price. As it is assumed that regional price increases based on the regional averages of the pass-through effects are uniform across the countries within each region, only the results of the poverty impact per region are shown. As the pass-through effects

were estimated based on observed data, they do implicitly account for domestic factors that may limit pass-through further, such as subsidies or price controls on certain commodities.

Table 14.3 gives the results.⁵ It suggests that under the given assumptions, the recent surge in global food prices would put about an additional 126 million people at risk of falling into poverty and the total number of poor in the countries covered would increase from 806 to 915 million (the base year for all poverty and population observations is 2004). Almost one-half of the increase (48 million) would affect people in South Asia, especially India, and there also would be a substantial increase in the number of poor in sub-Saharan Africa (37 million). The extreme poverty incidence would increase by 2.8 percentage points to 23 further. Africa would be hardest hit, in relative terms, as the poverty incidence would rise by 7.8 percentage points, implying that the recent food price increases would have more than wiped out the amount of poverty reduction achieved in the region between 1990 and 2004.

All other things being equal, with an estimated impact of biofuels on food prices of somewhere between 15 and 70 further, according to the estimates cited above, it could be argued that government stimulus for biofuel production, especially in the OECD countries, may have driven between 19 million and 88 million more people into poverty. These estimates have to be taken with great caution given the assumptions made and a number of potential benefits that have not been accounted for. However, for the reasons explained below these most likely entail promise for contributing to poverty reduction in the future if the right policies are implemented, rather than they carry much weight at present. Hence, the concern that biofuel production at present is an impeding factor to reaching the United Nations' Millennium Development Goal of poverty reduction is warranted.

Opportunities for the Poor

Higher prices due to biofuel expansions as well as the development of adapted biofuel production systems in developing countries can create new income opportunities for rural and agricultural communities. As indicated, differentiation between subsistence and market producers and between net sellers and net buyers of food in developing countries is necessary. Net sellers of agricultural produce will benefit from higher prices to the degree they have connections to markets integrated with international trading systems. Better income opportunities might also derive for landless workers in agriculture given the incentives to intensify agricultural production. However this potential is described as fragile, and is reduced where

Table 14.3 *Impact on global poverty of surge in agricultural commodity prices*

	Simulated pass-through to consumer food prices of 69% increase in world agricultural food prices, January 2006 – March 2008	Poverty Incidence (%) (USD 1 PPP per day poverty line)			Number of poor (millions)			Total Population covered in simulation (million)
		base (2004)	food price simulation	Increase poverty incidence	base	Food price simulation	Increase in Poor	
East Asia	5%	9.6	10.8	1.2	183.8	207.5	23.8	1,918.2
South Asia	5%	31.2	34.7	3.5	479.6	532.6	53.0	1,537.1
Latin America & Caribbean	6%	8.7	9.6	0.9	47.2	52.2	5.0	544.0
Sub-Saharan Africa	19%	36.9	44.6	7.8	207.8	251.5	43.7	563.3
Total		20.3	23.1	2.8	927.7	1053.5	125.8	4562.6

Source: United Nations Department of Economic and Social Affairs (UN/DESA) based on household survey data using the POVCAL database of the World Bank. See Vos (2008) for estimation methodology.

feedstock production tends to be large scale or causes pressure on limited agricultural resources: capital investment, land, water and the net cost of food for the poor.

Biofuels rely on many of the same policy, regulatory or investment shortcomings that impede agriculture as a route to poverty reduction. It is difficult to generalize about the impacts of biofuels on poor people because of the differing effects of different feedstocks/production systems; varying downstream (transportation) costs; existing (nonbiofuel) crop production and processing patterns; and patterns of land holding. With sugarcane, biofuel yields can be very high reducing the pressure on land, but the economies of scale sought by producers and subsequent land concentration may reduce access by the poor to land. This is likely to also be the case with palm oil.

The required economies of scale in farm production for ethanol are likely to favour large scale production systems. Adaptation on small farms will depend on outgrower schemes or on the successful engagement of cooperatives and other producer organizations (Peskest *et al.* 2007). In the case of off farm, how far existing agroindustry will be able to transform to biofuels production and what roles public and private investment may have, will be context specific.

The arguments illustrate the complexity in understanding the precise impact of the expansion of biofuel production on agricultural growth and poverty. The net implications are difficult to identify and meaningless unless placed in country-specific contexts. It is clear though that many of the problems that emerge from biofuels are not unique to biofuels but are challenges facing agricultural development policy for many decades.

GREEN OR MEAN?

Liquid biofuels can replace only a small share of global energy supplies and will not eliminate dependence on fossil fuels. Even so, expanding biofuel production is exercising an important impact on world agriculture and a mostly adverse effect on food security. This impact may become stronger over subsequent decades unless there is an important shift away from current policies. Presently, the production of biofuels in many but not all countries is not economically viable, given existing agricultural production and biofuel processing technologies, even at historically high crude oil prices. Government support is driving the expansion of biofuel production. Among the motivating factors behind policies has been the desire to support farm incomes, promote energy security and mitigate climate change. The evidence presented in this chapter suggests that the

contributions to energy security are slight and the impact on reducing GHG emissions is minor and for certain types of biofuels even negative when the impact on land use change and loss of carbon stock is taken into consideration. Furthermore and perhaps most importantly, biofuel production is affecting food security among the poor.

Hence, where this is the case, a first shift in policy direction should be to move away from any primary focus on the production of biofuels to meet fossil-energy saving targets and towards lower energy consumption. Generally the costs of reducing GHG emissions by saving energy are much lower than by substituting energy sources.

For biofuels to play a complementary role in energy saving and climate change mitigation, further fundamental policy shifts are needed. Current biofuel policies, especially in OECD countries, consist of heavy subsidies and mandates for the sector, which exacerbate the market distortions already produced by agricultural support policies. Trade protection measures limited market access for potential developing country producers of biofuels to the detriment of an efficient international pattern of production and resource allocation. There is a need to open markets and reduce/eliminate production-linked support to biofuels to ensure the most efficient biofuel production patterns internationally. Countries must refrain from policies that explicitly promote demand for biofuel feedstock to the detriment of food supplies (for example, current mandates and subsidies for biofuel production and consumption).

Investment in research and development is critical for the future of biofuels as an economically and environmentally sustainable source of renewable energy. A clear focus needs to be on those biofuels that maximize the reduction of fossil fuel usage and GHG emissions, while research and development efforts should focus much more on second-generation technologies such as those producing biogas and BTL-fuels from organic waste or other biomass and cellulosic ethanol from crop and forest residues.

As shown, the type of land used for biofuel production affects the environmental performance of these fuels. Governments should favour the use of areas not currently used for crop production – either degraded or with low nature values – while use of environmentally sensitive land needs to be discouraged.

Further development and expansion of the biofuels sector will contribute to higher food prices over the medium term and to food insecurity for the most vulnerable population groups in developing countries. Changing existing government support in the directions suggested above would reduce this unintended impact. In addition, with a better trade environment if OECD countries would lower import tariffs on feedstock or biomass, some developing countries could gain from increased biofuel

production and exports, thereby improving their employment and income opportunities and reducing the costs of usage of biofuels.

Biofuel crops do not necessarily crowd out food crops, at least not under the alternative scenarios examined here. Instead, there is room for complementarities and synergy and rural agricultural development and socioeconomic growth can go hand-in-hand with enhancement of bioenergy production capacity. However the main challenge to support sustainable global food security will require agrarian development and reform programmes to raise investment and stimulate productivity of food production. These programmes should focus on small poor farmers since they are the most vulnerable group in the rural areas, providing investment in rural infrastructure, access to credits, access to affordable, modern farm inputs and access to land through land redistribution. South Asia and sub-Saharan Africa (and some countries in Latin America and the Caribbean) should be the priority focus of these programmes since they are the most vulnerable in terms of food security (United Nations 2008b). A recent UN report has shown that in Asia, raising agricultural productivity in all countries in the region to the level of Thailand could lift more than 200 million people out of poverty (ESCAP 2008). Increased public spending on R&D to improve agricultural technology and raise productivity is essential. In the 1980s, governments reduced R&D spending for agricultural development because it was thought that the food security problem had been resolved. This trend has been detrimental for agricultural productivity, especially for small farmers in developing countries.

The food crisis that emerged in 2008 cannot be fully attributed to the expansion of biodiesel production, but the debate spurred by the apparent trade off between food and (renewable) energy security could end with positive spin offs. A renewed priority for sustainable agricultural development in developing countries and focus on newer generations of biofuels that do not compete with food production may yield win-win outcomes. This will require major shifts in the current policy orientation and a major commitment to sustain massive investments in developing country agriculture and rural infrastructure for many years to come. So long as such changes are not forthcoming, there will be justified grounds to vilify biofuel production and government support for it.

NOTES

1. The author is Director of Development Policy Analysis at the United Nations. I am grateful to Keiji Inoue for excellent research assistance. The views and opinions expressed in this chapter are those of the author and cannot be attributed in any way to those of the United Nations or of its member States.

2. Calculations based on the Commodity Research Bureau's *The CRB Commodity Yearbook 2007* and FAO (2008).
3. The contemporaneous impact was found to be insignificant.
4. At the time of writing, newer PPP estimates and adjusted poverty lines released by the World Bank were not yet available. With the new poverty line the number of poor is estimated to be substantially higher than when using the previous poverty line, but that trends in poverty (after applying the PPP adjustments retroactively) remain similar to those observed under the previous assumptions. See Chen and Ravallion (2008).
5. The country sample with usable household survey data for the exercise covers 4 billion people in developing country regions (87 per cent of the total population of the regions in Table 14.3 and 78 per cent of that of all developing regions). The final results are adjusted for the total population of developing countries.

Appendix

This appendix comprises a sample of J.B. (Hans) Opschoor's massive list of publications on sustainable development and climate change.

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Index

- Adams, W.M. 41, 42
ADB 176
Adelman, I. 100
Advisory Opinion on the Legality of
the Threat of Use of Nuclear
Weapons 82
Africa 68, 137, 189, 242, 244
see also Sub-Saharan Africa
African Charter on Peoples Rights
81
Agency Managed Irrigation System
(AMIS) 27, 28, 29
Agenda 21 85, 114
Agrawala, S. 50
agricultural commodity prices (impacts
on global poverty) 246
Aid Strategies (assessment) 102
Al Gore 51, 148, 151
see also Gore, Al
Alaska 55
Amazon 56
Brazilian 185
Aminzadeh, S. 87
AMIS 31
Amsterdam 225
Amu Darya Delta 175
Anderson, M.S. 20
Antarctica 52, 72
anthropoids 47
Anti-genocide Convention 75
Aral Sea (shrinking) 175–6
Araral, E. 35
Armenia 175
Arts, K. 79
ASEAN 68
Asia 2, 110, 244
Ayres, R.U. 10, 203, 192, 209
Azerbaijan 156

Bartlett, S. 91
Beckerman, W. 16, 116

Beijing 222
Belgium 66
benefit-cost 31
Bergh, J.C.J.M. van den 10, 11, 192,
194, 204
Berkhout, F. 198, 208, 210
Berman, H.J. 20
biodiversity 41, 43, 63
loss 174
loss and conflict 174
loss and water 174
treaty 65
biofuels 10–11, 12
biofuel (climate change) 238
Brazil 235
China 235
economic viability 236
EU 235
food crisis 241
food process 241
global production 236
India 235
poverty 241
production growth 235–6
production 233
subsidies 13
USA 235
biological pathogens, 9
Black, R. 147–8
Blaikie, P. 121
Bolivia 73
BOT 222
see also Build, Operate and
Transfer
Botswana 136, 137, 189
boundaries 30
group 30
resource 30
symbolic 30
Bourguignon, F. 41
Bouwer, L. 53

- Brahmaputra 56
 Brazil 51
 Brookfield, H. 121
 Brown, L.R. 16, 151
 Brutland Commission 67
 Brutland Report 62, 115, 215
 BTL 248
 Burma 138
 Bush, G.W. 50
 Buzan, B. 111, 112, 152
- Canada 24
 capabilities 37
 Caribbean 59
 Caucasus 165
 CDM 97, 104
 CEA 156, 161
 CFCs 50, 52
 Central Asia 165
 Chambers, R. 180, 190
 Chicago 22
 child poverty 163, 165
 Child Rights (Climate Change) 79
 Children Alliance 84
 China 2, 47, 51, 66, 107, 169, 189, 221–2, 230
 water pollution 221
 Chinese ecological initiative 225
 see also ecological cities
 Chinese Government 9, 214
 see also China
 CIA 153
 civil wars 127
 Clean Development Mechanism 51
 see also CDM
 clean energy 13
 climate change 1, 13, 15, 40, 47, 48, 52, 80, 89, 101, 106, 152, 156
 climate conflict 142
 climate refugees 142
 consequences 5
 Convention 65
 Child Rights Convention (CRC)
 86, 96
 and development 94
 evolution of discussion 95
 impact on children 84
 ODA 107
 Clinton, Bill 224
 Clinton-Gore Administration 50
- Club of Rome 119
 CNA 142, 154
 CO₂ 1, 53, 55, 56, 114, 115, 122, 215, 224, 240
 Coastal Community Development 19
 Cold War 136, 145
 collateral damage 129
 collective action 17, 18, 35, 45
 collective choice 32
 collective farms, 160
 Collier, P. 38, 126
 Colombia 137
 Committee on the Rights of the Child 90
 Common Fisheries Policy (CFP) 20
 common pool resource 4, 13, 17, 18, 19, 26
 Conciliar Process 71
 Concluding Observation by the Committee on the Right of the Child 88
 conflict 8, 14, 126, 139
 resolution 34
 resource 126
 years and growth 138
 Consortium for Self-Governance (CSGA) 22
 Constitution of the Oceans 64
 Covenant on Economic, Social, Cultural and Cultural Rights 92
 Convention on the Rights of the Child (CRC) 79
 COP 98
 Cornia, A.G. 172
 Costa, M. 111
 Costa Rica 52
 Cote d'Ivoire 135
 CRC 86, 87, 88, 89, 90, 92
 Crutzen, P.J. 16
 CVM 119
- DAC (donors) 106
 Daly, H. 117
 Danube 69
 Darfur 111, 142, 149
 Darkoh, M.B.K. 7, 179, 189
 deluge 59, 76
 dematerialization, digital *see* digital dematerialisation
 Denmark 19, 99, 105

- deprivation (relative) 130
 desertification 74
 development (spatializing) 179
 DFID 85, 92
 Diamond, J. 55
 Dietz, T. 7, 19, 47, 121
 digital dematerialization 10, 14, 192
 digital economy 194
 Dijk, M.P. van 11, 214, 215, 218
 Dollar, D. 38, 188
 DRC (Zaire) 136–7
 DRE 240
- Earth Summit 122
 East Asia 137
 Emmerich, R. 51
 Eastern Europe 117
 EC 101
 Treaty 65, 69
 ecospace 47
 ecological cities 9, 214
 see also tomorrow's cities
 ecological city 9, 220
 see also ecological cities
 Ecological Neighbourhood 226
 see also ecological city
 economic growth 15, 37, 205
 see also growth
 economic theory 118
 ECOSOC 74
 ecospace 52
 ecosystem goods 36
 ecosystem service approach 36
 see also ESapp
 Ehrlich A.H. 100
 Ehrlich, P.R. 100
 Eichenberger, R. 20
 El Niño 53
 energy, sustainable 124
 energy prices 12
 energy security (food and biofuel) 249
 environment (institutional) 171
 environment and development 14
 environmental change 37
 environmental crisis 109–10
 Environmental Kuznets Curve 207, 107
 see also EKC
 Environmental Security Council 72
 environmental security 121
 environmental transformation 9
- EPA 50
 epistemic communities 12
 ESapp 4, 5, 42, 43, 45
 ESapp framework 45, 46
 ESCAP 249
 ethanol prices (Brazil, EU and USA)
 237
 ethnic identities 127
 EU 57
 EU-ACP 69
 Europe 68, 110
- Factor Four 122
 Factor X 207
 FAO 40, 233
 Farmer Managed Irrigation System
 (FMIS) 27, 28, 29
 FCCC 79, 87, 95, 96, 115
 federal systems (common-pool
 resources) 3
 Feigl, H. 16
 Fichter, K. 210
 Fisher, B. 4, 7, 36
 fisheries 26
 Florida 22, 54
 FMIS 31
 food prices 12, 44, 233
 biofuel impact 244
 impact on poverty 242
 food security 12
 Fortman, B. 109, 115, 121
 Framework Convention on Climate
 Change 50, 63
 see also FCCC
 France 105
 Frey, B.S. 18, 20
- G7 186
 Gabcikovo-Nagyvaros Project 83
Gaia Peace Atlas, The 110
 game theory 129
 Ganges 56
 GAO 160
Guardian, The 152
 GDP 116, 128, 129, 157, 160, 226
 Georgia 175
 George W. Bush 148
 see also Bush, G.W.
 GAAT 70
 GHG 51, 52, 53, 238–9, 248

- Giarini, O. 119
 Gibson, C. 19
 Global South 8, 144
 global warming 57
 Global Youth Climate Movement 91
 globalization 181, 183, 184, 187–8
 GNI 94, 99
 GOC 98
 Gore, Al 109
 see also Al Gore
 governance regime 25
 governance 18, 25, 33, 48
Governing the Commons 30
 graduated sanctions 33
 greed 127–8, 133
 greed versus grievance 133
 Green House Gas (GHG) 49, 59
 green or mean 247–9
 Greenland 55
 grievance 130, 133, 127–8, 140
 Gross World Product (GWP) 38
 growth 13, 139
 theory 10
 GSP 92
 Gupta, J. 6, 94, 96 103
 Gustav, Hurricane 59
 GWP 38, 39
- Hancock, G. 190
 Hansen, N.R. 16
 Hardin, G. 26
 Hartmann, B. 8, 142, 145
 Haughton, G. 9
 HDI (Human Development Indicators) 132
 HDR (Human Development Report) 6, 80, 110, 132
 health 9
 Hegre, H. 136, 139
 Henderson, H. 116
 Hertin, J. 198, 208, 210
 Hess, C. 18
 Himalayas 56
 Hisschemöller, M. 96
 Hobbes, T. 134
 Hoeffler, A. 126
hominins 47
homo 47
homoeconomicus 128
 Homer-Dixon, T.F. 148
- Hong Kong 52
 horizontal inequality 131–2, 139
 Horn of Africa 111
 Hueting, R. 120
 humanspace 47, 52
 Humphreys, M. 134
 Hungary 69
- IAEA 65
 ICE (Immigration and Custom Enforcement) 152
 ICG 177
 ICJ 82
 ICSU 49, 50
 ICT 2, 11, 192–3
 categories of effects 210–11
 impacts on dematerialization 211–12
 induced commodities 202
 information effects 200–201
 material (material impacts) 196
 micro level impacts 208–9
 National Accounts 197
 new markets, new products 202–3
 price and income effects 200
 production 197
 R&D 201–2
 see also research and development
 rebound effects 210
 stages of production 198–9
 substitution and complementarity 204
 typology 195
 IFRI 244
 Illinois 22
 ILM 65
 IMAGE 50
 IMF 16, 38, 234
 India 2, 32, 51, 66, 70, 137, 189
 Indian Ocean 59
 Indian University 19
 Indiana 22
 Indianapolis 22
 Individual Transferable Quota (ITQ) 25
 Indonesia 135, 136, 137
 Indus 56
 industrialization 9
 inequality 37
 horizontal 127, 140
 vertical 127

- information 195
 definition 195
 economy 194
 markets 118
 insecurity (environmental) 117
 Institute of Fisheries Management 19
 Institutional Framework (cotton
 production) 168
 Inter-American Commission on
 Human Rights 83
 Inter-American Declaration 83
 intergenerational equity 66, 67
 International Court of Justice 61, 69
 see also ICJ
 International Forestry Resources and
 Institutions (IFRI) 33
 International Environmental Law 60
 and humankind 64
 International Timber Organization 74
 Inuit 55
 IPCC 1, 5, 16, 50, 51, 85, 95, 97, 239
 IUCN 62
 IUWM 217

 Jansen, M. 88
 Japan 105, 125
 Johannesburg (World Summit) 65
 Johannesburg Conference 2, 3, 66
 Johnson, R.N. 16

 Kant, I. 133–4
 Kaplan, R.D. 150
 Kathmandu 132
 Katrina, Hurricane 54, 59, 144, 149,
 150
 Kazakhstan 156
 Kenworthy, J.R. 9, 219
 Keynes, J.M. 116
 Khayesi, M. 7, 179,
 Kilimanjaro 56
 Kellogg, Brown and Root (KBR) 152
 Korea, South 137
 Kraay, A. 188
 Kuhnert, S. 19
 Kyoto Protocol 50, 79
 Kyrgyzstan 156

 La Niña 53
 Lam, W.F. 27, 28
 Latin America 2, 68, 189, 244

 Law of the Sea 65
 Lempert, R.J. 10
 Lerman, Z. 160, 161
 Licari, L. 86,
 Limits to Growth 119
 Linderhof, V.G.M. 192
 Lipset, S. 135
 Live Cycle Analysis (LCA) 194
 livelihoods 37
 lobster 27
 Local Public Economies 24
 Locke, J. 134

 Maastricht Treaty 101
 MAGW 50
 Malaria 9
 Malaysia 70
 Male Declaration on the Human
 Dimension of Climate Change 87
 malnourishment 163
 see also malnutrition
 malnutrition 164
 see also malnourishment
 Malthus, T.R. 145
 Malthusian (population/scarcity) 143,
 144, 147
 marginal analysis 43
 markets (restructuring) 120
 markets (using) 122
 Martinez-Alier, J. 38, 39
 Massey, D. 184
 Material Product Chain (M-P) 194
 Mbaiwa, J.E. 189
 McCarthy, T. 48
 McGinnis, M. 19, 22
 McKenzie, M. 92
 McLaughlin, S.B. 16
 Memanus, P. 9
 MDGs 2, 3, 4, 40, 45, 80, 123, 222
 see also Millennium Development
 Goals
 MDGs Declaration 3
 Meadows, D.H. 119
 MEDEA 153
 Mediterraneanization 56
 Metropolitan 23
 Mexico 51, 70
 Millennium Summit (UN) 60
 minimal recognition of rights 34
 Mintrom, M. 19

- Missouri 22
 Mol, A.P.J. 11–12, 16
 monitoring 32, 33
 Montisquieu, C.L. 134
 Moon Treaty 63
 Morrison, C. 41
 mortality (under 5) 163
 Moss, R.H. 112
 Mozambique 137, 138
 multiple switches 139
 Munton, R. 186
 Murshed, S.M. 7, 8, 126, 138
 Myers, N. 145–6
- N_2O 239
 National Academy of Science Panel on
 Common Property 26–7
 National Geographic 52
 National Research Council 27
 natural disasters 89
 NeoMalthusian 8, 100
 Nepal 27, 29, 31, 35, 132
 Irrigation Institutions System (NIIS)
 27, 28
 Nepali farmers 35
 nested enterprises 34
 Netherlands, The 49, 50, 54, 56, 99,
 105, 244
 Ministry of Foreign Affairs 123
 Netting, R. McC. 20, 26
 New International Economic Order
 62
 New Orleans 150
 New York 22
 New Zealand 53
 Newman, D. 114
 Newman, P. 9
 NGETs 10
 NGOs 50, 52, 70, 74, 82, 83, 97, 103,
 104, 105, 118, 142
 Community 50
 Joint European NGOs Report 104
 Nigeria 135
 Noordwijk Declaration 95
 North 54, 55, 94, 95, 114
 North–South 94, 95
 see also Global North
 North European Coast 56
 North Pole 57
 Norway 52, 73, 99, 105
- ODA 98, 106
 OECD 44, 67, 97, 98, 99, 101, 103, 107,
 206, 207, 236, 239, 244, 245, 248
 OECD-DAC 98
 OHCHR 88
 Oposa Judgment 82
 Opschoor, J.B. 3, 11, 17, 18, 19, 47, 48,
 58, 59, 75, 76, 109, 112, 115, 117,
 120, 124, 125, 191, 192, 194, 215
 Ostrom, E. 3, 4, 17, 18, 19, 20, 21, 23,
 26, 30, 35
 Our Common Future 68, 182
 see also Brutland Report
 Outer Space Treaty 63
- Pagiola, S. 42, 44
 Paine, T. 134
 Pakistan 70
 Parks, R. 23
 Patzek, T.W. 16
 peace (perpetual) 134
 PES 4, 5, 44, 45
 Philippines, 71, 82, 137
 polarization (economic) 131
 police 23
 policy research 43
 pollution (water and air) 176
 polycentric 17
 approach 22
 theory 21
 see also polycentricity 19, 24
 poverty 5, 36
 alleviation 41
 child 157
 income poverty 157
 non-income poverty 157
 rates in Kazakhstan 167
 reduction 2, 5, 15, 37
 rural and national poverty 156,
 159
 trap 126
 and vulnerability 158
 PPP 244
 see also purchasing power parity
 precaution 59
 Precautionary Principle 43, 64, 65
 Prisoner's Dilemma 113
 property rights 129
 proportional equivalence 31
 public goods 17, 18, 20, 37

- R&D 240
see also research and development
- Rasmussen, L. 114
- rational choice theory 126
- RDS-TMC 2003
- redistribution of risk 110
- refugees (climate) 144–5,
 refugees (environmental) 144–5
 refugees (Army Corps of Engineers)
 151
- regime matches 25
- Reijnders, L. 202, 207
- remittances 162
- research and development (R&D) 196
- resource (degradation) 168, 173
- Rio de Janeiro 67
see also Rio Declaration 62, 68
- Rita, Hurricane 59
- RIVM 50, 205
- Robinson, M. 84, 90
- Rokx, C. 164
- Ross, M.L. 140
- Rotterdam 224
- Rubige, B. 48
- Russia 73, 159
- Sachs, W. 114, 142
- Sahel 55
- Salih, M.A.M. 1
- Sancton, A. 24
- Sands, P. 61
- Satterthwaite, D. 9
- Scandinavia 55
- Schrijver, N.J. 59, 64
- securitized (environment) 152
- security 59, 110
 conceptualizing 110
 environmental 109, 111–12
 environmental strategies 113
 human 110
 livelihood 154
 national 143
- self organized systems 33
- Sen, A. 37, 100
- SEPA 222
see also State Environmental
 Protection Agency
- Shelton, D. 87
- Siberia 55
- Simmons, C.S. 185
- Singapore 137
- Slovakia 69
- Small Police Agencies 23
- SMEs 199
- Smith, Adam 115
- SMSAs 23
- social capital 33
- social contract 133
- soil salinity 174
- South 54, 114
- South Africa 47, 110, 245
- South Asia 249
- South, Canada 55
- South Korea 125
- Southeast Asia 57
- SPA 197
- Spoor, M. 7, 156, 158
- Sri Lanka 137
- Srinivasan, U.T. 39
- St. Louis 22
- Standard Metropolitan Statistical Area
 23
see also SMSAs
- state procurement 170
- state farms 160
- Statistical Classification of Products by
 Activity 195
see also SPA
- Stewart, Francis 131
- Stockholm Conference 81
- Stockholm Declaration 62
- Sub-Saharan Africa 245, 249
- sustainability 59, 71
- substantive law 120
- supply chain (cotton) 172,
 sustainability (strong and weak) 72,
 116
- sustainable development 1, 13, 15, 59,
 179, 181, 182, 184–5
 principles 67, 70
 spatial dimension 182
 sustainable city management
 219–20
- sustainable urban development 67,
 214
- sustainable water planning research
 results 229–30
- Sweden 61, 99, 105
- Switch approach (research) 9, 217, 219
- Switzerland 20

- Tai Lake 223
- Taiwan 137
- Tajikistan 156
- Tampa-St Petersburg 22
- Tanzania 138
- taxation 170
- taxes 170
- Thailand 70
- Tinbergen, J. 42, 72
- Third World 145
- Tomorrow's cities 9
 - see also* ecological cities
- Toonen, T.A.J. 20
- Total Productivity Factor 205
 - see also* TPF
- tragedy of the commons 25
- Treaty on Migrating Fish 65
- Treaty on Persistent Organic Pollutants 65
- Truman, H.S. 99
- Turkey 51
- Turkmenistan 156
- Turner 4, 7, 36

- Uganda 137
- UK Government 186
- Ukraine 159
- UN (Commission for Europe) 81
- UN (High Commission on Human Council) 84
- UN (High Commission on Human Rights) 84
- UN Convention on the Law of the Sea 63, 67, 68
- UN Millennium Project 40
- UN Trusteeship Council 72
- UNCED 112
 - see also* Rio Declaration
- UN/DESA 246
- UNDP 6, 16, 49, 50, 85, 110, 111, 142, 149
- UNESCO 60, 63, 175
- UNESCO-IHE 216, 223
- UNICEF 84, 91, 161, 164
- United Nations (Charter) 61
- United States (US) 24, 54
- Universal Declaration on Cultural Diversity 63
- UNWEO 74

- urban water cycle management 218
- urban water management approaches 224–5
- urbanization 9
- US 57
 - DoD or Department of Defense 153
 - Homeland Security 153
 - Northern Command 153
- Uzbekistan 156

- VAT (Value Added Tax) 122
- Vellinga, P. 53
- Venezuela 73
- Verbruggen, H. 192, 205
- Vos, R. 12, 100, 233

- Wackernagel, M. 9
- Walsh, M.E. 16
- water, piped 162
- water city (Wuhan city in China) 223
- water recycling system 226–7
- WCED 60, 100, 115, 182
- Weeramantry, Judge 83
- Wernick, I. 16
- West Africa 53
- West European Community 117
- wetlands (in Chinese ecological cities) 229
- Whitaker, G. 23
- WHO 85, 86
- WIEWLS 239
- Wilde, Oscar 118
- Wilson, D. 19, 20
- WMO 49, 50
- World Bank 66, 91, 158, 168, 233, 241, 242, 234, 243
- World Declaration on the Survival, Protection and Development of Children 84
- World Development Indicators Database 39
- World Development Report (WDR) 38
- world food prices index 234
- World Heritage Convention 61
- World Heritage Sites 61

World Summit 3, 84, 112
 on Children 84
 Johannesburg 112
WTO 16, 68, 70
 The Appellate Body 70

Yangtze River 223

Zambia 138

Zimbabwe 138