Edited by

Eija Palosuo

Rethinking Development in a Carbon-Constrained World

Development Cooperation and Climate Change

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MINISTRY FOR FOREIGN AFFAIRS

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Edited by Eija Palosuo

Assisted by members of the Steering Committee Anja Nygren / University of Helsinki, Milma Kettunen and Matti Nummelin / Ministry for Foreign Affairs of Finland, Tytti Nahi / Service Centre for Development Cooperation – KEPA and Joanna Saarinen / Finnish Meteorological Institute.

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Notes on Contributors

Shardul Agrawala is a Senior Economist, Climate Change, Environment Directorate, at the Organisation for Economic Cooperation and Development (OECD), where he leads the work programme on Climate Change and Development. He served as the Convening Lead Author (CLA) for the chapter on Adaptation Practices, Constraints and Capacity for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Dr. Agrawala received his PhD from Princeton University, and has previously held positions at Princeton, Columbia and Harvard universities.

Aaron Cosbey is a development economist specialising in the areas of trade, investment and climate change as they relate to sustainable development. He is an Associate with the Trade & Investment programme, and with the Climate Change and Energy programme at the International Institute for Sustainable Development, Canada, where he heads up the Institute's work on trade and climate change.

Florence Crick completed her PhD on 'Rural household adaptation to drought in Africa' at the University of Oxford. She recently worked for the Environment Directorate of the OECD for 18 months as a Climate Change Adaptation Consultant. Dr. Crick has now moved to Brisbane and works as a Research Coordinator in the new Australian National Climate Change Adaptation Research Facility.

Yannick Glemarec is a specialist in policy dialogue, development and finance in the areas of climate change, environment, and energy. After holding various positions in UNDP Country Offices in Viet Nam, China and Bangladesh, he has been serving since 2007 as the UNDP Executive Coordinator for the Global Environment Facility and Director of Environmental Finance. In this capacity, he has responsibility for the operational management of a USD 6 billion portfolio comprising about 1,000 projects and activities in over 140 countries.

Jose Miguel Guzman is a Demographer from the Dominican Republic with a PhD from the University of Montreal. Currently Chief of the Population and Development Branch within the Technical Division at UNFPA, he worked many years at CELADE/ECLAC and has taught, researched and published extensively on issues of population policy, reproductive health, gender, fertility and ageing.

Stefan Gössling is a Professor at the Department of Service Management, Lund University, Sweden. He has worked extensively on tourism and development processes in the Western Indian Ocean, as well as tourism and global environmental change. His edited books include Tourism and Development in Tropical Islands (Edward Elgar, 2003), Tourism and Global Environmental Change (with C.M. Hall, Routledge 2006) and Climate Change and Aviation (with P. Upham, Earthscan 2009).

C. Michael Hall is a Professor in the Department of Management, University of Canterbury, New Zealand and a Docent in the Department of Geography, University of Oulu, Finland. Coeditor of Current Issues in Tourism, he has published widely in the area of tourism, gastronomy and environmental history. He is currently undertaking research on tourism and regional development, global environmental change and local food systems.

Markku Kanninen is a senior scientists at the Center for International Forestry Research (CIFOR). He has published about a total of some 250 publications on forest ecology, climate change, and forest management. He holds an ScD degree from the University of Helsinki, Finland. He has been actively involved in the work of the Intergovernmental Panel on Climate Change (IPCC) since 1990. He is a member of the Finnish Academy of Sciences and Letters.

Karina Kristiansen is Research Associate at International Alert, primarily working on the climate change and conflict programme. She holds an MA in Conflict, Security and Development from King's College London, and she previously interned at the UN Office for Coordination of Humanitarian Affairs (OCHA).

Lim Li Ching (B.Sc. Ecology, M.Phil. Development Studies) is a Senior Researcher at Third World Network, an international NGO based in Malaysia, focusing on biosafety, sustainable agriculture and climate change issues. Li Ching is also a Senior Fellow of the Oakland Institute, USA. She was a lead author in the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAAASTD) and coeditor of *Biosafety First* (Tapir Academic Press, 2007).

George Martine is a Sociologist/Demographer with a PhD from Brown University who has worked many years on development issues, especially in Latin America. He recently authored UNFPA's pioneering report on "Unleashing the Potential of Urban Growth" and is Senior Editor of a recent Earthscan book ("The New Global Frontier: Cities, Poverty and Environment in the 21st Century").

Axel Michaelowa is researcher at the University of Zurich and partner in the CDM Consultancy Perspectives. His research focuses on the Kyoto Mechanisms, particularly the CDM. He is a Member of the Board of the Swiss Climate Centre Foundation, and was a lead author in the IPCC's 4th Assessment Report.

Katharina Michaelowa is professor of political economy and development at the University of Zurich and director of the Center for Comparative and International Studies (CIS) at the ETH and the University of Zurich. Her work focuses on decision-making processes in developing countries as well as in international organisations and bilateral donor organisations.

Sarah Mohan is a consultant with the North-South Institute on climate change issues. She is currently a programme officer at USC Canada, and has previously worked for the International Centre for Trade and Sustainable Development, Consumers International, and the Make Poverty History Campaign, on issues ranging from climate negotiations to special and differential treatment of developing countries at the WTO.

Bill Morton is Senior Researcher, Development Cooperation, at the North-South Institute, Canada. His main research areas include international policy on aid effectiveness, governance of the aid architecture and Southern perspectives on aid and development effectiveness. Prior to The North-South Institute he worked in the Asia-Pacific branch for an international projects consulting company, and with Oxfam on their Horn of Africa program.

Peter Newell is Professor of Development Studies at the University of East Anglia. He has worked on climate change issues for over 15 years and conducted research and

policy work for the governments of the UK, Sweden and Finland as well as international organisations such as UNDP and GEF and a range of environment and development NGOs. He was recently awarded a UK Economic and Social Research Council *Climate Change Leadership Fellowship* to work on *The Governance of Clean Development*.

Eija Palosuo is a journalist and a communications officer with focus on development and environmental issues. Prior to having produced this publication for the MFA of Finland, she has worked with various media, NGOs and organisations in the field of development cooperation, most recently with the UNDP Nordic Office in Copenhagen.

Wolfgang Sachs is an author, university teacher and journal editor. Between 1966-1975 he studied and took degrees in theology and the social sciences in Munich and Tübingen before taking his PhD at Berkeley. Since 1993, he has been Senior Fellow at the Wuppertal Institute for Climate, Environment and Energy. He is currently Head of Research on globalisation and sustainability. He is a Docent at Kassel University, and a frequent guest lecturer at Schumacher College, England. Member of the Club of Rome.

Jayant Sathaye is a Senior Scientist and Leader of the International Energy Studies Group at Lawrence Berkeley National Laboratory, University of California, with a BTech (Hons) degree from the Indian Institute of Technology, and a PhD. from the University of California. In the 1990s he authored nine publications of the Intergovernmental Panel on Climate Change, and was a Coordinating Lead Author for the Sustainable Development and Mitigation chapter of the Report of Working Group III of the IPCC Fourth Assessment.

Virginie Schwarz is a specialist in public policies on energy and climate change mitigation. She has been in charge of French electricity market policies and regulations, and Director for energy and air quality in the French Agency for Environment and Energy Management (ADEME). Since 2006, she has been advising UNDP on climate change mitigation policies and strategies.

Daniel Scott is a Canada Research Chair in Global Change and Tourism at the Faculty of Environment, University of Waterloo, Canada. He is the Chair of the World Meteorological Organization's (WMO) Expert Team on climate and tourism and was the lead author of the 2008 Technical Report 'Climate Change and Tourism: Responding to the Challenges' published by the World Tourism Organization.

Dan Smith is Secretary General of International Alert, London, and a member of the Advisory Group of the UN Peacebuilding Fund. He is the lead author of the ground breaking report 'A Climate of Conflict' (2007) on the links between climate change, peace and war. Previously (1993-2001) he was Director of the International Peace Research Institute, Oslo.

Preface

Expectations are mounting as the ongoing climate negotiations approach their culmination in Copenhagen in December 2009. The road travelled has been a learning process: many insights have been gained during the gradual establishment of the international system to address the daunting problems of climate change. Today we better understand the nature of man-made climate change, not "just" as an environmental problem, but indeed as a critical development issue.

By now it is evident that the impacts of climate change have become a major threat to the efforts to eradicate poverty and achieve the Millennium Development Goals in general. In order to lead to sustainable outcomes, all development actions must take this emerging factor into account. Neither livelihoods of rural peasants, habitats of urban dwellers, nor economic and social infrastructure can be improved unless plans are adapted to take into account the changing climate. In many cases, stand-alone adaptation measures will be required.

At the same time, development policies, programmes and projects need to be part of the solution, not part of the problem. In order to keep the social and economic costs of adaptation affordable for humankind, the root causes need to be addressed. Rethinking of our development path by all actors is needed, with a view to bringing the greenhouse gas emissions down to a sustainable level. Rich countries obviously have the greatest responsibility, but developing countries can also contribute by discarding the choices that have proven to be dangerous. Development aid can help in this task. Ways and means have to be found through which people in all countries can lead a life worthy of human dignity, in a way that is compatible with the constraints set by nature.

Rarely has the concept of sustainable development been as valid as now: there is a pressing need to reconcile the economic, social and environmental dimensions of development. The current economic crisis has made it all the more evident. But at the same time, the crisis has also highlighted our opportunities. Basic economic structures are being reviewed, and governments are taking measures to reinvigorate economic development. These measures can be directed towards stimulating environmentally sound production and consumption, thereby continually and permanently reducing environmental stress.

The issue of climate change and development has many facets, and the authors of this book approach it from a variety of angles, with special reference to development cooperation. As such the articles can provide enriching, substantive inputs not only into the process leading to Copenhagen, but also into practical development work. For climate change negotiators and experts, the articles can help in setting policies in a wider context with a view to finding practicable win-win-win solutions. For the benefit of the development community, they elaborate underlying interlinkages and present practical suggestions for improving day-to-day work.

The book covers immediate concerns, but ends by providing long-term visions. Both elements are essential: visions are required for choosing the direction of travel, but it is also necessary to understand the immediate as well as the future challenges of the route. We need many books as companions on the way to climate security, let this be one of them.

Outi Berghäll
Director, Climate Change
Finnish Ministry of the Environment (2000-2007)

Overview

Eija Palosuo

In search of a revised vision

In the last few years, increasingly loud warnings of the effects of climate change have been sounded by influential groups of scientists, rolling out scenarios so startling they are difficult to fully comprehend or act upon. The Intergovernmental Panel on Climate Change (IPCC) warns of frequent heat waves, heavy precipitation events, droughts and tropical typhoons. The much cited *Stern Review on the Economics of Climate Change* counts the monetary costs, predicting for example that cereal production will drop significantly in the Southern hemisphere, with severe consequences. Maybe because of the scientific nature of climate discussion, it has been difficult for many sectors of society to deal with it and to decide how seriously the whole issue should be taken. If the worst scenarios are realised, that would mean prioritising climate change above all our current concerns. However, uncertainties remain that allow us to stall, debating on how big a risk we are willing to take. Furthermore, the impacts of the economic crisis on the international climate regime are yet to be seen.

Links between development and climate change have increasingly been made and brought into the spotlight, resulting in progress in certain areas. Despite the initial steps taken, bridging the gap between the climate change community and the development community remains a challenge, as noted by the OECD specialists Shardul Agrawala and Florence Crick in their article in this book. The two communities have different priorities, often operate on different temporal and spatial scales, and do not necessarily speak the same language. Significant proportions of annual official aid flows are being directed towards activities affected by climate risks: failing to consider these risks – apart from the possibility of wasting resources - could even contribute to increasing the vulnerability of societies to the impacts of climate change in some types of development projects.

Even more difficult than trying to identify the changes needed in current development activities, is trying to see the big picture: the vision we hold about development in general and development cooperation specifically. What is "the better world" that we are trying to build, and how relevant to creating it are the current strategies we embrace? In a very short period of time, prospects for future conditions all over the planet have seriously been shaken, with climate change and numerous other, emerging environmental problems causing us to question the very basis of industrial civilisation. Development cooperation has grown as part of the same history, and based on the same assumptions, and consequently, would benefit from being updated accord-

ingly. It is this difficult challenge that this book presents and discusses.

Where is our focus today, regarding development priorities? In 2005, the UNDP in its annual Human Development Report named development assistance, international trade, and security as the three pillars of cooperation to pay attention to, in order to reach the Millennium Development Goals (MDGs) by 2015. These pillars may well be used as examples here, as all three are of central importance in the current development paradigm; at the same time, they cannot be dealt with "outside" of the impact of climate change.

1. Increased aid is required in order to reach the MDGs, but how much is enough in the new situation? The growing flows of money for adaptation and the questions about governing the new funds are changing the picture quite a bit. There is also the question of the costs of reacting to climate change in donor countries: how will the required measures influence their political will and national budgets?

2. International trade has proven an effective motor of development for numerous previously poor countries: how far and in which way should we count on it in the future? If for example, the abovementioned predictions for the future of cereal production prove correct, the resultant lack of grain will obviously have consequences not only for food security, but also for the trade prospects of those countries, whose development scenarios depend on agricultural exports. In addition, the high hopes of tourism as a boost to development might require re-evaluating, as the results of the mitigation policy regime may easily be reflected in increased costs of international travel. Of course, the entire field of tourism is very much in the centre of the climate change discussion.

3. In regard to security, the prospects for decreasing the number of violent conflicts and spreading democracy might face new obstacles brought about by climate change. Good governance has been one of the key concepts in development cooperation for some time now, and based on the articles in this book, that emphasis should be further increased and reinforced.

Although these questions are fundamental to creating a vision of successful development, trying to address them can be very daunting. However, there could be a positive side to all this, with new possibilities emerging. Development and climate change discussions often seem to be on a collision course, but they do not need to be: common goals and targets can be set and common interests found. The global nature of the problem ensures that both the North and the South will remain strongly interdependent by each others' actions in trying to fight climate change, and new structures of international cooperation and new coalitions could be formed in the process. Could we finally hope for more equity? Could we create a vision of development that is based on cleaner energy and less consumption, one that leads to a redistribution of global resources on a more equal basis?

Structure and themes of the book

This book aims to provide Elements for Discussion for those involved in development and development cooperation as practitioners, decision-makers and researchers, at a crucial moment just prior to the Copenhagen Climate Conference. The contributors include researchers from academic institutions, as well as representatives of UN organisations and NGOs. For the purposes of this book, the contributors were asked, based on their field of expertise, to examine the underlying fundamentals within a specific area in the light of climate change and to come up with suggestions – even new "visions" – within the context of development cooperation.

The discussion of the scientific uncertainties of climate change is beyond the scope of this book. The assessments given by the Intergovernmental Panel on Climate Change (IPCC) in their Fourth Assessment Report, synthesising current state-of-the-art scientific knowledge of climate change, and representing a joint effort of hundreds of internationally acknowledged scientists, have been used as the starting point.

Climate change and the foundations of development

The book has three sections, all of which have a slightly different approach to the topic. The first section tries to outline on a general level some of the burning questions that have arisen from the anomalies between the predicted changes in global climate and the current aims and assumptions of development.

Shardul Agrawala and Florence Crick provide an overview of the linkages between climate change and development, and then focus on how well climate change adaptation considerations are presently being taken into account in development activities, based on their work at the OECD. A wide range of development policies and projects will need to incorporate the risks posed by climate change, both to enhance resilience and also to reduce the risk of "maladaptation". Typical examples of projects facing climate risks are agricultural investments that may not pay off as expected if the climate becomes unsuitable for particular crops; promoting human settlement in areas that may become unsuitable; or developing infrastructure that may not be designed to cope with changed weather extremes. The authors analyse the use of annual official aid flows, as well as the status of climate change in various assessments, development plans, strategies and projects.

Even though considerable progress has been made by donors in recent years at the level of individual assessments and projects, very few core development plans explicitly consider the implications of climate change. In general, little attention has been given at the strategic levels of decision-making to climate change and adaptation considerations. In order to make progress, it is important that the current

project-based approach be replaced with a more strategic and programmatic track, focusing on long-term planning and linking of different decision-making levels. This would require more than simply additional resources: there is a need to ensure access to relevant climate information, and institutional changes are required in both host countries and donor agencies. The authors also see a need to establish greater clarity on the relationship between mainstreaming efforts and the adaptation activities that are financed under the international climate change regime.

The two remaining articles in the first section deal with the internationally defined goals of development – the Millennium Development Goals – and questions of funding and increasing energy needs for their achievement. According to the IPCC report, countries have to adopt different strategies to advance MDGs, and "the paths they adopt will have important implications for the mitigation of climate change … Consideration of clean energy services, even though not explicitly mentioned in the MDGs, will be a vital factor in achieving both sustainable development and climate mitigation goals." (IPCC 2007, p. 697)

Sarah Mohan and Bill Morton argue that while the MDGs may remain the overarching framework for development cooperation efforts, the realities of climate change will play a major role in determining the best way to achieve the goals, and in the cost of doing so. Indeed, investments in reducing vulnerability and augmenting adaptive capacity may be among the most high-return investments for achieving both the MDGs and climate goals. In this context, the authors discuss the role of development cooperation and Official Development Assistance (ODA) in supporting and financing climate change adaptation. They point to existing problems within the development cooperation system, including the lack of adequate developing country ownership, voice and representation, which undermine the effectiveness and legitimacy of ODA-financed adaptation measures. The authors attempt to calculate how much climate change could increase the costs of attaining the MDGs, and the implications for the prevailing ODA target figure of 0.7% of GNI in donor countries. They conclude that a dramatic change in political will is needed to mobilise the significant new funds and implement the important development cooperation reforms that are necessary in an era of climate change.

The two objectives of improving energy access and mitigating climate change may seem irreconcilable, as mitigation is usually associated with reducing energy consumption. The need for greater energy access is urgent however. Virginie Schwarz and Yannick Glemarec note in their article that, because of population growth, if no new policies are put into place 1.4 billion people will still lack access to electricity in 2030. To reach the MDGs, this number would need to fall to less than one billion by 2015. According to the authors, there is room for win-win strategies, but the traditional approach is not the answer: paradoxically, efforts to reduce poverty by counting on fossil

fuels could end up having adverse impact on the poorest populations in the likely case that international fuel prices continue to rise in the future.

Clean energy technologies are often superior options for meeting the needs of developing countries, as they can increase energy security, reduce the energy bill of oil-importing countries, increase access to energy services in a cost-effective way, and provide local jobs. However, their deployment is handicapped by a wide range of policy, technological, attitudinal and financial barriers. Development aid can play a critical role in increasing awareness of the potential of clean energy technologies by promoting supportive policies, strengthening institutional and individual capacities, and facilitating access to appropriate funding. In order to meet the overall energy requirements of developing countries, the challenges of attracting enough direct investments and driving them towards lower carbon technologies also need to be addressed. The authors argue that these issues – for which private funds are scarce – should become a priority for development assistance.

Changing the focus: some key areas

The second section of the book looks at specific fields of activity where the approach to development which is chosen could have a great impact on climate change and vice versa. It tries to place some of the issues that have been discussed as relevant to "saving the planet" in the context of development cooperation, and looks to see if common interests can be found. As an example of some of the priorities put forth outside of the actual development literature, the President of the Earth Policy Institute, Lester R. Brown, in his book *Plan B 3.0* advises his readers to "make a case for the inclusion of poverty eradication, family planning, reforestation and renewable energy development in international assistance programs" and to "urge an increase in these appropriations (…)" (Brown 2008, p. 286). However, the topics chosen for this section are meant to serve merely as suggestions, and examples of some of the key areas, rather than attempting to identify them systematically.

Population growth and size have often been defined as being at the root of many environmental problems, note George Martine and José Miguel Guzman in their article on population dynamics and climate change. The United Nations expects the world population size in 2050 to be in the range of 7.8 to10.8 billion, and few would question that the differences in the environmental implications between the two figures would be crucial. Assuming that the issue could be easily resolved simply with massive family planning programs in poorer countries, the authors argue, is too simplistic; even though population size and growth do matter enormously, there is no "quick fix". The fastest-growing countries are not the ones that will be making the largest contribution to global environmental problems in the near future. Furthermore, the

majority of population growth today is less the result of current fertility patterns than those of fertility and mortality patterns of previous generations. There are also other, less-discussed components of demographic dynamics that need to be incorporated in the debate, such as age structure, household composition and immigration.

The world is undergoing a rate of urban growth that is unprecedented in human history: current projections suggest that the urban population of developing countries will double in the space of a generation. How, where and in what conditions such growth will occur will have a huge effect on sustainability in general and on climate change in particular. Attention should be paid to poverty, income inequality, and segregation, all of which are key elements in the vulnerability of urban populations to climate change. The authors encourage decision-makers to urgently reverse the current trend in many Asian countries where government policies support the expansion of dwellings in low elevation coastal zones. Apart from population growth, cities are centres for many other environmental concerns, such as pollution, resource degradation, and waste generation, but at the same time, demographic concentration can reduce per capita costs and energy demand while minimising pressures on land. Paradoxically, the authors argue, cities could therefore hold our best chance for a sustainable future.

Trade has received a great deal of attention as an engine of development. Yet, while a fair amount of work has been done to mainstream climate change adaptation into development assistance, there has been little or no work that considers the trade-related impacts, writes Aaron Cosbey. There are a number of significant consequences to take into account. As a result of changes in agricultural production, the prices of food are predicted to rise, almost entirely to the benefit of exporters in higher latitudes, while the need of developing countries to import cereals is expected to rise by 10% to 40% by 2080. The infrastructure of ports will demand heavy investment due to rising sea levels; but new transport opportunities may also appear, such as the opening of new trade routes through the previously impassable Northwest Passage in Canada's Arctic waters. One way or another, air transport will certainly become more costly, with implications for such goods as fresh-cut flowers and high-end perishable produce. Cosbey also notes that there have been a number of moves to implement trade-related measures that seek to punish carbon-intensive imported goods, and these tend to be formulated with developing country competitors in mind.

On the other hand, forms of energy that are less carbon-intensive may become new sources of export revenues for developing countries, such as electricity from North African concentrated solar thermal installations. While climate change may have both positive and negative influences on the potential of trade to act as an engine of development, the uneven burden of the shifts in the prevailing patterns appears to fall most heavily on developing country producers and exporters. It seems clear that, in many

cases, the most effective development policies will rely less on promoting traditional export-led growth and instead resort to non-traditional exports, where those can be developed, or to place more emphasis on endogenous development processes that depend less heavily on foreign markets. A realistic assessment of future policy measures is needed, to serve as the basis for development assistance that avoids risks and exploits potential opportunities. Climate policies, in turn, should be formulated so that they take the concerns of developing country exporters into account.

Tourism presents a policy dilemma for many countries and agencies in the face of climate change. What has often been described as pro-poor tourism has been increasingly promoted by organisations and development agencies such as the United Kingdom's Department for International Development (DFID), the UNWTO, the World Bank, and the Asian Development Bank (ADB), as an important element in national poverty reduction strategies and in development financing. Tourism seems to provide a potential "quick-win": currently international tourism is a primary source of foreign exchange earnings in 46 out of 50 of the world's LDCs. At the same time it both contributes to and is strongly affected by climate change.

The economies that most depend on tourism tend to be island states, which are also some of the most vulnerable to the effects of climate change. According to the authors of the article on tourism, Stefan Gössling, C. Michael Hall and Daniel Scott, there are many factors that may affect future prospects in this field: for example, climate policies leading to higher cost for air travel, consumer awareness of the environmental impacts and increasing threats to the economic and political security of the destination. Climate affects a wide range of attractions and other factors critical for tourism, such as wildlife productivity and biodiversity, water levels and quality, and snow conditions and glacier extent. Climate also has an important influence on environmental conditions that can deter tourists, including infectious disease, wildfires, insects or extreme weather events.

The current development of tourism in most countries follows pro-growth paradigms in which annual growth in arrival numbers is considered an indicator of success and a proxy for wealth transfer to poor local populations. In the light of the results presented here, the authors argue, there may be reasons to reconsider such strategies. Destinations would seem well-advised to assess their dependency on and vulnerability in regard to energy-intense tourism, and to restructure their tourism products to favour low-carbon, high value tourism. Addressing the large information gaps regarding the vulnerability to climate change of the tourism sector in developing nations must be a core component of any future strategy, if tourism is to contribute to poverty alleviation and achieving the MDGs.

Global food supplies have increasingly come under pressure for various reasons. According to preliminary estimates, the year 2008 saw another 40 million people

pushed into hunger. Climate change puts an added burden on agricultural production, as it has the potential to irreversibly damage the natural resource base on which agriculture depends, notes Lim Li Ching in her article. Meanwhile the agricultural sector has, for the last two decades, suffered neglect and underinvestment in terms of priorities in ODA and of national governments, as well as in the lending policies of development banks. There now appears to be a resurgence of agriculture on the development agenda; however the question of what type of agricultural development is required is equally crucial. The "business-as-usual" scenario of industrial farming, input and energy intensiveness, collateral damage to the environment, and marginalisation of small-scale farmers, is no longer tenable, Lim argues.

Instead, the international community and national governments should systematically redirect agricultural knowledge, science and technology towards sustainable biodiversity based agriculture and agro-ecological sciences, while simultaneously addressing the needs of small-scale farmers. Indigenous and traditional knowledge are a key source of information on adaptive capacity, as many poor farmers already attempt to minimise crop failure through e.g. increased use of drought-tolerant local varieties, water harvesting, mixed cropping and agroforestry. Supporting and facilitating these autonomous adaptation measures needs to be critically enhanced by the development community, while a longer-term planned approach for adaptation is also necessary. By rethinking the current model of development, agriculture has the potential to change from being one of the largest greenhouse gas emitters to a much smaller emitter and even a net carbon sink, while also contributing to poverty alleviation. In essence, investments of the development community in sustainable agriculture projects and action plans, supported by the right policy and institutional environment, could bring about a 'win-win-win' scenario for agriculture – climate adaptation, climate mitigation and increased productivity, the author argues.

Forests provide biomass fuels and traditional medicines for billions of people, and in many developing countries, forest-based enterprises create at least a third of all rural non-farm employment. Meanwhile the role of forests in the global carbon balance is important, as one-fifth of global carbon emissions originate from forest destruction and forest conversion. According to Markku Kanninen, PRSPs and other poverty alleviation policies have been overlooking the importance of forest ecosystem services in, for example, providing food and fuel wood, or regulating water, climate and erosion. The loss of these forest ecosystem inputs will reduce human wellbeing at all levels and on all scales. Promoting tree and forest planting can be a win-win option in many cases, by simultaneously producing ecosystem goods and services for local livelihoods and industries on the one hand, and carbon sequestration services for climate change mitigation on the other.

There are also possible synergies between carbon sequestration and adaptation

measures, e.g. through afforestation of vulnerable areas, watersheds, and rehabilitation of degraded lands; so far these possibilities have not been well reflected in the national adaptation plans of action (NAPA's). Reducing emissions from deforestation and forest degradation (REDD) is recognised as one of the major actions necessary for mitigation of climate change, and regardless of the form the mechanism takes in the post 2012 climate regime, significant financial resources could flow from the developed world to developing countries in the future. Increased investment into protection and sustainable management of forests through REDD, CDM and similar mechanisms offers an excellent opportunity to foster economic development in rural areas, based on sustainable use of forest resources, the author argues. Successful implementation of these measures will often require strengthening the stake of local communities in protecting their forests assets and allowing them to use and benefit from these resources.

Violent conflict was highlighted in the Human Development Report 2005 as the most brutal suppression of human development: it disrupts food systems, contributes to hunger and malnutrition, and undermines progress in health and education. Nine of the 10 countries ranked at the bottom in the human development index (HDI) in the Report had experienced violent conflict at some point since 1990. The Report also notes that "preventing and resolving conflict and seizing opportunities for post-conflict reconstruction would demonstrably accelerate progress towards the MDGs" (HDR 2005, p.151).

Over the past two decades, the world has seen a decline in the number of armed conflicts and, in some cases, democracy has gained stronger ground. After a period of relative improvement, the consequences of climate change now heighten the risk of political instability, especially in countries faced with poor governance, state fragility, recent armed conflict, and poverty. According to Dan Smith and Karina Kristiansen, pressures to migrate may be strengthened by conflicts erupting between different groups over access to diminishing resources. Health systems will come under unprecedented stress; and reduced economic input is closely correlated with increased risk of violent conflict. At the same time, the resilience that traditional societies could fall back on has diminished: farming communities in many African countries are half-in and half-out of the modern market system, and their vulnerability in the face of economic change and political pressure is already high.

However, climate change could also provide new opportunities for peace, the authors argue. In divided communities, climate change poses a threat against which to unite, while adaptation efforts offer a task on which to cooperate. They suggest a formula where poverty reduction, adaptation to climate change, and peacebuilding are combined into a single coherent approach. The key points of synergy to be targeted are good governance and local participation. Simultaneously addressing peacebuild-

ing needs and climate change adaptation requires building the capacity of communities to understand the linkages and act on them. With good governance being an increasingly significant part of development cooperation, helping to create the right institutional context is a challenge that donor governments have every opportunity to act on, the authors conclude.

Towards a better world: updating the vision

The third section of the book focuses on the "ultimate goal" of development efforts: our vision of the world as we would like to see it. The model adopted by the industrial world obviously cannot be followed by everyone on the planet, since climate change is already threatening to undo decades of progress and undermine efforts to achieve the MDGs. What are the alternatives to this vision? What are the most important choices on a structural level that define the development pathway of a given country, and what is the role of different actors in the field of development cooperation in determining that? Replacing the issue of growth with issues of equity and distribution poses a challenge for the entire concept of development, and answers need to be found quickly. A repeated warning in all of the articles in the last section is that the window of opportunity is rapidly closing.

According to the IPCC report, the choice of development policies can be as consequential to future climate stabilisation as the choice of climate-specific policies (IPCC 2007, p.700). Rather than trying to look for ideal and general instruments, effective results can be achieved by focusing on relatively marginal changes in certain key sectoral decisions. As Jayant Sathaye argues, it would be important to identify relevant non-climate policies e.g. in the areas of trade, finance, rural and urban development, insurance, and forestry. One sector to watch is transportation, where differences in urban planning policies generate widely different outcomes in terms of energy consumptions and CO_2 emissions. Some of the alternative measures discussed in the article, such as energy efficiency lead mostly to reduced emissions; but in some cases the link is more ambiguous. For example, the impact of the removal of energy subsidies on CO_2 emissions is likely to be positive in most cases, as higher prices trigger lower demand. However, this may also result in increased emissions if poor consumers are forced off-grid and back to highly carbon intensive fuels, such as non-sustainable charcoal or diesel generators.

Similarly, while improving access to commercial fuels tends to increase emissions, it simultaneously decreases unsustainable use of fuelwood and related deforestation. Mitigation options can create tradeoffs between carbon emissions reduction and other sustainable development criteria, and it is often difficult to assess the net outcome of the various effects. Weighing other development benefits against climate benefits will

be a key basis for choosing development sectors for mainstreaming climate change considerations. In some cases, it may even be rational to disregard climate change considerations because of an action's other development benefits. As Sathaye points out, what matters is not only that a "good" choice is made at a certain point in time, but also that the initial policy persists for a long enough time – sometimes several decades – to truly have an effect. This, in turn, raises deep institutional questions about the possibility of governments to make credible long-term commitments.

A key question in current climate policy, according to Axel Michaelowa and Katharina Michaelowa, is whether high levels of human development can be reached at low levels of per capita emissions. The authors compare countries with similar levels of development but different levels of emissions, and key elements contributing to the outcomes are analysed. According to the data, it is possible to achieve a quite respectable level of human development – an HDI of 0.8 – at very low per capita emissions levels. Emissions surge rapidly as soon as an urbanised middle class develops, however, and in order to reach universal human development of over HDI 0.9, the authors argue, world emissions would have to grow by at least 30%. Some of the key elements of a low emissions path are identified, such as an integrated planning policy that prevents haphazard urbanisation and related rapid growth in car traffic, and a far-reaching energy efficiency policy for domestic appliances.

Michaelowa and Michaelowa urge that the focus of the future climate policy regime should be on options that prevent a rapid rise in emissions. They remind us of the financial challenges at the beginning of such a phase: for example, development of energy efficiency standards and a credible enforcement structure could be supported by development cooperation. As for ways out of the current global situation, the authors present three possible solutions: increasing energy efficiency, decarbonising all energy sources, or limiting consumption. In their final summary, they see huge challenges with the first two, which leaves the politically unpalatable option of limiting consumption the decisive one.

The role of different actors in the new paradigm of development is the focus of Peter Newell's article. He charges that some of the world's most powerful institutions in the areas of trade, aid and finance, are continuing to fund and encourage activities that are energy intensive, export-oriented and produce widespread social and environmental externalities – often even in cases where they were intended to address climate change. Instead of coordinated strategies, the activities of one set of institutions systematically undermine those of others. New trade agreements increase the transport of goods over longer distances, adding to the emissions that climate negotiators are struggling to reduce, while Multilateral Development Bank lending supports projects that commit vast amounts of greenhouse gases into the atmosphere. For instance, Newell notes that in 2006, as the World Bank raised its energy sector commitments,

the oil and gas sector received a 93% increase in funding, while investments into "new renewables" increased by only 1.4%.

Nonetheless, Newell argues that the current situation may provide an opportune moment to question the development architecture in relation to climate change. Increasingly global bodies will have to justify their role in relation to efforts to tackle climate change, and those that fail to do so will ultimately be disbanded. Efforts should be made towards greater coherence, coordination, accountability and representation. Newell warns of the consequences of a "honey pot effect", where actors gravitate towards new sources of funding around climate change on an issue where they sometimes do not have a track record or the capability to deliver. Moving from a crowded and competitive market to a division of labour which allows each actor to do what they do best is critical. Concrete proposals are also needed for an energy round in the WTO, aimed at meeting the needs of the poor and addressing climate change. One way of garnering trust amid the current stalemate in the talks would be to develop an agreement that sought to reduce barriers to low-carbon technologies, allowing market leaders such as China, Mexico and India to export the latest in renewable technologies. The author also suggests assessments of what roles multi-lateral and regional development banks might realistically play in facilitating a shift to a lower carbon economy, as well as of the incentives and disincentives necessary to get businesses of different sizes and sectors fully engaged in the transition.

The end of conventional development has left us facing a tragic dilemma, argues Wolfgang Sachs in the final article of the section: with the imagined vision of a better life being thoroughly shaped by Euro-Atlantic civilisation, the means for everyone to attain it are ever less available. With the current model, the exit from poverty and powerlessness leads straight into overuse and overexploitation. For example, Sachs notes that the annual economic costs of environmental damage as a result of economic growth were estimated in the 1990s at between 8% to 13% of China's domestic product, which translates into losses higher than the growth-rate of the national economy. The prerequisites of development have changed: while in the old days the world appeared full of nature but void of people, today the satisfaction of needs and wants is not constrained so much by the paucity of hands and brains as by the scarcity of resources and living systems.

The answer, Sachs suggests, is to move out of an economy wasteful of both natural resources and people, towards an economy privileging non-fossil resources and a decentralised and smaller-scale production pattern where people will in part have to be substitutes for natural resources. Rather than laying off people, gains should come from laying off wasted kilowatt-hours, barrels of oil, and pulp from old-growth forests. As an example of a development path that might bring the world to a greater level of resource justice, Sachs mentions the model of "contraction and convergence" pro-

posed by Aubrey Meyer. It schematically envisages two different development paths – one for industrial countries, one for developing countries – whereby no nation has the right to a disproportionate share of the global environment. Each country endeavours to achieve the common goal of material and energy consumption compatible with the demands of other countries, while remaining within the carrying capacity of the biosphere. This is what the argument inspired by Kant comes down to, Sachs notes: institutional patterns of resource consumption should be considered unjust if they rest upon rules which cannot in principle be adopted by all other nations.

In the context of development cooperation, Sachs' article emphasises the need to rethink the concepts of justice and equity. Previously, justice was understood as a greater share for more and more people in a growing world economy, and the "rising tide" was to "lift all boats"; this was also the tacit assumption behind the United Nations system and bilateral development cooperation. For decades, development experts defined equity primarily as a problem of the poor. They highlighted the lack of income, the lack of technologies, and the lack of market access; they advocated remedies for raising the living standards of the poor, thereby working at lifting the threshold rather than modifying or even lowering the ceiling. Comfortably enough, linking the idea of justice to growth allowed us to evade the hard issue of distribution. This approach has turned out to be definitely one-sided, Sachs argues: either well-being remains confined to a global minority because the prevailing styles of production and consumption cannot be generalised across the world, or sustainable models of well-being gain acceptance, opening the opportunity of sufficient prosperity for all. Poverty alleviation, he concludes, cannot be separated from wealth alleviation.

Responsibility and opportunity: towards Copenhagen

Many of the measures most often suggested for fighting climate change have connections with activities central to development cooperation. We are dealing with a tricky concept, however, as it is much less visible than poverty and hunger, the first and most important areas to target as defined by the Millennium Development Goals. In order to address these two primary problems successfully, we need to make sure we do not end up in a situation where MDG 7, Environmental Sustainability, becomes the Goal from which everything else has to be derived when alternatives no longer exist. As Aaron Cosbey states in his article, any development assistance initiatives that can simultaneously achieve development objectives and contribute to mitigation and adaptation should be pursued as a priority, given the urgent need, *from a development perspective*, of successfully addressing climate change.

In a sense, we already hold the keys to success with regards to integrating climate change mitigation and adaptation with development efforts. The thing to do, as in

the case of a number of other issues in the field of development cooperation, would be to live up to the existing ideals and promises: many of the articles in this book emphasise the need for more coherence and better cooperation among different fields of activities and different actors, improvement of participation and ownership, increasing of funding, and mainstreaming of climate change concerns into the development agenda. While these observations are valid and essential in order to tackle the issue, climate change may face the risk of being treated as yet another "slogan" to use at the level of speeches and setting of goals. The development community is familiar with the discourse of mainstreaming, and the list of important areas to mainstream grows by the year; it is much more difficult to implement these intentions meaningfully. In his article here, Jayant Sathaye notes that the extent to which mainstreaming leads to a sustainable development path will depend on the technological, social, economic and political processes that affect the current and future development path trajectories: merely piggybacking climate change onto an existing political agenda is unlikely to succeed.

It is time to identify the responsibilities and opportunities provided in the area of development for building a more sustainable future, and to study the vision behind development efforts – the right medicine cannot be prescribed if the diagnosis is not up to date. The context of the Copenhagen conference in 2009 provides an opportunity that should also be grasped by the development community. At this point in the history of humankind, the gravity of the situation may be such that failing to see the larger context is not an option.

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Climate Change and Development: Time to Adapt

Shardul Agrawala and Florence Crick

Introduction

This has been a period of renewed hope and concern for the fate of the climate system. On the one hand, a broad coalition of actors including international negotiators, national and sub-national governments, as well as civil society and the private sector, has coalesced around the need for strong policy action on climate change. On the other hand, scientific evidence continues to mount that climate change is already underway and will increasingly affect the basic elements of life for societies around the world, including access to water, food production, health, and the environment. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) warns that climate change will result in more frequent heat waves, heavy precipitation events, droughts and tropical cyclones. The report also notes that while poor countries and poor people are most vulnerable, even advanced societies remain inadequately adapted to the risks posed by current climate, let alone climate change (IPCC 2007).

Clearly, while we continue the process of negotiating international commitments to reduce greenhouse gas emissions, that alone will not be enough. There is also an urgent need to place climate change and its impacts within the mainstream of economic policies, development projects, and international aid efforts.

Bridging the gap between the climate change and development communities, however, requires more than a simple handshake. This is because the two communities have different priorities, often operate on different temporal and spatial scales, and do not necessarily even speak the same language. Many development practitioners are not familiar with the intricacies of climate science or of the climate negotiations, as they continue their annual journey from one exotic locale to the next. Meanwhile, few in the climate change community have even heard of the Paris Declaration on Aid Effectiveness or the Accra Agenda for Action which guide the agenda for development co-operation.

Beyond the need for a common vocabulary, successful integration of climate change risks in development planning also requires specific information for assessing the significance of climate change for development activities, along with operational guidance on how best to take such information into account within the context of other pressing social priorities.

This article examines some of the key linkages between climate change and development. While these linkages have implications for both greenhouse gas emissions and societal vulnerability to the impacts of climate change, the focus of this article is primarily on the latter. The article then examines how adaptation planning and action has progressed within the context of development cooperation, first from the perspective of international donors and then from the vantage point of developing countries. The article concludes by outlining a comprehensive approach to integrating climate change adaptation in development activities.

Climate change and development: Key linkages

Unquestionably, climate change is closely intertwined with development. Climate is a resource in itself, and it mediates the productivity of other critical resources, including food and fibre, forests, fisheries and water resources. However, climate can also be a hazard. Extreme weather events, for example, routinely cause widespread disruptions in society's ability to utilise critical resources. It is equally the case that human development choices are having a demonstrable impact on local and global climate. Land use changes, particulate pollution, and overconstruction all have a discernible influence on local and regional climate patterns. Meanwhile, development paths fuelled predominantly by continued or enhanced consumption of carbon-intensive energy sources are causing significant changes in the global climate. This presents both a challenge and an opportunity for many developing countries, which are projected to account for more than 70% of the increase in world primary energy demand, and over 70% of the increase in carbon dioxide emissions over the period 2004-2030 (IEA 2006).

How development occurs also has implications for the vulnerability of societies to its impacts. In many instances, business as usual development may automatically help raise the capacity of societies to cope with climate change. In principle, a range of development activities oriented towards reduced poverty and improved nutrition, education, infrastructure and health would automatically help decrease vulnerability to many climate change effects. A healthier, better-educated population with improved access to resources is also likely to be in a better position to cope with climate change. Further, in situations where vulnerability is primarily contextual, adaptation to climate change might simply reinforce existing development – alleviating poverty and improving nutrition, health care, livelihoods and so on – as these activities will also boost the capacity for coping with climate change. However, high levels of development do not necessarily enhance adaptation to climate change. Developed countries, themselves, remain vulnerable to the impacts of climate change. The devastation caused by Hurricane Katrina in New Orleans and the high death toll from the heat wave that hit France in August 2003 remind us of the current vulnerabilities of devel-

oped societies to climatic extremes.

Furthermore, some types of development projects could, inadvertently, by failing to consider climate risks, contribute to maladaptation by increasing the vulnerability of societies to the impacts of climate change. For example, new infrastructure may not be designed to cope with changed weather extremes and thus may either provide inadequate protection from extreme events or may have a shorter useful lifetime than intended. Such outcomes could retard development by allowing climate extremes to result in larger losses of life and destruction of property than would occur if infrastructure was built to withstand risks from climate change. Agricultural investments may not pay off as expected if the climate is becoming unsuitable for particular crops. Yields could decrease and food might need to be imported. Promoting human settlement or infrastructure development in areas that may become unsuitable because of climate change could even increase a region's vulnerability. Such areas may become vulnerable to rising sea levels, changes in flood and drought frequency, more exposure to infectious disease or heat stress, and other climate change related risks. There are also instances where climate change might adversely impact development projects, the efficiency with which development resources are invested, or the achievement of broader development objectives.

Integrating adaptation to climate change within development activities will thus be essential if governments wish to achieve the targets set in the Millennium Development Goals, as well as related national poverty eradication efforts and sustainable development. This is particularly true for policies, projects and decisions with a medium to long term footprint, when the climate change impacts will become much more significant.

Adaptation planning and actions by international donors

Recent years have witnessed a significant increase in the degree of attention to the risks posed by climate change and to adaptation within the context of development cooperation activities. Traditionally the concern of one or two environment specialists within donor agencies, adaptation to climate change is now being increasingly recognised as key to good development practice.

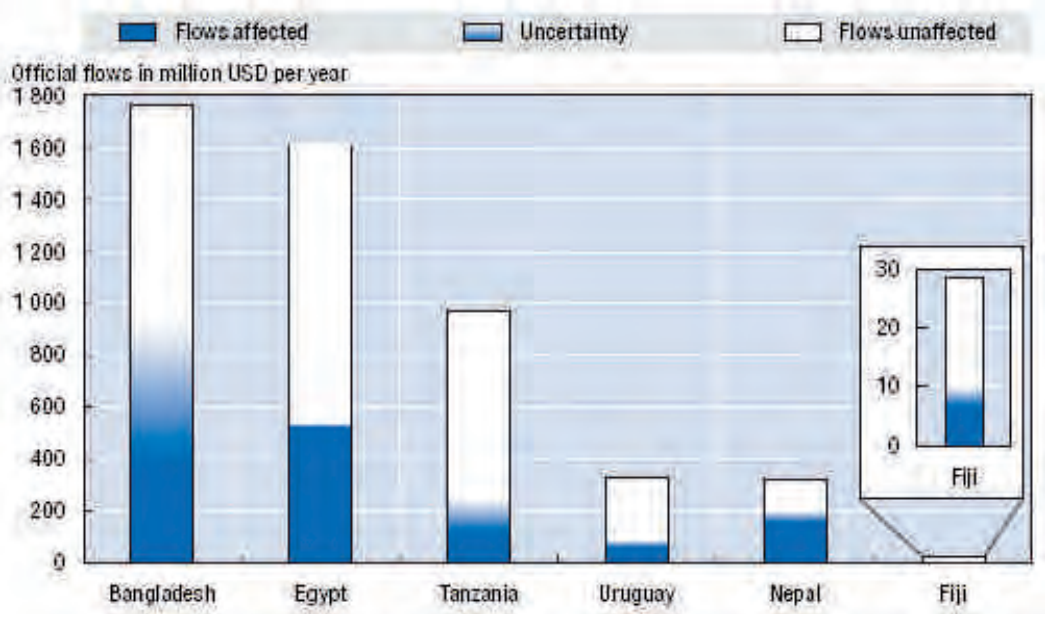
This growing interest within development co-operation agencies is partly in response to the growing significance of climate change adaptation within the international climate change negotiations, particularly since 2001 when three international funds were established to address adaptation[1]. It was also around this time that three

[1] The Least Developed Countries Fund, the Special Climate Change Fund, and the Adaptation Fund. These funds are part of a more complex architecture of international funding sources for adaptation that also include the GEF Trust fund, and bilateral initiatives.

development agencies – the World Bank, the German development agency (GTZ), and the Norwegian Agency for Development Cooperation – commissioned studies examining the implications of climate change on some of their activities and the extent to which their projects and plans pay attention to climate risks (Burton and van Aalst, 1999; Klein, 2001; Eriksen and Naess, 2003). These assessments concluded that the awareness of and attention paid to climate change in these agencies was generally low, and that few or no links to climate change had been made even in areas where climate was already posing considerable risks to the achievement of development goals (Klein et al., 2007).

Another impetus was provided by the Multi-Agency Report on Poverty and Climate Change (2003) authored by development and environment practitioners in ten development agencies, that helped raise awareness amongst development practitioners about the significance of climate change on their core activities.

It was a subsequent analysis by the OECD that quantified for the first time the exposure of official development assistance to climate risks, including climate change. Based on case studies of six developing countries (Bangladesh, Egypt, Fiji, Nepal, Tanzania, and Uruguay) the OECD analysis showed that a significant proportion of annual official aid flows are directed towards activities affected by climate risk (Figure 1, below). Estimates ranged from a high of 50-65% of total official aid flows in Nepal to a low of 12-26% in Tanzania. In monetary terms, over half a billion US dollars might be affected in Bangladesh and Egypt and around 200 million in Tanzania and Nepal (van Aalst and Agrawala 2005). In Fiji, while the absolute amount is low, approximately one-third of all aid flows is nevertheless directed towards activities that might be affected by climate change.



Note: Based on Creditor Reporting System; Official flows averaged over 1998-2000

Figure 1. Annual official flows and share of activities potentially affected by climate change (van Aalst and Agrawala 2005).

Despite the risks of oversimplification that come with such a classification, this analysis highlights that the consideration of climate risks (including climate change) could be essential to the successful achievement of general development goals as well as to the success of individual projects and investments. However, an examination of national development plans as well as donor country assistance and sectoral strategies of these six case study countries revealed a rather nuanced picture. While developing countries and international donors have contributed to considerable progress in terms of climate change vulnerability and impact assessments, as well as towards the implementation of capacity building efforts and projects specifically dealing with adaptation, it remains the case that very few core development plans, strategies and projects explicitly considered the implications of climate change.

Recent progress by donors

Considerable progress has been made by donors since the publication of the OECD analysis in 2005, although it remains far from homogeneous on all fronts. Perhaps the most significant progress has been made in terms of recognition of the significance of climate change and the need to integrate adaptation within development activities at

the highest levels within donor agencies. This includes the Declaration on Integrating Climate Change Adaptation into Development Cooperation adopted by Development and Environment Ministers of OECD Member countries in April 2006, the EU Action Plan for the period 2004-2008, the G8 Gleneagles Plan of Action and the World Bank's Clean Energy and Development Investment Framework. There are also a number of high level policy initiatives at the national or agency level. These include White Papers on development cooperation, sustainable development strategies and environment or climate change action programmes. For example, the White Paper on the Australian Government's Overseas Aid Programme identifies climate change adaptation as one of the three priorities for future Australian environment-related development assistance, particularly in the Pacific. Another example is the UK's White Paper on International Development 'Eliminating World Poverty – Making Governance Work for the Poor' which makes the challenge of finding adequate climate change adaptation options for developing countries a high priority for the government's development goals over the next five years (Gigli and Agrawala 2007). These high level initiatives play a critical role in establishing priorities and incentives at the level of donor agencies, and facilitate the downstream consideration of climate change adaptation at the operational level.

Another area where considerable progress has been made in recent years is with regard to the screening of development portfolios for climate risks. Donors which have initiated such climate risk screenings of their development cooperation projects or programmes include Netherlands, UK, Switzerland, and the World Bank, among others. Screening approaches and methodologies, however, are not harmonised. They range from qualitative "quick scans" of development portfolios (e.g. van Aalst *et al.* 2007) to the use of formalised risk screening tools at the project level (e.g. IISD/ World Bank/IDS 2007).

Progress is also being made in terms of developing operational guidance on implementing and mainstreaming climate change adaptation. Denmark, for example, is currently implementing its operational guidance in select pilot countries, with the aim of developing an approach for 'climate proofing' Danish development cooperation. The UK, meanwhile, has developed the Opportunities and Risks from Climate Change and Disasters (ORCHID) process, which is a systematic climate risk management methodology designed to assess the relevance of climate change and disaster risks to an organisation's portfolio of development projects. The United States and the Asian Development Bank, meanwhile, have developed guidance on incorporating adaptation considerations at the project level. At the time of writing, relatively few agencies have developed such operational guidance, and the ones that have are still in the process of testing and refining it.

Finally, the need for a harmonised approach towards operationalising the integra-

tion of adaptation measures in development activities has also been recognised by international donors. This in turn, has led to the development of the *OECD Policy Guidance on Integrating Climate Change Adaptation into Development Cooperation* which aims to service both international donors and developing country partners. The OECD Guidance has been under development since 2006, and is scheduled for release in mid2009.

Adaptation planning and actions by developing countries

While the challenge of adapting to human induced climate change is a relatively new policy priority, societies have a long record of adapting to the impacts of weather and natural climate variability. These include proactive measures such as crop and livelihood diversification, disaster risk reduction, insurance, water storage, and irrigation. Also included are reactive or ex-post adaptations, for example, emergency response and migration (IPCC 2007). Significant advances have been made since the mid1990s in terms of the capacity to adapt proactively to seasonal and interannual fluctuations in climate such as El Niño and La Niña in many developing countries in Africa, Asia, Latin America and the Pacific. For example, the Sahara and Sahel Observatory was founded in 1992 to improve early warning and monitoring systems for agriculture, food security and drought in Africa. Meanwhile, regional climate outlook forums have been initiated since the late 1990s in East, West and Southern Africa, parts of Latin America and Asia, where seasonal climate forecasts are used to plan for the upcoming rainy season. Despite these advances, many parts of the developing world remain poorly adapted even to current weather extremes, as evidenced by the significant loss of life and livelihoods in a number of extreme weather events each year.

Anticipatory adaptation for the impacts of climate change, meanwhile, has come into policy focus only since the mid-1990s following the negotiation of the United Nations Framework Convention on Climate Change (UNFCCC). Developing countries in particular have made progress in conducting climate change vulnerability and impact assessments, organising adaptation workshops and capacity building initiatives, establishing institutional mechanisms to address climate change, and developing their First National Communication to the UNFCCC. These National Communications do in principle address national adaptation priorities, although the focus of these documents has so far been much more on greenhouse gas emissions inventories and projections, as well as mitigation policies. Subsequently, a number of adaptation projects are also being implemented in a wide range of developing countries through a variety of funding mechanisms to support adaptation within the climate regime. For example, the Strategic Priority on Adaptation fund of the Global Environment

Facility (GEF) is being used to fund Community Based Adaptation programmes of developing countries.

The Least Developed Countries (LDC) Fund meanwhile has provided support to these countries in the preparation of their National Adaptation Programmes of Action (NAPAs) which address their urgent and immediate needs with regard to adaptation to climate change. A key output from these NAPAs is a list of priority adaptation activities, whose further delay could lead to increased vulnerability or increased costs at a later stage. By mid-2008, 38 LDCs had submitted their NAPAs to the UNFCCC. Projects identified in NAPAs cover a wide range of activities, including general capacity building and awareness raising, research and information, early warning systems, investment in changing resource management, institutional reform and regulation, and mainstreaming into development plans (Osman-Elasha and Downing, 2007; Ayers, 2008).

Despite this progress in terms of dedicated adaptation efforts, adaptation generally does not feature within core development plans and activities. For example, an analysis by the OECD looked at the national development plans of six developing countries (Bangladesh, Fiji, Egypt, Tanzania, Uruguay and Nepal) and found that in general climate change was not mentioned in their long-term national planning documents. Current climate risks were occasionally mentioned in these documents, although generally there was no explicit consideration of how these risks might affect the achievement of the development objectives. However, the Republic of Kiribati provides an example of a country making efforts to mainstream adaptation into its national development policies. It has implemented two national adaptation processes: the NAPA and the Kiribati Adaptation Programme. Whilst the NAPA gives attention to urgent and immediate adaptation needs, the Kiribati Adaptation Programme focuses on long-term planning for climate change adaptation. Lessons learnt from both of these initiatives will be used to plan the Kiribati national response to climate change from 2008-2009 onwards. A framework to integrate these two programmes into the overall national policy development process is provided by the National Development Strategy 2004-2007, which is supplemented by the Climate Change Adaptation Policy and Strategies and the Government Budget. The Strategy notes that "climate change is posing costly risks to economic growth, and calls for the development of participatory and cost-effective ways of minimizing and managing risk of loss from climate change related events". It thus provides an opening for integrating climate change adaptation planning into the national policy process.

There are now also some examples of countries integrating climate change concerns in their poverty reduction strategy papers (PRSPs). For example, Rwanda and Bangladesh have created clear links between their NAPA and PRSP in order to facilitate the mainstreaming of adaptation to climate change. In addition, a number

of priorities identified in Tanzania's PRSP (e.g. early warning systems, irrigation and development of drought resistant crops) could be synergistic with adaptation to climate change, although climate change risks are not explicitly considered (Agrawala and van Aalst 2008).

In the Rwanda NAPA, the process of selecting the priority adaptation activities was closely linked to the various national and sectoral policies of Rwanda as it took into account the urgent and immediate needs established in the PRSP, Economic Development and Poverty Reduction Strategy (EDPRS) and other development programmes. In addition, one of the criteria used to select between the different priority adaptation options was the contribution of that option to sustainable development. Furthermore, for each high priority project identified, links are made between the objectives of these projects and key development strategies of Rwanda (including the Rwanda Vision 2020, the Rwanda PRSP and other relevant national and sectoral policies). Such explicit links should help facilitate the integration of the identified high priority adaptation projects into overarching development frameworks. In addition to these links, the Rwanda NAPA was actually used to inform the second national PRSP, the EDPRS. The review of the first PRSP in February 2006 helped to integrate environment and other aspects of climate change into the EDPRS as an essential element of economic development (Republic of Rwanda, 2006). The EDPRS itself includes a clear recognition of the importance of providing the required framework to facilitate adaptation and mitigation activities (Republic of Rwanda, 2007). The EDPRS specifically states that "an incentive framework will be put in place to implement the National Programme for Adaptation on Climate Change (NAPA)" (Republic of Rwanda, 2007).

The Bangladesh PRSP highlights how a national policy framework can provide the basis for mainstreaming climate change adaptation programmes, such as the NAPA and the Comprehensive Disaster Management Programme. The PRSP recognises climate change as a cause of 'grave concern' to the country, highlighting the challenges posed by sea-level rise. The poverty diagnosis discusses extensively the relation between natural disasters, growth and poverty. Climate change is considered as one of the challenges for water resource management and environmental protection. The PRSP has 19 policy matrices that were developed to operationalise the strategy, one of which focuses exclusively on comprehensive disaster management. One of this matrix's key targets is to 'factor vulnerability impacts, and adaptation to climate change into disaster management and risk reduction plans, programmes, policies and projects'. This, together with an acknowledgement of the NAPA as a national implementation programme, helps to ensure policy coherence for adaptation activities. The Bangladesh NAPA also took the PRSP into account as the priority adaptation strategies identified were specifically prepared to complement it. The NAPA refers to

PRSP policy matrices on 'comprehensive disaster management' and 'environment and sustainable development' in developing strategies to address climate change issues and raise awareness.

While climate change considerations have in general not been integrated within national development policies, there are examples at the sectoral level of sectoral policies explicitly taking climate change considerations into account. For example, a number of Tanzania's environmental and sectoral policies developed in the 1990s are intended to increase its ability not only to cope with current environment problems, but also with the additional risks posed by climate change (van Aalst and Agrawala 2005). Tanzania's 1997 National Environmental Policy provides a framework for mainstreaming environmental considerations into decision making processes. In Fiji, several sectoral plans contain examples of specific adaptation strategies, such as promotion of non-sugar crops and commodities to enhance food security (agricultural sector), a switch to sustainable management strategies (forestry sector) and a review of the Mangrove Management Plan (fisheries sector). In Bangladesh, the national water policy (1999) and national water management plan (2001) both recognise that Bangladesh's future water supply and demand will be affected by climate change.

The abovementioned examples, however, still remain the exception rather than the rule. In general, little attention is paid to climate change and adaptation considerations at the strategic levels of decision-making. There is more action at the project level, but even here the initiatives are still at a relatively early stage of implementation and rather fragmented. There is a need to combine bottom-up action on adaptation with a more programmatic approach that facilitates the consideration of both current and future climate risks at multiple levels of decision-making.

Moving towards a programmatic approach to adaptation

The previous sections have highlighted the progress being made on adaptation within developing countries and international donor agencies. Progress is evident at the international level with high-level declarations, at the level of scientific assessments of climate change impacts, and at the local level with the implementation of adaptation projects. National level priorities for adaptation have also been identified for some countries, especially LDCs who have developed NAPAs.

Given the fact that adaptation has received significant policy attention only over the past few years, this progress is quite significant. At the same time, however, a number of challenges remain. Implementation of high level policy declarations on integrating adaptation in development still remains in an early stage. Progress, meanwhile, is more pronounced on the assessment of climate change impacts, than on the

drivers of vulnerability, and is still very limited with regard to adaptation responses. Further, while several adaptation projects have been implemented, their scale is as yet rather limited relative to overall societal needs. Finally, there remains a very significant gap between the estimated costs of adaptation and the available resources to implement and mainstream adaptation.

Overall, the implementation of adaptation actions and their integration into development processes remains piecemeal, fragmented, and largely project-based. The multiplication of on-the-ground adaptation projects and activities, although important, is not necessarily scalable to significantly affect broader societal vulnerabilities. Further, many local level actions are conditioned by incentives and constraints which are imposed from higher level processes. These include regulation, pricing of climate sensitive resources like water and coastal mangroves, and investments in infrastructure.

If deeper progress is to be achieved on adaptation, it is important to complement the current approach, which focuses on the implementation of a collection of individual and fragmented local level projects, with a more strategic and programmatic track focusing on long-term planning and on linking the different decision-making levels. This will require an integrated or 'whole of government' approach, where adaptation is taken into account at all levels of decision-making (trans-national, national, regional, local) and within a variety of decision-making processes, such as development planning, regulatory and budgetary processes, as well as decisions made by international donors, civil society and private actors.

The OECD has developed Policy Guidance which takes such an integrated approach to the integration of adaptation within development processes. Specifically, this Policy Guidance examines four levels of governance where adaptation should be integrated: centralised National Ministries and decision processes at the national level, sectoral Ministries, project level, and the local level which includes both urban and rural contexts (OECD 2009).

The integration of adaptation at each of these levels will require an analysis of the governance architecture and the different stages of the policy cycle to identify entry points where the consideration of climate change adaptation could be incorporated. At the national level, typical entry points could include various stages in the formulation of national policies, long term and multi-year development plans, sectoral budgetary allocation processes, as well as regulatory processes. On the other hand, the entry points would be very different at the level of on-the-ground projects, where climate change adaptation considerations might need to be factored within specific elements of the project cycle.

The identification of various entry points does not necessarily require that changes need to be made in order to successfully incorporate adaptation considerations. Rather, these entry points provide critical junctures to examine existing decision-making

processes (policies, plans, resource allocation, projects) in the light of the implications of climate change. In some cases, significant changes might indeed be warranted, while in others available information might not justify any, or perhaps only modest, changes.

This is what we refer to as applying a climate lens, which involves examining: i) the extent to which the policy, plan or project under consideration could be vulnerable to risks arising from climate variability and change; ii) the extent to which climate change risks have already been taken into consideration; iii) the extent to which the policy, plan or project could inadvertently lead to increased vulnerability, leading to maladaptation or, conversely, miss important opportunities arising from climate change; and iv) for pre-existing policies and plans which are being revised, what amendments might be warranted in order to address climate risks and opportunities.

To take one illustration, planned development of certain geographical zones (e.g. coastal areas vulnerable to sea level rise and storm surges) or sectors (e.g. hydropower) may be viewed in a different light when the medium to long term risks posed by climate change are taken into consideration, or infrastructure might need to be designed with regard to different standards in areas exposed to increased climatic risk. The result of applying a climate lens should be a better policy, plan, or project that is more capable of achieving its intended objectives in the face of a changing climate, including variability and extremes.

Implementation of such an integrated, programmatic approach, as outlined by the OECD, would require more than simply additional resources. It calls for close coordination across government agencies, across all government levels, between government and donors, and with civil society and the private sector. It would also require coming to grips with some more fundamental challenges.

One such key challenge is clearly the inadequate availability of, or access to, relevant climate information critical to integrating adaptation. For example, at the national level, this information includes historical climate data, current vulnerabilities to weather and climate, projections of climate change and their associated impacts, as well as information on possible adaptation responses and techniques for evaluating and prioritising them. An initial step, therefore, might be for national authorities to assess what information is currently available and disseminate it to key stakeholders via user-friendly, tailored products. This can also result in a needs assessment in terms of what additional information might be required, which could then be used to establish priorities for action.

At the same time, however, it must be recognised that climate information will always remain imperfect, with considerable uncertainties. Therefore, decision-making on other fronts to better integrate adaptation should not be put on hold pending the availability of significantly improved climate information. For example, institutional

changes, such as moving the coordination of adaptation efforts closer to centres of national authority, can be accomplished now. Likewise there are a number of "no regrets" actions that can already be implemented even in cases where more specific information on climate change impacts might be lacking. These could include forging better linkages between efforts to implement adaptation and existing mechanisms for implementing disaster risk reduction.

International donors also have a key role to play in facilitating the implementation of stand-alone adaptation measures, as well as the integration of adaptation into core development priorities and projects. Donors can support capacity building efforts to better monitor climate, as well as to assess future climate change impacts and adaptation priorities at the national level. In this context there is a need for greater awareness raising within donor agencies as to the risks posed by climate change. They might also use high level policy dialogues as a vehicle to raise the profile of adaptation in the eyes of senior officials in partner countries, particularly in key Ministries such as Finance and Planning. Finally, there is also a need for donors to better coordinate and harmonise their efforts on adaptation within specific countries. The five overarching principles of the Paris Declaration on Aid Effectiveness – partner country ownership, donor alignment with partner country priorities, harmonisation, managing for development results, and mutual accountability – should be major reference points for guiding development co-operation efforts in this area.

In addition to better aligning climate change adaptation mainstreaming efforts with the Paris Declaration and the subsequent Accra Agenda for Action, there is also a critical need to clarify the relationship between mainstreaming efforts and the adaptation activities that are financed under the international climate change regime. This is particularly timely in the current context for three reasons. First, the Adaptation Fund is becoming operational, with the promise of scaling up dedicated adaptation financing to several hundred million dollars per year. Second, mainstreaming efforts initiated by various donors are also being scaled up. One example is the Pilot Programme on Climate Resilience that has been launched by a coalition of multilateral and bilateral donors to mainstream adaptation. Finally, international negotiators are focusing on financial commitments from developed countries to support adaptation in developing countries as part of a post-2012 climate regime. On the one hand, these developments offer the possibility of implementing an ambitious adaptation agenda that complements project level and programmatic initiatives, and in which dedicated financing and mainstreaming efforts complement each other. On the other hand, there is a risk of duplication of effort, vague mandates, and inadequate benchmarks for evaluation.

Adaptation as a development challenge has only just emerged.

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The Future of Development Cooperation in a Changing Climate

Sarah Mohan and Bill Morton

Introduction

While there has been much debate regarding the role that development cooperation and official development assistance should play in addressing climate change, a possible road map for the way forward is now emerging. Firstly, the current development cooperation paradigm – with its focus on achieving the MDGs, sustainable development approaches, and improving the political, social and economic well-being of the poor – represents a solid starting point for addressing climate change adaptation. Secondly, this paradigm can be built on, and updated in two crucial ways: through a greater emphasis on reducing the vulnerability of the poor to a range of risks, and through ramping up the mainstreaming of climate change adaptation into general development programs.

As is discussed in this paper, however, there are significant obstacles to following this road map. Re-orienting official development assistance (ODA) towards addressing vulnerability will require a change in both thinking and approach. The mainstreaming of climate change adaptation remains in its infancy. More serious than these obstacles, however, is the question of whether the development cooperation system, in its current form, is fit for the task of playing a significant and effective role in supporting adaptation to climate change. A number of shortcomings have emerged during the past decade, including the increasing complexity and fragmentation of the aid architecture, and lack of progress in building developing country ownership of the development process.

The most serious problem, however, concerns the question of financing and what role ODA should play. Significant new funding will be necessary to achieve the Millennium Development Goals in an era of climate change, and to bring climate change into the development mainstream. At the same time, new and additional funds are needed to address the challenge of mitigating and adapting to climate change as goals in their own right. Yet development cooperation's viability as part of the financing solution is compromised by a crisis of legitimacy: the lack of equitable governance mechanisms for international policy and decision-making in which developing country interests are adequately represented. This undermines developing country buy-in and participation in existing development cooperation measures, which suggests that adaptation measures financed through development cooperation will be similarly

affected. This article explores these issues. The first section concerns development cooperation's role in reducing vulnerability and in mainstreaming climate changing adaptation. The second section examines existing problems in the development cooperation system, and the third section addresses the question of ODA and financing for climate change adaptation. The fourth section summarises and presents conclusions.

Reducing vulnerability and mainstreaming climate change adaptation

It is now widely recognised that the reduction of vulnerability is a key strategy for strengthening climate change adaptation, and that development cooperation can play an important role in this area while maintaining its core objective of contributing to the MDGs. One approach that development cooperation can take involves supporting dedicated activities to reduce specific climate change risks (Agrawala 2005). There is a growing literature, and agreement within the development cooperation community, however, that the focus of interventions should be different (Eriksen et al. 2007; Schipper 2007; Smit et al. 2001; IISD 2005); and that a more broad-based, programmatic approach that emphasises building adaptive capacity is needed. This alternative view suggests that, instead of adopting a project approach to specific risks, a key focus of development cooperation should be on tackling the underlying factors that cause vulnerability itself, and on expanding the capacity to cope with shocks (Eriksen et al. 2007; Leary et al. 2006; Schipper 2007).

There are several hurdles, however, to the adoption of such programmatic approaches. First, interventions are highly context specific, since the factors driving vulnerability depend on local conditions (Eriksen et al., 2007). What works in one situation may therefore not work in another; but context-specific approaches may be prohibitively time-consuming and expensive, and may stretch the capacity and competencies of development cooperation agencies and their staff. Secondly, there are political hurdles. Programmatic approaches to reducing vulnerability may be unpopular with some donors, since they lack the "visibility" of discrete projects. This may make it difficult for donors to demonstrate to taxpayers that their efforts to support climate change adaptation have had clear results.

Despite these potential drawbacks, investments in reducing vulnerability and augmenting adaptive capacity may be amongst the most high-return investments to achieve both the MDGs and climate goals – and they are relatively underfunded (McGray et al., 2007; UNDP 2007: 193). Development activities that use this approach can go hand in hand with adaptation activities such as climate-proofing of infrastructure and disaster response and rebuilding, as well as mitigation activities which facilitate reduction of greenhouse gas emissions.

A major shift will be required, however, if this climate-oriented vision of development cooperation is to be become reality. Development cooperation agencies will need to re-focus policy, and integrate climate change responses across all aspects of their practise. Early experience demonstrates the difficulties associated with such a shift: climate change was too often interpreted solely as an environmental issue, and rarely seen as a development concern in its own right (Schaar 2008: 3). When awareness existed, it focused mainly on mitigation issues. Virtually no agencies considered how their projects would augment or weaken a country's ability to cope with climate change (Eriksen et al., 2007; Schaar 2008).

This situation is now starting to change, and there is a growing understanding that "good development practice is the best way to deliver adaptation: increasing the resilience and capacity to manage the impacts of a changing climate." (Vernon 2008). The preferred approach is through mainstreaming climate change considerations into development cooperation, so that climate change is addressed within development planning, sectoral decision-making and regular budgeting processes, rather than through stand-alone measures or as a separate sector (Eriksen, 2007). Mainstreaming has gained significant high level endorsement, as demonstrated by OECD countries' agreement on the 2006 Declaration on Integrating Climate Change Adaptation into Development Cooperation. Nonetheless, the integration of adaptation measures into development processes "remains piece-meal, fragmented and largely project based" (Agrawala and Crick, 2009: 7).

If mainstreaming does start to take hold, development cooperation agencies may then need to deal with "mainstreaming overload" (OECD 2005), and to ensure that at the operational level, mainstreaming is not reduced to a "box-ticking" exercise. Without strong leadership at the political and management levels, climate issues may continue to meet resistance and create confusion. Indeed, the presence of a high-level champion for gender concerns was a determining factor in the success of mainstreaming that issue into development agencies. One survey of gender assessments found that in the absence of a strong central supervisor for mainstreaming efforts, attempts to include gender considerations at the operational level "were met with a great deal of passive opposition and little enthusiasm" (Aasen, 2006), a finding confirmed by the World Bank (2005). Mainstreaming must therefore be part of management's responsibilities and management must be held accountable for work in this area for it to be successful.[1] To avoid cutbacks and marginalisation, the issue must be institutionalised through capacity building that demonstrates how factoring in climate change concerns will contribute to more successful and sustainable project outcomes (Gibb, 2009).[2]

If the current obstacles to mainstreaming can be overcome, it has much to offer as a strategy for how development cooperation can play a constructive role in

strengthening climate change adaptation. Equally importantly, mainstreaming can also play a part in ensuring that ongoing development activities do not exacerbate climate change or its impacts. When development activities are undertaken without due attention to climate change implications – for instance when tourism is promoted in ecologically and climate-sensitive areas – they risk maladjustment: in other words, they risk undermining or preventing adaptation or mitigation of climate change. International development cooperation that does not consider climate change implications may take countries down carbon-intensive development paths, as with funding for coal-driven power plants in China. This may bring short-term results in generating economic growth, but in the long term these benefits may be reversed. Growth policies therefore need to be re-thought to ensure they are climate resilient and that they encourage investment in sectors that are globally competitive, dynamic, resistant to climatic impacts, and highly adaptable (Vernon, 2008).

Existing shortcomings in the development cooperation system

With committed leadership, development cooperation may be able to meet the challenges associated with establishing a stronger focus on reducing vulnerability and on mainstreaming climate change adaptation. It is important to recognise, however, that the overall development cooperation system – comprising the countries, institutions, and processes that govern the delivery and management of development assistance – faces existing and substantial challenges that it is struggling to overcome. Unless these are addressed, it is unlikely that development cooperation will be in a position to play a positive and effective role in supporting climate change adaptation.

The first challenge relates to the substantial growth during the last decade in the number of countries, channels, and private actors involved in development assistance. A number of countries (China and India) have established significantly larger aid programs, and others (such as Brazil, Malaysia, Thailand and South Africa) have established aid programs for the first time. Including middle income and some high income countries that are not part of the OECD Development Assistance Committee (DAC), there are now around 34 countries playing a new or more significant role in development cooperation, bringing the total of bilateral donors to 59. Equally significant is the increase in the number of individual channels providing aid, which now numbers around 230 agencies, funds and programs. In addition, there are thousands of private actors, including a growing range of foundations, philanthropic bodies, Non Governmental Organizations (NGOs) and community based organizations (CBOs) (Bhattacharya 2009). The proliferation of funds is similarly evident in the climate change domain, where no less than eight bilateral and six multilateral funds

emerged between January 2007 and June 2008 (Porter et al., 2008).

The sheer number of actors now involved in development cooperation has provided more choices and opportunities for aid-recipient countries, but it has also spawned an overall system that is complex, fragmented, and unwieldy. Many of the actors that are not members of the OECD-DAC prefer, understandably enough, to pursue their own aid programs on their own terms. In so doing, they operate outside of existing structures and processes for the management and coordination of development cooperation approaches. This includes those that promote principles and norms based on agreed objectives, such as those articulated in the Paris Declaration on Aid Effectiveness.[3] This further means that within the countries, institutions and processes that comprise the current development cooperation system, there is little existing basis for a comprehensive, coordinated approach to addressing climate change issues, let alone for integrating climate change adaptation across all aspects of programmes and activities. If agencies choose to mainstream, they are likely to do so on the basis of individual choice, rather than as part of collective action.

The second challenge that threatens the development cooperation system's ability to play an effective role in supporting climate change adaptation relates to the question of ownership. Like all development cooperation approaches, a renewed focus on reducing vulnerability and on mainstreaming climate change adaptation depends on the engagement and support of developing countries. Aid will not be effective in facilitating climate change adaptation unless developing countries are centrally involved in the development and management of adaptation and mitigation responses. Ultimately, the countries most affected must be in a position to lead, manage and take ownership of adaptation measures that are undertaken in their own countries.

So far, however, the development cooperation system has a poor record of supporting developing country ownership at the national level. Over the last ten years ownership has emerged as the central issue affecting aid effectiveness, and has been recognised as key to the donor-recipient aid relationship. It was intentionally placed first on the list of Paris Declaration commitments, reflecting the fact that it is the most important overarching factor in supporting the Declaration's overall aid effectiveness objectives (Wood 2008). Both the Declaration and its 2008 addendum (the Accra Agenda for Action) describe ownership in terms of developing countries' ability to exert effective leadership over the development of national development policy and strategy. This recognises, implicitly, that international development institutions and donor countries have previously exerted excessive influence over developing country policy, in particular through the use of conditionalities attached to aid. Progress in implementing the Declaration's vision of ownership has, however, been varied. As the 2008 Evaluation of the Paris Declaration showed, there are wide differences in the extent to which donor countries are actually prepared to "let go"

and reduce past levels of control and leadership over development cooperation programs (Wood 2008).

There are also varying levels of commitment to assuming ownership in aid recipient countries (Wood 2008). This suggests that, among other things, developing countries have understandings of ownership that are very different to those articulated in agreements such as the Paris Declaration. Indeed, southern analysts describe ownership in terms that go well beyond the Declaration's relatively narrow vision. Ownership is seen as a complex issue integrated within a country's economic, social and political make-up (De Mel 2007), and as "the exercise of national independence and sovereignty in a democratic process in the determination of development policies and strategies" (Tujan 2008: 2). Southern commentators also point out that national development plans are an inappropriate mechanism for the articulation of national ownership, given that donors require these plans as a basis for funding, and thus continue to exert influence over the plans' content (Culpeper and Morton, 2007).

Ownership therefore constitutes a disputed and hotly contested aspect of the development cooperation system. While this continues to be the case, it is unlikely that the development cooperation system can deliver climate change adaptation approaches that, at the national level, are led, managed and owned by the developing countries that are worst affected. This, in turn, is likely to significantly undermine the viability of these approaches.

The third and most serious challenge facing the development cooperation system concerns the processes that govern overall policy and decision-making at the international level. If development cooperation is to play an effective role in financing and supporting climate change adaptation and mitigation, these processes must have the involvement – and confidence – of the countries worst affected by climate change. Yet decision-making and policy within the current development cooperation system is largely controlled by developed countries and by Northern-dominated institutions. Bodies such as the G8, the World Bank and the OECD Development Assistance Committee all play key roles in determining international policy on the role of development cooperation, and on the norms and standards for aid quantity and quality. Developing countries – the recipients of aid – have either no, or disproportionately little representation and voice in the governance mechanisms of these institutions. For example, borrowers from the World Bank have "virtually no real control over [its] fundamental decisions" (CGD 2005: 24). A total of 46 Sub-Saharan African countries are represented by only 2 chairs on the Bank's Board of Directors. The OECD-DAC played the driving role in crafting agreement on the Paris Declaration on Aid Effectiveness, but none of its 23 members are developing countries.

It is little wonder, therefore, that in the eyes of many developing countries the de-

velopment cooperation system lacks the legitimacy to represent their interests. Some analysts maintain that developing country voice and representation is the top priority for reform of the aid architecture (Evans 2006), and that solving the legitimacy problem is far more urgent than implementing Paris Declaration commitments, which are confined to the delivery of aid (South Centre 2008).

Recent experience suggests a glimmer of hope for improvements in representation and voice. The DAC and OECD donors in general are working more closely with developing country partners, and civil society actors are now starting to play a stronger role in influencing international agreements such as the Accra Agenda for Action. The recently established UN Development Cooperation Forum has the potential for taking a stronger role in the governance of development cooperation, has broad support from developing country governments and civil society organisations, and addressed climate change as part of its first meeting in 2008. Overall, however, these small improvements are insufficient: the Development Cooperation Forum has no decision-making mandate, and its precise role, including its level of influence, are still being determined (Brown and Morton 2007). If developing country interests are to be legitimately represented in the development cooperation system and in its responses to climate change, deep reform of the governance of the key development institutions and decision-making bodies will be required.

Financing climate change adaptation: What role for ODA?

Official Development Assistance (ODA) has a role to play in promoting the mitigation of, and adaptation to climate change, but more funds will be necessary to ensure that both development and climate objectives are incorporated, through mainstreaming, into development cooperation. As most estimates find that the ODA available today is insufficient for achieving the Millennium Development Goals, development agencies must ensure funds are not just diverted from existing development activities. Financing needs for adaptation are very large, and it is unlikely, based upon past trends, that new and additional ODA will be made available to fulfil all of this need.

In light of the need for new resources for financing climate change, and the limited amount of ODA available, counting ODA as both finance for development and climate change is inadvisable: it goes against the jurisdiction, authority and principles of the UN Framework Convention on Climate Change (UNFCCC). Instead, ODA should go to development activities that address the drivers of vulnerability to climate change and build response capacity through mainstreaming of climate change adaptation into development cooperation. A separate set of climate

costs – relating to climate proofing infrastructure, and addressing particular climate risks – should remain the domain of the UNFCCC.

There are also, of course, substantial financing needs for climate change mitigation. An additional investment of $200-210 billion will be needed, according to the UNFCCC, by 2030 to reduce greenhouse gas emissions to 2008 levels (UNFCCC 2008). These investments to return GHG emissions to the current level will have to come from a variety of sources: funding through the UNFCCC, national public and private investments, and some ODA (Michaelowa and Michaelowa, 2005).[4]

Two spheres of influence: ODA vs. climate finance in adaptation financing

According to one useful conceptual framework for adaptation to climate change (McGray et al. 2007) there are four types of adaptation that need financial support. There is, firstly, financing that responds to specific climate risks; secondly, that manages climate risks; thirdly, that builds adaptive capacity more broadly; and fourthly, that addresses the drivers of vulnerability. These four categories correspond to activities that range from a focus on the known impacts of climate change to a focus on building the capacity of communities to respond. The authors argue that UNFCCC climate funds under the GEF have focused on the first category of confronting specific climate change risks. On the other hand, ODA, in its focus on reducing poverty, is focused on the last type, namely addressing the root causes of vulnerability to climate change: poverty and dependence on climate-vulnerable sectors.

Missing, they argue, are investments in building adaptive capacity and managing climate risk. Mainstreaming climate change in development cooperation through a vulnerability approach, as described above, could clearly include investments in building adaptive capacity – that is, building the resilience of economies, societies and ecosystems – and thus go some way to addressing that crucial third category of adaptation activities.

We can thus sketch out two separate spheres of influence for ODA and non-ODA financing of adaptation financing. On the one hand, there is finance through the UNFCCC and Kyoto Protocol instruments that addresses and manages specific climate change risks, and then there is ODA which addresses the drivers of vulnerability and builds adaptive capacity, including adaptive capacity as a means to address the MDGs. While there is undoubtedly some overlap in the type of activities that are financed, in focus, intent and legal status, the finance provided is different in nature. The next two sub-sections estimate and explore these two spheres of adaptation financing.

Financing for managing and confronting particular climatic risks

Estimates of the cost of managing and confronting particular climatic risks range from $10 to $50 billion a year for the developing world, according to the World Bank and Oxfam respectively (UNFCCC 2008). Like all other estimates of the costs of climate change, these numbers are not exact, and the bases and assumptions for the calculations remain open to doubt.

The UNFCCC text includes a strong call for "new and additional resources" to assist developing countries in covering their adaptation needs. In particular, Article 1 of the Convention makes reference to "common but differentiated responsibilities and capabilities". In essence, this principle states that, owing to their historic responsibility for greenhouse gas emissions and their greater capacity to pay for climate change impacts, developed countries are obliged to provide financial transfers for the mitigation of and adaptation to climate change (LeGoulven 2008; Oxfam 2007). As such, developed countries should provide funding out of a responsibility to pay, both morally as those responsible for polluting, and legally under international law (Barrett 2007 in LeGoulven 2008).

Despite this strong mandate for voluntary contributions, the actual amounts provided to the funds created by the Convention have been extremely limited. In 2008, only $96 million was committed to the Global Environment Faculty (GEF) Funds established for this purpose, and of this, a mere $26 million was actually disbursed (see Table 1 below). There is some possibility that these amounts will be supplemented by a number of alternative arrangements, including the Adaptation Fund, which is to be financed by a 2% levy on Clean Development Mechanism (CDM) transactions.[5] However, the amounts that these mechanisms may yield are as yet unclear; and there are political barriers involved in the implementation of all of them.

Table 1. Multilateral Vertical Funds for Adaptation to Climate Change

Mechanism	Description	Origin	Amount Available	Amount Disbursed
Strategic Priority on Adaptation	Multilateral financial mechanism funded by developed country pledges: funds go only to projects which demonstrate global environmental benefits	GEF; UNFCCC	$50 million	$28 million committed, $14.8 million disbursed
Least Developed Countries Fund (LDCF)	Funded through pledges from developed countries, supports the preparation and implementation of National Adaptation Plans of Action (NAPAs)	GEF; UNFCCC	$115 million	$59 million committed, $9.8 million disbursed
Special Climate Change Fund (SCCF)	Developed country funding; goes to long term mitigation and adaptation needs of developing countries	GEF; UNFCCC	$65 million	$9 million committed, $1.4 million disbursed
Adaptation Fund	Funded by 2% levy on CDM credits and voluntary pledges, potential recipients propose their implementation agency	Kyoto Protocol of UNFCCC	$160-950 million by 2012; $50 million to date	Not yet operational as of early 2009
Pilot Program for Climate Resilience (PPCR)	UK, US, Japan contributors; focus on developing climate-resilient development plans through program, tech assistance, and direct investment	World Bank Strategic Climate Fund	$500 million	Not yet operational as of early 2009

ODA for the MDGs, reducing vulnerability, and increasing adaptive capacity

Official Development Assistance (ODA) can, by reducing poverty and tackling inequality, address the drivers of vulnerability and help attain the MDGs. At the same time, development activities can work to enhance adaptive capacity, as analysed in more detail in Section 1 above, through mainstreaming climate change. Although less effort has been put into estimating these costs, the price of attaining the MDGs in an era of climate change can still provide a preliminary assessment of the scale of financing needed.

Climate change will make it more costly to achieve the Millennium Development Goals; but even without meeting the costs of climate change, the MDGs face serious financing shortfalls. The UN Millennium Project has estimated the financing needed to achieve the MDGs in the absence of climate change. They calculate that the cost of meeting the Goals in all countries will amount to $121 billion per annum in 2006 and $189 billion per annum in 2015. Including emergency relief, capacity building and research, approximately $152 billion USD (2003 dollars) in ODA will be needed per annum by 2010 and $195 billion per annum by 2015 to achieve the MDGs. As a result, rich countries will need to increase the percentage of GNI dedicated to ODA up to at least 0.54% by 2015 just for the Millennium Development Goals to be achieved. Including ODA to address non-MDG concerns[6] the project estimates that 0.7% of GNP will need to be dedicated to ODA (Millennium Development Project, 2005). This is the same level as the original target for ODA/GNP set at the UN in

1970 that most OECD donors have subsequently consistently failed to meet.

According to Nicholas Stern, climate change could increase the cost of attaining the MDGs by as much as $100 billion (Stern 2008). This would bring the ODA bill up to $295 billion by 2015 and, using the Millennium project's original estimates of developed country income, bring up the percentage of GNP dedicated to ODA just for the Millennium Development Goals up to 0.82% by 2015. Based upon the project's assumed ratio of MDG to non-MDG ODA, this would require that at least 1.06% of GNP be dedicated to ODA – well above the 0.7% that is the current target. The global economic slowdown will push this percentage up further by slowing growth in developed countries and lowering their GNP, while reducing developing country capacity to mobilize domestic resources for the MDGs. While it is too early to quantify these amounts, suffice to say that by 2015 a very conservative estimate of at least 1.1% of GNP will need to be dedicated to ODA to meet the MDGs in a world facing climate change and slower economic growth.

Previous experience and historic ODA levels suggest this is an unrealistic target. Indeed, there has been a long-term decline in the percentage of national income that has been dedicated to international aid, notwithstanding the Millennium Development Goals and increasing per capita incomes that make aid more affordable. In 1960, net ODA in US Dollars as a percentage of donor countries' gross national incomes was 0.51%. In the 1970s and 1980s, net ODA ranged between 0.35% and 0.32%, but steady decreases in the 1990s brought the proportion down to 0.22% by the beginning of the new millennium. Aid statistics peaked in 2005 and 2006, when net ODA was 0.33 and 0.31 % respectively, owing to one-time debt forgiveness grants. By 2007, net ODA was back down to 0.28% (OECD). On this basis, it would need a dramatic change in political will in developed countries to scale up ODA even to the 0.7% target – let alone to the level of 1.1% of GNP that will be required when climate change and the economic slowdown is considered.

The governance of climate change financing

The availability of funding for climate and development is not the only constraint on the involvement of development finance in the climate solution. Civil society and some developing country representatives have raised concerns regarding the involvement of ODA for a number of reasons. Firstly, they argue, the poor representation of developing countries in decisions on climate change in development agencies is undermining developing country ownership of climate strategies (CCIC 2008). In particular, opposition to the decision of developed countries to provide climate financing through bilateral and multilateral ODA has focused on the governance implications of the involvement of the OECD Development Assistance Committee and the World

Bank in climate change policy making. Criticism regarding the World Bank's new Strategic Framework on Development and Climate Change, its Climate Investment Funds, and the Pilot Project on Climate Resilience, have focused on the low representation of developing countries in governing boards of funds and the organisations themselves (Muller and Winkler 2008 in Le Goulven 2008; CCIC 2009).

Secondly, it is argued, funding provided through aid or loans weakens the UNFCCC. It is pointed out that the environmental convention is the global body which has the governance structure and legal mandate to mobilize funds for climate change and disburse them through a process which incorporates the voices of developing countries into the design of climate change financing mechanisms (South Centre 2009). In reiterating the terms of their August financing proposal (see FCCC/AWGLCA/2008/MISC.2), developing country negotiators in Poznan emphasised that the UNFCCC must be strengthened as the central clearing house for climate change financing.

Thirdly, there are fears regarding access to funds. Developing country representatives have raised concerns within the UNFCCC process that existing and proposed sources of financing for adaptation to climate change are unwieldy and place too many demands on developing country applicants. This is not only true for World Bank funding, but also the GEF, whose extensive procedures and criterion have been described in depth elsewhere (Le Goulven 2008; CCIC 2008). In the eloquent words of the Indian delegation to the UNFCCC: "the proposed financial architecture must ensure access to funds for adaptation instead of forcing developing countries to adapt to funds made available" (UNFCCC 2008).

Conclusion

This article has presented a potentially pessimistic picture of the role that development cooperation can play in addressing climate change adaptation and mitigation. Firstly, in order to help attain the MDGs and also meet climate change goals, ODA will need to increase to unprecedented levels, a hard task given current global economic conditions. Second, development cooperation must address recently emerging problems as well as seemingly intractable systemic issues such as the lack of genuine developing country ownership, voice and representation. These represent significant challenges, but they are not insurmountable. The growing number of actors within the development architecture may provide an opportunity to take the mainstreaming of climate change adaptation beyond traditional country donors and multilateral institutions. Over the next few years the UN Development Cooperation Forum may emerge as a more representative and equitable forum for addressing aid and other development matters, including climate change. The increasing urgency of addressing climate change may lead to greater understanding of the respective areas of involve-

ment of the development cooperation system and the UNFCC, including greater clarity on which aspects of adaptation ODA should finance, and which it should not. Ultimately, however, development cooperation will play only one, relatively small part in global efforts at climate change mitigation and adaptation. The success of development cooperation and these overall efforts will depend on high level political commitment to change. There are signs that such commitment may now be emerging, and this is good news for everyone.

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Endnotes

[1] This finding is confirmed in the climate change arena, where countries with a high-level mandate for mainstreaming and leaders who implement it (such as the UK) are more advanced in their mainstreaming efforts than countries where government and management leadership is weaker (such as Canada).

[2] The climate paradigm challenges people's deeply held belief systems, albeit in a different way than the gender question. Work across development and environment ministries in developed countries, and environment and finance ministries in developing countries, can help challenge conventional development thinking. A focus on climate challenges how we think about development (as industrialisation, or as capacity to survive and thrive in the face of shocks), about growth (about short term GDP per capita growth, or longterm sustainability and real costing of environmental impacts) and about rural development (as just more agricultural yield, or about the resilience of rural economies, crops and communities).

[3] The Paris Declaration on Aid Effectiveness was agreed on in 2005 at a High Level Forum involving donor countries, multilateral agencies and aid-recipient countries. It sets out joint commitments on ownership, alignment, harmonisation, managing for results and mutual accountability. It was followed in 2008 by a High Level Forum in Accra where participants agreed on an addendum to the Paris Declaration, the Accra Agenda for Action.

[4] Between 1998 and 2000, the members of the OECD Development Assistance Committee (DAC) spent 2.7 billion USD or 7.2% of total bilateral Official Development Assistance (ODA) on mitigation of climate change

[5] Other mechanisms, including levies on the Kyoto Protocol's two other flexibility mechanisms, namely the Joint Implementation and Emissions Trading (ET) schemes, could also yield funding. Other proposals include a levy on emissions permits issued through cap and trade systems; the proceeds from a carbon tax; an airline levy; an international financial faculty for the climate, through which bonds are issued based upon a long-term aid commitment that acts as the capital; and public-private partnerships, particularly for investments in infrastructure and technology.

[6] According to the Project (2005), this "…includes a basic extrapolation of various kinds of official development assistance that are not related to the Goals (such as aid to countries of geopolitical importance for needs not covered in our costing). This is not a comprehensive measure of non-MDG needs. It is simply a baseline calculated on the basis of current ODA. We project that actual ODA needs for non-MDG-related goals — such as postwar reconstruction, the consolidation of new democracies, or the mitigation of climate change — will be considerably higher than this line.

Energy Access and Climate Change Mitigation: Friends or Foes?

Virginie Schwarz and Yannick Glemarec

Today, 1.6 billion people in the world still do not have access to modern energy services and 2.5 billion rely on traditional biomass fuels for cooking. In Africa and South Asia 70% and 59% of the population, respectively, do not have access to electric power. This is a major challenge to economic growth and global development goals. Modern energy services are central to achieving the Millennium Development Goals because they are positive catalysts for productivity, health, education, gender equality, safe water and communication services. Energy access is an important development priority in many developing countries. However, the IEA estimates that by 2030, there will still be 1.4 billion people without access to energy (IEA/2006 p.157& p. 419).

At the same time, the growing scientific consensus on climate change and its possible consequences make the necessity to reduce the world's GHG emissions a growing concern for the international community. The next 10 years will be critical for the future of our planet. Radical measures must be taken both mitigation of and adaptation to climate change before we lock into potentially irreversible, catastrophic climate transformations. All regions will be impacted by climate change with temperature changes, sea level rise, precipitation changes, droughts and floods that could lead to disruptions to ecosystems and biodiversity, changes in food production and water resources, and even damage to human settlements. Developing countries are especially vulnerable to climate change because of their geographic exposure, low incomes, and greater reliance on climate-sensitive sectors such as agriculture. It is imperative to act before climate change negates decades of progress and undermines efforts to achieve the MDGs.

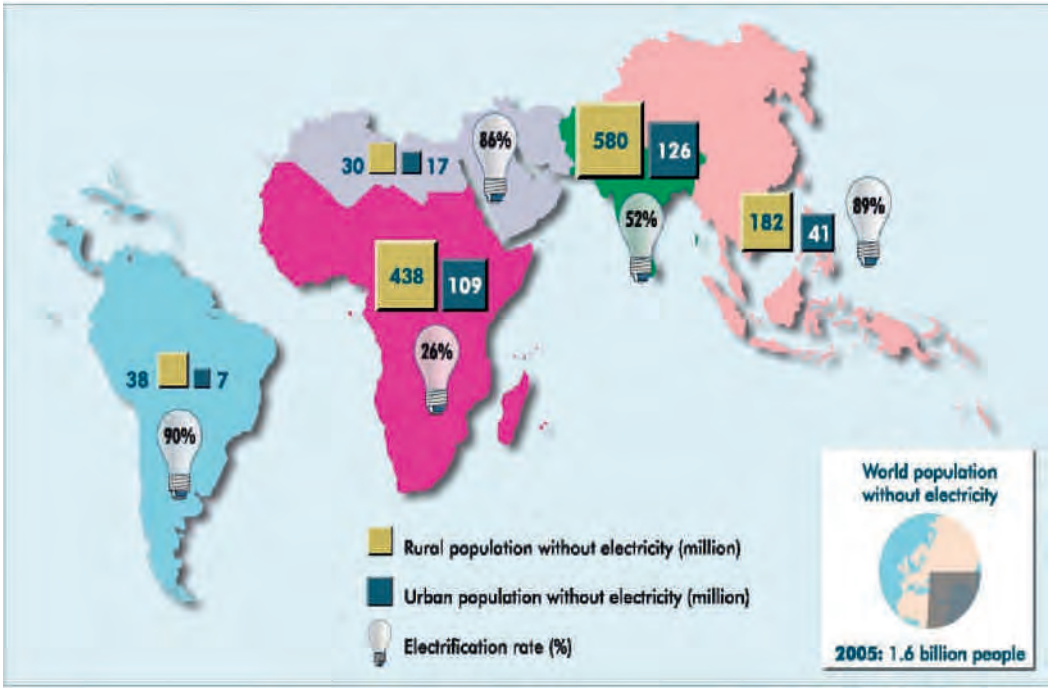
To some, the two objectives of improving energy access and mitigating climate change seem irreconcilable. There is a strong belief that improving energy access would necessarily mean increasing fossil energy consumption and therefore increase GHG emissions. Conversely, reducing GHG emissions would automatically imply limiting energy services, comfort and development. However, there is room for win-win strategies that meet the needs for energy services but do not harm the environment. Policies and new financing mechanisms designed to reduce GHG emissions can also improve the delivery of energy services.

Increased energy efficiency and reliance on local renewable energy solutions have the potential both to promote greater energy access, and to lower carbon emissions. However, their effective implementation is contingent on the removal of the barriers that limit their development. Development aid can play a critical role in this process by enhancing the capacity of developing countries to create favourable conditions for the development of policies, investments and the expansion of market-based instruments (carbon cap-and-trade systems mechanisms, etc.) and innovative finance options (carbon levies, etc.), that would lead to better energy access for all.

The energy access challenge

The number of people without electricity today stands at around 1.6 billion. Electrification is very unevenly distributed worldwide. Overall, 80% of those without access to electricity currently live in the rural areas of developing countries. Sub-Saharan Africa and South Asia have the highest proportions of people without access to electricity, in both urban and rural areas.

Figure 1: Population without Electricity, 2005



Source: IEA/2006 – *World Energy Outlook 2006*

From 1990 to 2005, the number of people with no access to electricity fell from 2 billion to 1.6 billion. Progress was mostly in middle-income, densely populated areas of Asia, Latin America and North Africa, with China recording the swiftest progress. Excluding China, however, the number of people without electricity has steadily increased over the past 15 years. Because of population growth, if no new policies are put into place there will still be 1.4 billion people lacking access to electricity in 2030. To reach the Millennium Development Goals, this number would need to fall to less than one billion by 2015 (IEA/2006 p. 157).

Since the vast majority of "energy poor" people live in rural areas and will continue to do so in the future, reaching them is a top priority. At the same time, meeting the needs of people and economies in periurban and urban areas that are experiencing rapid population growth is also critical. Governments are confronted with the double challenge of providing access to modern energy services to the isolated rural populations who currently rely entirely on traditional fuels, while at the same time meeting the rapidly increasing demand of growing urban populations and industrialising economic activities.

Addressing energy poverty is an important driver for the achievement of the MDGs and for national development. Modern energy services – whether derived from fuel, electricity or motive power – relieve tremendous burdens and create development opportunities for the poor by igniting economic growth.

Field evidence shows that benefits of access to modern energy services are real and significant (UN Energy/2008 p. 6&7). A recent cross-country examination of the development impacts of rural electrification programmes by the World Bank found that development benefits from these programmes are manifold and significant: improved levels of education, reduced indoor air-pollution, improved health services, development of home businesses, and reduced CO_2. Combined, the average estimated development benefits amount to USD 40-70 per household per month, considerably more than the cost of service. In Bangladesh, where over 40 million people have benefited from rural electrification in the last three decades, a study shows that villages with electricity generate 11 times more jobs than those without.

Linking energy access programmes to productive uses can amplify development benefits. Mechanical power for agro-processing in rural areas is one of the examples that generate significant development benefits of energy investments through productive uses. Development benefits can be significantly increased through modest investments that link modern energy services directly to economically, socially or environmentally productive applications.

Increasing access to modern energy services also brings major benefits for women and girls, especially in health, education, and productive activities. WHO estimates that indoor smoke arising from cooking and heating are responsible for 1.5 million

premature deaths annually in developing countries. Cost-benefit assessments of the introduction of clean cooking fuels shows that the economic benefits are enormous: at least six to seven times the cost of public intervention, with positive impacts on health, forest resources, time available for productive work, and GHG emissions. In Kenya, field research shows that use of improved stoves with a hood that draws smoke out through the roof reduces indoor concentrations of health-damaging pollutants up to 80%.

Access to modern energy services can also reduce the time women spend on "unpaid" energy related work (cooking, fuelwood gathering, agricultural processing, etc.) and free up time for paid activities.

Greater energy access and climate change mitigation – Irreconcilable objectives?

Improving energy access and mitigating climate are two major challenges in the coming years. However, some analysts consider the policies and activities aiming to make progress on both these issues are irreconcilable, for the following reasons:

- First of all, any emphasis put on climate change mitigation is considered a threat to development and energy access because mitigation is associated with reducing energy consumption and therefore reducing development possibilities.
- Secondly, mitigation is considered to be the responsibility of developed countries that have the highest current and historic emissions. Many developing countries have low greenhouse gas emissions in absolute and per-capita terms. Mitigation efforts on the part of smaller developing countries are considered meaningless because of their limited impact on world emissions.
- Third, clean energy options such as renewable energy are considered inappropriate as an energy supply in rural developing areas. These technologies are deemed too expensive and not market-ready. Thus, it is considered that they should be reserved for developed countries, and that developing countries should rely on traditional fossil fuel solutions, which are considered to be cheaper and easier to access.
- Fourth, clean energy options are also assumed to have less potential. Most renewable energy technologies are supposed to be at a Research and Development stage only and to be unable to be scaled up quickly enough to meet the urgent energy needs of growing economies. Similarly, energy efficiency potential is seen as limited in countries with few heavy industries.
- Finally, clean energy solutions are regarded as impossible to finance in rural developing areas. Financing instruments which have been newly developed to

reinforce financial pressures on firms to reduce emissions or provide financial incentives to invest in low-carbon emitting technologies, such as carbon permit trading, are considered to be inapplicable in developing countries.

On the other hand, some analysts are concerned that the current strategy of proceeding with a general reliance on traditional fossil fuel energy for immediate energy access and then, at some point in the future, switching to low-carbon solutions, could be self-defeating because of the dynamics of energy supply, demand and use in developing countries. Extended reliance on fossil fuel raises a series of sustainability issues, to wit:

Affordability is a key component of energy access. In a context where international fuel prices are rising – and are expected to remain high - the volume of fuels that low income populations can afford grows smaller and smaller, pushing more people into fuel poverty, even if they have the physical possibility to access energy. Paradoxically, efforts to reduce poverty by increasing access to energy, where the energy is fossil fuel-based, could end up having an adverse impact on the poorest populations. As energy demand could rapidly outstrip supply in the coming years, international fuel prices could keep rising, reducing the volume of fuels that low income populations can afford. This would push more people into fuel poverty. Between 2004 and 2007, over 50% of the incremental global demand for oil has come from Asia. As increases in demand – especially from rapidly industrialising countries such as China and India – have outstripped supply, the price of these commodities has risen (UNDP/2008 p. 11-12), making energy less accessible for the poorest populations.

Increased international fossil fuel consumption and higher resulting oil prices also have an adverse economic impact on oil-importing low income countries. According to the World Bank, higher oil prices are causing many net oil-importing Sub-Saharan African countries to lose economic ground, costing them a cumulative loss of over 3% of gross domestic product (GDP) and increasing poverty in those areas by as much as 4% to 6%. (World Bank/2006 p. 1)

Finally, uncontrolled increases in fossil fuel consumption have negative impacts on the environment, not only in terms of climate change but also on local air pollution and environmental health. In China, for example, the sulphur dioxide produced from coal combustion is estimated to contribute to about 400,000 premature deaths a year. These environmental hazards are drawbacks for development.

The need for a paradigm shift

To overcome the apparent conundrum, this article argues that it is necessary to rethink energy by focusing on the efficiency of energy use and the type of energy provided. More than the amount of energy supplied, socio-economic development is

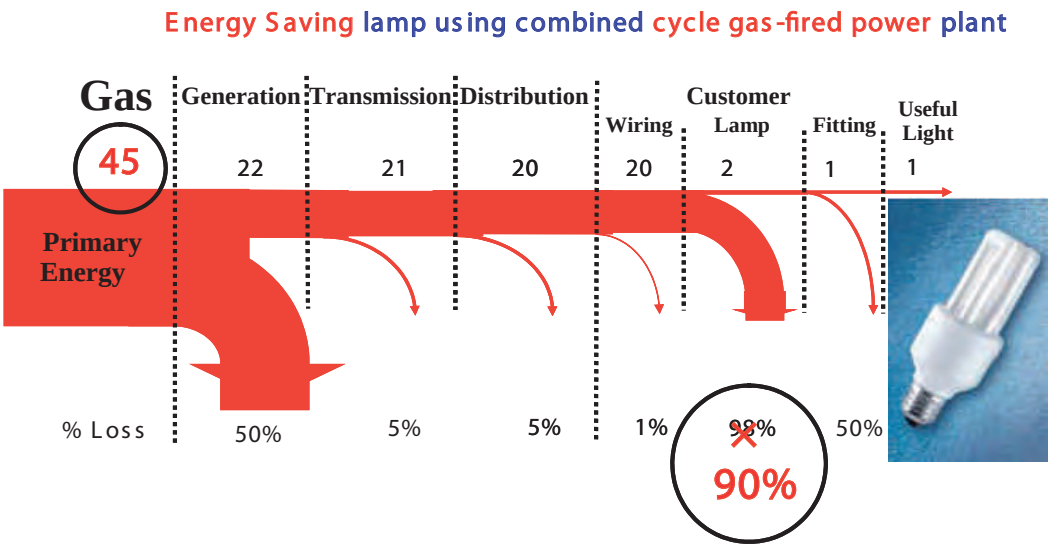
linked to the type of energy services provided. People need clean, efficient, safe lighting and warm homes without the risk of indoor air pollution or fires. It is possible to provide these services by using local renewable energy sources rather than fossil fuels. It is also possible to reduce the volume of energy necessary for the same result (thereby also reducing energy bills) by using efficient materials or appliances. Certain countries have also examine the possibility of meeting their growing energy needs through more controversial options such as coal generated electricity with carbon sequestration, or nuclear energy. These technologies however raise questions in terms of costs, availability and/or safety.

The power of energy efficiency can be illustrated easily by looking at a compact fluorescent lamp (CFLs). In the United States, a CFL can save over USD 30 in electricity costs compared to an incandescent lamp over the CFL's lifetime and save 2000 times its own weight in greenhouse gases. Figure 2. illustrates the energy saving potential of CFLs compared to incandescent lamps for the same amount of visible light.

The use of renewable energy and energy-efficient options such as biomass generators, solar-powered lanterns and cooking stoves, compact fluorescent lamps, and combustion of fatal gases can provide the same (or better) energy services while using less fossil fuels and emitting less GHGs.

When implemented in urban centres in developing countries where individual energy consumption is significant, energy efficiency solutions can help reduce per capita

Figure 2: Energy Services versus Energy Supply



For a given light output, compact fluorescent lamps use between one-fifth and one-third of the power of equivalent incandescent lamps.

or per unit consumption, thus freeing capacity to supply other areas of the country or a growing urban population. In rural areas, providing the population with efficient equipment (lighting, cooking, etc.) can open access to a number of services while requiring only minimal energy consumption that is easier to cover with decentralised, local renewable energy solutions.

In a number of countries, decentralised energy technologies have already made major contributions to expanding access to energy services for poor people in rural and remote areas with regards to electricity, cooking fuels/devices and provision of mechanical power.

In Nepal, for example, 4.7 million people lack access to electricity. Urban areas are relatively well-supplied, while rural areas, especially remote, isolated and dispersed hill communities, have little prospect of being supplied by the national grid in the near future. Beginning in 1996, Nepal's micro-hydro programme has supported the installation of 10 MW grids in 40 districts, supplying renewable electricity to more than 100,000 households. By 2011, the micro-hydro programme is expected to supply 25 MW of energy to over 250,000 households. The maximum market potential for micro-hydro schemes in Nepal is estimated at close to 150 MW, bringing access to energy to 1.5 million households (UN Energy/2008 p. 13).

Clean energy solutions (energy efficiency and renewable energy) that increase energy access while also reducing GHG emissions provide a number of benefits:

First of all, these low carbon development solutions can increase the energy security of oil-importing countries by reducing their degree of reliance on oil imports and their exposure to oil market fluctuations. Many of the renewable energy solutions are now competitive compared to traditional centralised fossil fuel-based solutions. The cost of most renewable energy technologies has been decreasing rapidly over the past years. For solar photovoltaic cells, the cost of modules has been divided by 30 to 40 since 1960, and with the progress made in R&D and currently booming markets, the Worldwatch Institute estimates that costs for solar photovoltaic power could decrease by an additional 40% between 2007 and 2010.

Secondly, energy efficiency and renewable energy can help reduce the energy bill of oil-importing developing countries. The McKinsey Global Institute has estimated that we could cut projected global energy demand growth by at least half, simply by taking advantage of opportunities to increase energy productivity, that is the level of output we achieve from the energy we consume. Additional annual investments of USD 170 billion for the next 13 years would be sufficient to increase energy productivity among all end users. The economics of such investments are very attractive: with an average internal rate of return (IRR) of 17%, they would collectively generate energy savings up to as much as USD 900 billion annually by 2020. (Mc Kinsey Global Institute/2008 p. 7-8) In this scenario, 57% of the investments would occur

in developing countries, notably China. Similarly, the IEA has shown that, on average, an additional dollar invested in more efficient electrical equipment, appliances and buildings reduces by more than two dollars the amount needed for investment in electricity supply. This ratio is highest in non-OECD countries (IEA/2006 p. 193).

Renewable energy and energy efficiency can also increase energy access of oil-importing developing countries. The supply capacity "freed" by clean energy projects can be used to reduce brown-outs and extend service coverage in sectors connected to the grid. In addition, clean energy options often take less time to implement than traditional energy projects. Renewable energy and energy efficiency solutions often lead to small scale projects and rely on more simple technologies. All the phases of the investment from preliminary studies to finding financing, obtaining permits and construction can be done more quickly, ensuring faster access to energy.

"Green" energy access options are well suited to rural, sparsely distributed areas. Because access to modern energy services is predominantly a rural problem, small-scale, distributed technology options (usually off-grid) can reach inaccessible and remote parts of countries where income is lower and volume of demand is lower. Many decentralised options, whether for cooking, mechanical power or electricity, are economically feasible and can complement efforts to expand grid electricity in rural and remote locations.

Providing energy access through low carbon technologies can be more cost-effective. Preliminary analysis by UNDP indicates that delivering basic energy services to poor people "beyond the grid" would require approximately USD 10 billion each year, which is less than onequarter of the USD 858 billion estimated by the World Bank to provide universal electricity access by 2030 based mainly on the grid option(UNDP/2008 p. 18).

Energy efficiency and renewable energy options can provide additional development benefits because they generally have a higher content of local jobs. An estimated 2.3 million people worldwide currently work either directly in renewable energy projects or indirectly in supplier industries. Since many of these jobs are linked to the installation and maintenance of the equipment, they are of necessity local. It is the same for energy efficiency. A 2004 report found that renewable energy creates more jobs per megawatt (MW) of power installed, per unit of energy produced, and per dollar of investment, than the fossil fuel energy-based sector(Kammen, Kapadia, Fripp/2004 p. 3). New research reveals that these jobs are not for just the middle classes – the so-called 'green collar' jobs – but also for workers in construction, sustainable forestry and agriculture as well as engineering and transportation."

Because they rely on renewable sources and are small scale, most of the clean energy options, such as solar or micro-hydro power, have minimal or no negative impacts on the environment.

Finally, most of these technologies are ready for roll-out. The IEA in its *Technology Report 2008* has documented several cost-effective, proven technologies that can both reduce GHG emissions and assist in poverty alleviation.

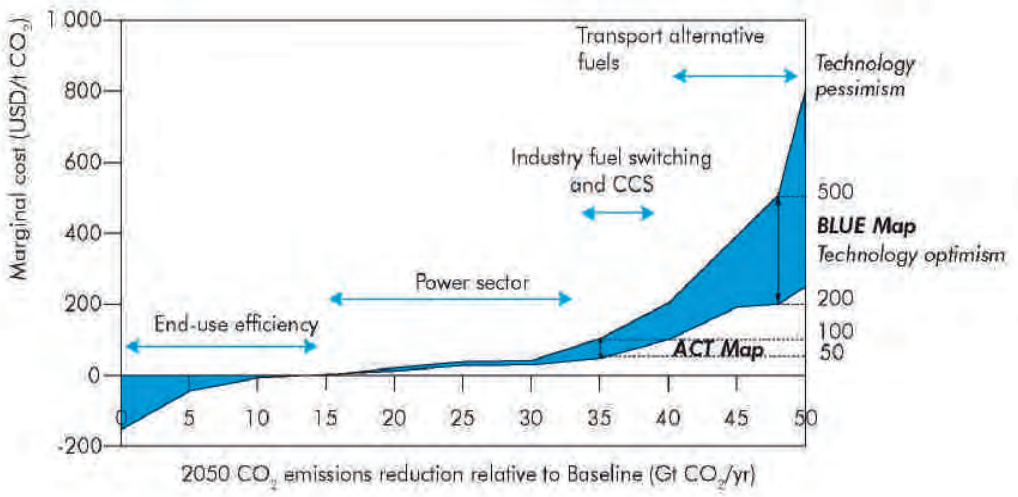
Unleashing the potential of clean energy services, the role of development assistance

Despite the inherent advantages of clean energy based solutions, however, adoption of these technologies is not progressing at the desired pace. The principal barriers to market penetration include limited awareness of decision-makers and industry representatives, as well as energy consumers, about the potential of clean energy technologies to meet national energy development objectives; limited supportive policies; limited institutional and individual capacities; and financial constraints.

A number of clean energy investments have negative (or very low) costs and short payback times because the savings they allow on energy bills over their lifetime are larger than their initial cost. This is particularly the case of energy efficiency projects (see Figure 3). Unfortunately, these potential win-win projects are often those confronted with the strongest policy and information barriers, notably within the building and transport sectors.

For example, the economics of energy efficiency technologies in the building sector work best with new construction, but builders have no incentive to save their customers money on their utility bills. Similarly, most utilities currently have little incentive to support energy efficiency programs without regulatory intervention.

Figure 3: Marginal Emission Reduction Costs for the Global Energy System, 2050



Access to information can also be a major barrier to consumer adoption of energy efficient appliances. Despite the overwhelming economic case for using compact fluorescent lamps, CFLs face a strong consumer resistance because of initial bad press, behavioural inertia and fear of change.

Finally, accessing financing remains a challenge despite the development of new financing instruments for clean energy and climate change management.

Until these barriers are removed, there is little chance of structurally transforming the markets of energy services towards widespread, lowcarbon energy access solutions. Development assistance can make a critical contribution towards the removal of these barriers by: (i) helping to establish supportive policy environments to enable markets to create effective solutions for clean energy for the poor; and (ii) facilitating access to appropriate financing.

Establishing a supportive policy environment for clean energy development

Establishing a favourable environment is a pre-condition for creation and implementation of projects related to clean energy access. By reducing the costs, risks, uncertainty and implementation time attached to the investments, barrier removal activities make these projects more attractive to potential private and public project developers and financers. In addition to national public funds, ODA can play a decisive role by supporting these enabling policies.

Because of the fragmentation of providers and consumers of energy efficiency solutions, there is no single market for clean energy services. Instead, the "market" consists of hundreds of providers, thousands of intermediaries, and millions of consumers. As a result, there is no single best solution to remove market barriers to clean energy development. Instead, policy makers need to consider the unique workings of individual markets in order to overcome the barriers specific to each market. (Golove, Eto/1996 p. xii&xiii).

For example, skills development and risk mitigation activities (education, certification programs, technological pilots, risk mitigation schemes, etc.) may prove more effective than regulatory mechanisms when the main barriers are attitudes, awareness, limited ability to obtain and process information, or perceived riskiness. This is particularly the case for access to clean, modern energy in rural and remote areas.

In most cases, establishing a supportive policy environment for clean energy development will require a mix of measures, including regulatory, economic, skills development, and awareness raising measures. In the wind energy sector for example, pre-conditions for the development of successful projects may require the preparation of wind assessments, standards for wind turbines, model contracts, training of local

technicians, information and communication, reviews of permit and licensing regulations, and modifications of charges to connect to the grid.

Even when barriers are mostly related to negative incentives that can be adjusted through regulatory changes, providing information may prove critical. For effective results, all levels of information are important: from general communication campaigns on benefits of renewable energy or energy efficiency, to individual guidance related to project design choices such as technology selection or choice of suppliers and contractors. Ensuring wide understanding of the issue of climate change is also a condition for ensuring public acceptance and support of policies and investment projects.

In each case, a sound understanding of the market barriers to be addressed and of the strengths and limitations of the proposed measures will be required for any particular market transformation exercise to succeed. Private funds are rarely available for such barrier removal exercises, so there is little alternative to ODA when national public resources cannot be mobilised. Here, development assistance can make a significant contribution to the development of the capacity of local and national decision-makers to identify the specific workings of individual markets and to implement an appropriate mix of market transformation measures.

In this context, UNDP for example, has mobilised approximately USD 2 billion in the last 15 years to help countries remove the main barriers to the implementation of greater energy access and security, energy efficiency and clean energy development projects, principally through the GEF[1] and associated co-financing.

Facilitating access to appropriate financing

In addition to policy and information barriers removal, additional support is necessary to improve the profitability and attractiveness of investments for projects with anticipated lower rates of return. This is often the case of renewable energy projects even if they remain less expensive than traditional fossil-based supply modalities in a number of rural areas in developing countries. Although these technologies can be competitive over their life-cycle with fossil fuel technologies, there is still need to mobilize the comparatively large up-front investment.

Most of the financing for energy projects in the coming years will have to come from private sources. Current levels of ODA, while significant, are unlikely to be sufficient to finance the necessary investments. For example, the IEA World Energy Outlook 2006 estimates that the investment required in energy infrastructure in de-

[1] UNDP is also one of the three founding Implementing Agencies of the Global Environment Facility, together with the World Bank and UNEP

veloping countries to meet growing energy needs could reach USD 500 billion per year over the period 2001-2030. ODA, at present, provides USD 5-7 billion per year for energy-related activities, and is only a small percentage of what is required.

The dual challenge is to find ways to attract enough direct investment to meet the growing energy supply infrastructure needs of low income countries to sustain their economic development, and to drive these direct investments towards lower carbon technologies so that countries are not locked into unsustainable paths for 30 to 50 years.

Recognising that public resources would prove insufficient to finance climate change efforts, the international community is currently piloting a number of new market-based instruments and innovative financial mechanisms to attract and drive direct investment towards lower carbon and climate resilient technologies and practices. According to the 2008 Global Trends in Sustainable Energy Investment Report, in 2007 the private sector invested nearly USD 150 billion of new money in clean energy technologies in response to these new market opportunities. Private investments in clean energy are expected to reach USD 450 billion by 2012 and USD 600 billion by 2020. (UNEP/2008 p. 7)

A key issue with a number of these new and innovative sources of finance is their acute regional and technological unevenness, with the bulk of these funds going to a few large emerging economies and to a few technologies. Although an estimated 575 million people still rely on traditional biomass for cooking in Sub-Saharan Africa (IEA/2006 p. 422), the region accounted for less than 1% of total private investment in clean energy in 2007.

For example, the Kyoto Protocol has created the Clean Development Mechanism (CDM) to promote both sustainable development and GHG emission reduction in developing countries. The CDM is a global cap-and-trade mechanism, which allows developing countries to earn credits for their emission reduction projects and sell these cheaper credits to industrialized countries. The UNFCCC estimated that the CDM could range between USD 10 and USD 100 billion per year by 2030, depending on emission reduction targets and the price of carbon credits. A recent World Bank study on CDM potential in Africa came to the conclusion that 170 GW of additional power-generation capacity could be created in Sub-Saharan Africa through low-carbon projects which were eligible for CDM (World Bank/2008). This would equal roughly four times the region's current modern-energy production.

Despite this potential, there is strong concern that only a limited number of countries will benefit from the CDM, and that this mechanism could entirely bypass Africa. Just five countries – China, India, Brazil, South Korea, and Mexico – are expected to generate over 80% of CDM credits by 2012. Almost half of these credits will come from non-CO_2 industrial gas emissions (such as HFC23 destruction) that are char-

acterised by a high return on investment, but have limited sustainable development benefits.

While it holds the promise of attracting a greater volume of resources, it is clear that developing countries need assistance to truly benefit from the carbon market and other emerging sources of financing for GHG emission reductions. All too often, current market rules are failing to attract direct investors into lower-carbon technologies in developing countries.

Rather than directly financing individual investments, development assistance can have a leveraging effect by helping countries assess the potential of these new financing instruments and create the necessary environment for domestic investors to access them.

In this context, UNDP, for example has developed and is in the process of developing a number of project financing and development facilities, including MDG Carbon Facility, and the Energy Access Facility. These facilities are specifically designed to assist project developers in formatting and preparing their projects in ways that will maximise their chances to access appropriate funds such as the Clean Development Mechanism.

Conclusion

Promoting energy efficiency and local renewable energy has the potential to make a significant contribution to increasing access to energy services in developing countries while reducing GHG emissions at the same time. Clean energy technologies are often superior options for meeting the energy needs of developing countries, because of their negative or low costs and wide benefits. However, their development is handicapped by a wide range of policy, technological, attitudinal and financial barriers. These barriers are specific to an array of technology and area-based markets.

Releasing the potential of local renewable energy and energy efficiency requires increasing efforts to remove barriers which hinder projects, and providing an enabling environment to attract public and private financing. These issues – for which private funds are scarce – should be a priority for development assistance. Development aid is crucial for enhancing the knowledge and understanding of national and sub-national authorities of the risks and opportunities related to climate change and how they are linked to energy access. More development assistance should also be focused on increasing the capacity of these authorities to design and implement comprehensive strategies, including barrier removal activities and accessing new sources of financing, for low carbon energy access, in a context were most of the investment will need to be financed from private funds.

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Population Dynamics and Climate Change: Recasting the Policy Agenda

George Martine and José Miguel Guzman

Introduction

Concern with climate change has recently become so acute as to supersede human anxiety over all other forms of environmental disturbances. There is solid cause for refocusing the agenda as observed by the Intergovernmental Panel on Climate Change (IPCC): "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level" (IPCC, 2007:30). It is estimated that if the emission of greenhouse gas (GHGs) is not curtailed, the earth's temperature will rise between 1 and 4 degrees centigrade over the course of the 21st century (IPCC, 2007: 30). These changes will evidently have enormous and multiple implications for humankind.

In an effort to get a better grasp on what needs to be urgently done to allay the dangers of climate change, researchers are re-examining the impact of traditional agents in environmental transformations, while new combinations of driving forces are also being investigated. Population dynamics and their interactions with other mediating factors are unquestionably among the critical issues that have to be scrutinised when searching for sustainable solutions to the challenges posed by a changing climate. However, this article argues that some of the traditional views on population/environment relations, which still prevail in the perception of the general public and in some policymaking circles, need to be refocused in order to reflect changing population dynamics and to recast policies in a more realistic framework.

The relevance of population dynamics to climate change has generally been considered in the context of mitigation efforts.[1] However, demographic changes not only affect the trajectory of climate change but also define the profile of the groups most vulnerable to the negative impacts of probable climate change. Hence, population dynamics must also be contemplated in any assessment and orientation of adaptation efforts.

Although demographic size and rate of growth have been the focus of most attention, population dynamics also involve other less-discussed but increasingly important aspects, such as the changing distribution of population over space, as well as its evolving composition by sex, age and household type over time. The various impacts of these different and inter-related components of population dynamics on sustain-

ability are, in turn, mediated by development processes, institutions and social organisation. This article will focus primarily on two major aspects: the relations between population growth and size on environmental change, and the significance of spatial redistribution patterns, particularly, urbanisation, for climate change. Given space limitations and the current state of research, other aspects of demographic dynamics will receive lesser attention.

This analysis of the interactions between different components of population dynamics and climate change suggests more discriminating policy approaches are necessary for the population field than those which normally prevail in public opinion and in much of the literature. Thus, population size and growth are undoubtedly critical drivers of climate change, but this does not necessarily mean that investing in vigorous family planning programs is sufficient to alleviate demographic pressures on climate change quickly and effectively. Similarly, urbanisation is undeniably the locus of some of the key processes that provoke climate change, yet the concentration of population in urban localities can be viewed as critical to future environmental well-being. Meanwhile, ongoing changes in household patterns and age composition throughout the world need to be considered more explicitly since they affect the nature of the production and consumption practices that condition the emission of GHGs.

Population size and growth: Crucial but differentiated

Population growth and size have traditionally been defined by environmentalists as being at the root of many problems in their field. This tenet has been routinely incorporated into discussions of climate change, with population growth frequently figuring as the primary culprit in any recital of the list of factors underlying global change. The appeal of this explanation is particularly attractive to the general public, since the linkage between population size and environmental damage appears obvious. The problem comes when people assume that the environmental problems stemming from population growth and size could be easily resolved simply with massive family planning programs in poorer countries. Such expectations are unrealistic.

This article holds that the importance of population size and growth as drivers of climate change cannot be minimised, and that there is much that can be done to address this issue when tackling future and long-term sustainability. However, such efforts do not constitute quick fixes to the present challenges. Currently, world population has reached 6.7 billion, having doubled in size since 1965, and it continues to grow by some 78 million additional people each year. The United Nations expects world population to grow to 9.2 billion by 2050, on the assumption that fertility rates will continue to decline significantly in poorer countries during the interim. The same source also indicates that the actual population size in 2050 could, in reality, be found

in the range between 7.8 and 10.8 billion, depending on the trajectory of fertility rates in coming years (UN Population Division, 2007).

Few would question that the environmental implications of having 7.8 billion people on this planet are radically different from those of 10.8 billion. Most environmental problems tend to be aggravated by population growth and greater population size. As mildly put some years ago by Vaclav Smil, there is little reason to believe that greater population size will make for a higher quality of life (Smil, 1993:207). Overall, lower rates of population growth and a smaller global population size would, *ceteris paribus*, favour better environmental outcomes.

Yet, sheer numbers do not tell the whole story. A world population of 7.8 billion could actually inflict greater damage on the global environment than one with 10.8 billion, depending on its relative patterns of production and consumption. In this connection, it is noteworthy that traditional categories linking development levels to population growth rates are becoming blurred. Brazil now has fertility levels that are lower than those of France; several developing countries, including China, now have the type of low fertility rates that until recently were found only in high-income countries. Conversely, a doubling of population is being anticipated in the world's most powerful developed country – the USA. Gaps in mortality and life expectancy between developed and developing countries are similarly decreasing.

Throughout all these changes, the population/environment nexus continues to be fundamentally mediated by development processes and by specific social and economic contexts. The population of the 50 poorest countries is expected to triple in the first half of this century, yet these fast-growing countries are *not* the ones that will be making the biggest contribution to global environmental problems in the near future. The wealthiest nations, with less than 20% of the world's population, are still responsible for the massive scale of natural resource consumption, much of it wasteful, as well as for the bulk of pollution. Thus, patterns of civilisation and styles of development, not numbers of people *per se*, have the greatest impact on the environment and on climate change today. Yet, the reason that today's numbers are not as threatening as they could be from a climate change perspective is simply because the majority of the world's population is still poor.

In short, the impact of size and growth is rarely linear or exclusive, since distinct population groups impinge on the environment, and more specifically on climate change, in very different ways. Population size, today, is much more damaging for the environment, given relative levels of consumption, in developed countries than in the poorest countries. Yet, it is vital to observe that, under current development models, the world's developing areas are pressing to emulate, *grosso modo*, the consumption patterns of industrialised countries. The consequences of their eventual success in this endeavour are obviously disturbing, from a strictly environmental point of view,

exactly because of the enormous population size that the world and some of the countries pursuing economic growth have achieved.

China and India together already account for onethird of humankind's mass, and the ongoing rapid expansion of their middle classes could quickly tip the scales of sustainability. The fast-growing poorer countries of today could, in the future, make a huge impact on the global environment and on climate change if, as is desirable from a humanitarian standpoint, they are successful in pursuing development. The widespread adoption of the consumption practices and living standards typical of the affluent in all these countries would seriously deplete existing resources, expand energy use, accelerate climate change and threaten global environmental well-being. The current lifestyles and consumption patterns of the rich simply could not be generalised to the world's entire population without causing severe environmental imbalances that could challenge humankind's very survival.

Yet, to condemn developing countries to permanent poverty in order to preserve the environment and reduce climate change risks for all is evidently unacceptable, particularly in view of the fact that the industrialised countries are *not* taking all the necessary steps to reduce their own large impact on climate change. This situation evidently presents humankind with very difficult decisions concerning equity, styles of development, poverty alleviation, and sustainability. In the short term, a decrease in population size would have the greatest efficiency in developed countries where per capita consumption is highest. But, since most of these countries already have below-replacement fertility, and are also ageing rapidly, the effects on the world economy might be more significant than their effects on the environment.

Realistically, what are the chances of a rapid reduction in population growth rates and the stabilisation, or even the reduction, of global population size? Two additional facts need to be considered in this connection. First, fertility rates generally cannot be brought down quickly by simply providing family planning services. Research indicates that people need to have some positive indication of possible improvements in their lives (including a reduction of infant and child mortality rates) before they are motivated to significantly reduce their fertility. In other words, abject poverty is not per se an effective motivator for fertility reduction; some glimmer of the potential for social mobility and improvement of living conditions has to be perceived by people for rapid fertility decline to take place. Access to reproductive health services is nonetheless clearly important for its own sake, as a basic human right and an important form of empowerment.

Secondly, it must be observed that even rapid fertility declines would not immediately produce the stabilisation or reduction of population sizes. Family planning just does not have retroactive effects! Actually, the majority of population growth today is due less to current fertility patterns than to imbedded demographic inertia, that

is, the result of fertility and mortality patterns of previous generations. This inertia results in a time lag of several decades between the initial reduction in fertility levels and any population decline. It is estimated that over half of world population growth from now to 2050 will be attributable to inertial factors (National Academy of Science, 2000).

Such sobering observations on the limitations of efforts to achieve rapid population stabilisation, however, should not dampen greater efforts to empower women, and to provide them with access to family planning services in the framework of high quality reproductive health services. A large proportion of the world's women still do not have access to the means that would allow them to have the number of children that are desired (UNFPA and Alan Guttmacher Institute, 2004). This gap is also verifiable in the fastest-growing demographic groups within developed countries. Human-rights based policies that empower women and address unmet needs for reproductive health services, whether in developed, developing or poor countries, would have an important impact on reducing the rate of population growth, the eventual size of the world population and thus the long-term impact on the environment and on climate change, while also giving people more control over their lives. Even inertial growth could be reduced if the age at which people married was raised and the conception of the first child was delayed (Bongaarts, 2007). However, these changes require important cultural changes.

In brief, the responsibility of increases in population size and rate of climate change, and particularly the possibility of rapid reductions in population mass or growth rate, is considerably more complex than generally perceived. On the one hand, there is no "quick fix" for the magnitude of the world's population mass that has been built up over time, especially during the last 60 years. On the other, it is simply impossible for the entire world population to practice the same levels and types of consumption that the developed world has become accustomed to without greatly accelerating the risks of climate change. Yet, it is equally unthinkable for the world to maintain current levels of poverty and socio-economic disparities. In this framework, mitigating climate change effectively will require a much more profound scrutiny and re-orientation of our very pattern of civilisation.

Finally, it should be observed that population size and growth can be paramount when dealing with national *adaptation* policies. O'Neill et al. (2001), in a comprehensive study of linkages between population and climate change, concluded that reduced demographic pressure, through lower fertility and slower population growth, would help developing countries in dealing with the expected effects of climate change. However, a declining population may have problems to adapt as it will come under intense fiscal pressure due to aging; in such a context, industrialised countries tend to revert to pro-natalist policies. These aspects regarding the significance of population

size and growth in adaptation merit further investigation and subsequent incorporation into national strategies.

Other demographic factors beyond total population size and growth

Other less-discussed components of demographic dynamics need to be incorporated in the debate on climate change. This sections looks briefly at changing age structure, household composition and immigration. The subject of massive urban growth and its implications is discussed at greater length in the final section of this article.[2]

The importance of changing age structures (particularly ageing), as well as the changing size and composition of households, on climate change has only been recently recognised (O'Neill and Chen, 2002; O'Neill, 2005). The issues are complex and much remains to be done in order derive a more complete understanding of their implications, especially in developing countries. This article will not purport to cover them in any depth, but simply to illustrate the fact that anticipating changes in number, size, and composition of households is becoming a critical element of monitoring and forecasting climate change emissions.

A recent study by Dalton et al. (2008) concludes that, in the United States, population ageing could reduce long-term emissions by almost 40% in a low-growth demographic scenario. It also concluded that, in some cases, the effects of ageing on emissions can be as large, or larger, than the effects of technical change. Another study in the United States (O'Neill and Chen, 2002) shows that household size and type seem to have a minor effect on energy consumption. However, the researchers consider that in developing countries: "Aging, behavioural changes favouring nuclear over extended families, later ages at marriage, higher divorce rates, and increased propensities to live alone are expected to contribute to further shifts in size and structure." These demographic changes in developing countries could probably have stronger "effects on energy use than would be expected in industrialized countries."

Along the same lines, Dalton et al. (2007) analyse whether changes in the demographic characteristics of households in China and India, considered in projections over the next century, could have an impact on consumption, economic growth, energy demand, and carbon dioxide emissions. Examining changes in population size, urbanisation, and the size and age structure of households, the authors conclude that urbanisation would lead to a significant increase in emissions (presumably because of changing consumption patterns), while aging would contribute to a decline in emissions. Combining both effects, demographic change would produce an increase in emissions from China by 45%, and from India, by 25-55% by the end of the century.

Another interesting aspect is the impact of immigration on GHG emissions. Given

that it is practically the only developed country experiencing significant population growth, and that a sizeable proportion of this growth is attributable to immigration, the experience of the USA is particularly relevant in this respect. Pitkin (2007) examined whether immigration affects long-run projections of USA CO_2 emissions, via the impacts on population scale, population ageing, and labour supply. He basically concluded that the rate of immigration would be less relevant than the relative success of the immigrants in achieving the same earning and consumption levels as the native-born households.

Although such studies are still limited to only a few countries and are based on models that require further improvements, they clearly show the need to consider the relevance of population composition in mitigation efforts. Future research should pay greater attention to this aspect.

Urbanisation and urban growth

Massive urban growth in developing countries can be viewed as the most important social and demographic trend of the 21st century. Historically, environmentalists, whose earlier attention was primarily centred on the preservation of nature in rural areas, have traditionally taken a dim view of urbanisation and city growth. In their view, cities were mainly seen as the locus of the critical environmental problems generated by the production and consumption patterns of modern civilisation.

Cities do indeed have a large ecological footprint. Nevertheless, recent years have witnessed a remarkable turnaround in environmental thinking, due to the gradual realisation that the size of the urban footprint stems, not from the concentration of population, but from the fact that they are the major sites in which modern production and consumption is concentrated. Clearer perception of the potential advantages of cities in addressing social and economic problems has further contributed to this change in mentality (UNFPA, 2007). Moreover, the role of urbanisation in reducing population growth in developing countries is clear: urban areas universally have lower fertility than rural areas because they offer few incentives and many disincentives for large families. Thus, it is increasingly recognised that urban localities actually offer better chances for long-term sustainability, starting with the fact that they concentrate half of the Earth's population on less than 3% of its land area. The dispersion of population and economic activities, at similar levels of consumption, would surely make the problems worse rather than better.[3] In addition, this article argues that towns and cities are also critically important in the world's efforts to address global environmental outcomes, including climate change. In contrast, however, given the way cities are growing in the developing world, the urban population is at greater risk of the effects of such change.

UNFPA's *The State of World Population 2007* draws attention to the fact that the battle for a sustainable environmental future is being waged primarily in the world's cities. They concentrate many of Earth's major environmental concerns: population growth, pollution, resource degradation and waste generation (UNFPA, 2007). Paradoxically, cities also hold our best chance for a sustainable future. Demographic concentration, in a still growing world population of 6.7 billion people, is absolutely essential for the preservation of biodiversity. If well designed and administered, the compactness and economies of scale of cities can reduce per capita costs, reduce energy demand and minimise pressures on surrounding land and natural resources. As recently emphasised in Habitat's State of the World Cities Report: "Well-planned and well-regulated cities hold the key not only to minimizing environmental losses, but to generating creative solutions to enhance the quality of the environment and to mitigate the negative consequences of climate change" (UN Habitat, 2008: xiv).

Much has been made recently of the fact that, according to official data, more than half of the world's population now lives in an urban area. The more important reality is that the world is undergoing a scale of urban growth that is unprecedented in human history. Current projections suggest that the urban population of developing countries will double in the space of a generation.[4] Africa and Asia alone will add another 2.7 billion urbanites between now and 2050; this is equivalent to 87% of the world's urban growth in the period. How, where and in what conditions such growth will occur will have a huge effect on sustainability in general and on climate change in particular. This effect has to be examined in two complimentary frameworks: a) the impact of cities on the generation of climate change, and b) the vulnerability of urban populations to the effects of climate change. Given space limitations, attention here is focused primarily on the regions that will be most affected by future urban growth.

Cities as drivers of climate change

Cities have long been the primary locus of economic growth in most countries, and the current context of globalisation has served to increase this concentration of economic activity in urban areas. Typically, they generate more than 80% of a country's GDP. The ecological footprint of cities is attributable primarily to the emission of greenhouse gases stemming from energy use and land use change. It is thus not surprising that the results of modelling efforts described in the previous section suggest that the impacts of urbanisation are significant in climate change.

However, the relationship of towns and cities to global climate change differs radically in developed versus developing countries. Cities in the industrialised world, despite some progress towards the reduction of their ecological footprint, still tend to generate more GHGs than poor cities. Moreover, as pointed out by Habitat, there are

considerable variations between cities according to their spatial organisation and environmental approaches. For instance, San Diego in the United States generates more CO_2 emissions than the much larger Tokyo, in part because of its greater dependence on individual automobile transport (UN Habitat, 2008:133). This research additionally shows that CO_2 emissions are also more related to consumption patterns and gross domestic product per capita than they are to urbanisation levels per se. Thus, the megacity of São Paulo in Brazil, despite being four times larger than San Diego, produces one-tenth of the latter's emissions (UN Habitat, 2008:xiv).

Nevertheless, several developing countries, particularly those generally classified as "newly industrialising", are also beginning to make significant contributions to the emission of GHGs. For instance, large population sizes, industrialisation, increased energy use, changing consumption patterns and increasing use of automobiles in countries such as China, India and Brazil are transforming them into prime emitters. Indeed, China recently surpassed the United States as the leading emitter of greenhouse gases, in large part due to its sources of energy.

One aspect of urban consumption which has so far received little attention, but may soon have a serious impact on the emission of GHGs, stems from the changing dietary profiles of the rapidly-growing urban middle classes in some parts of the developing world. As countries prosper and their middle class grows, urban people are switching from diets composed largely of staple food crops to higher-protein diets that include more meat, dairy products, eggs and fish. Livestock animals naturally produce methane as part of their digestive process. Methane is reputed to be 20 times more potent a greenhouse gas than carbon dioxide. Some 15% to 20% of global methane emissions already come from livestock, and that number is sure to increase significantly with changing diets in urban areas.

Many of the critical environmental problems in urban areas that contribute to global warming stem from what has been termed "the unsustainable use of space".[5] Although data are incomplete, there is little doubt that motorised transport constitutes one of the primary causes of urban energy use and thus of CO_2. It is also, by far, the fastest-growing cause of CO_2 worldwide. The inefficient appropriation of land by peri-urbanisation and residential urban sprawl contribute to greater transport and energy uses as well as pollution. This brings several inter-related topics into focus: the size of the urban blot; the spatial location of urban growth by ecosystem; the relative importance of urban sprawl versus other urban forms of city structure; and, the relative significance of transportation modes for longer-term sustainability.[6]

Although human settlements have so far taken up a relatively small fraction of the Earth's surface area, their specific spatial location can still exert significant environmental and socio-economic consequences. The manner in which this occupation of the Earth's land surface by towns and cities will evolve with urban population

doubling is a real concern. Depending on their future spatial growth patterns, urban localities could expand drastically in coming years, both in dimension and in their occupation of inappropriate areas. A recent World Bank study provides concrete evidence that urban land areas are growing faster than ever, not only because of their increase in absolute numbers of people, but also because their average density (that is, the number of inhabitants per square kilometre) is being progressively reduced (Angel et al., 2005).

This tendency towards declining density, combined with unprecedented absolute increases in the urban population, could greatly expand the land area of cities in the future. Where and how this new land is incorporated into the urban makeup could have a huge impact on climate change. Given that the world's urban population is expected to double within a relatively short time, and that most of this growth will be concentrated in Africa and Asia, it would seem advisable to try to orient this spatial growth in ways that not only avoid the invasion and destruction of prized ecological and agricultural assets, but that also reduce other environmental costs linked to climate change.

Urban sprawl increases energy use and the emission of GHGs: issues of transportation are critical in this context. For developing countries faced with rapid expansion of their urban population, automobile-based dispersion is extremely inefficient. Although automobile transportation is accessible to only a small portion of the population, it is prioritised in the transportation plans, processes and road-building activities of a wide variety of places. Car production and utilisation has spread quickly throughout the world, leading to higher infrastructure costs, congestion, reduced efficacy of land and energy use, as well as greater production of CO_2. Car-centred transport systems are implanted to the detriment of other forms of transit and public transportation systems. Since the majority of the population in developing countries evidently do not have the economic resources to access automobile transportation, this approach leads to increased inequity, as well as greater impacts on climate change.

The consequences of the failure to address the land and housing needs of the poor for environmental degradation and global warming is perhaps less evident, but they are also critically important. Disregard for the land and housing needs of the poor affects both ecosystem services as well as the city's ability to responsibly and effectively plan for sustainable growth. Despite being the largest social category, poor people seem to go largely unacknowledged in the formulation of city plans in developing countries. As a result, the poor end up in slums and informal settlements on the worse possible sites.

The resulting lack of access to water, sewage or solid waste management systems in informal settlements pollutes rivers and ends up affecting the appearance, air quality and health of the entire city. Frequently, the pattern of occupation in informal set-

tlements that results from unequal access is haphazard and asymmetrical, making it difficult to provide vehicular transportation or other types of services. The sprinkling of such settlements throughout the city also creates hurdles for the design of effective mass transportation, increases the costs of implementing it and thus results in greater use of energy. Continually adjusted improvisations that ineffectually attempt to accommodate the increasing flow of people and vehicles (and sometimes animals) through narrow winding streets that bypass these sprawling settlements, not only consume enormous resources, but also contribute to energy waste and pollution. In short, failure to address the needs of the poor ends up affecting the entire city population and further contributes to climate change.

Overall, if urbanisation is viewed in isolation, its net effect on climate change might appear as negative in light of the high level of emissions of urban areas. However, this impact merely reflects society's chosen patterns of production and consumption, rather than the effect of concentration *per* se. Since results are mediated by social and institutional factors, the policy implications of this finding revolve around the need to plan ahead, incorporating energy efficient systems and promoting behavioural changes. Given the inevitability of urbanisation, its inherently beneficial impacts in terms of preserving other natural areas, and the potential advantages of cities in terms of per capita costs and technological developments, such proactive and environmentally-friendly policies are essential.

Urban vulnerability: Adaptation as the other side of the equation

Climate change will increase the risk of flooding, cause other environmental damage in coastal areas and increase the frequency of natural disasters. There is already considerable evidence showing that natural disasters have become more frequent during the last few decades. The damage caused by climate-related disasters in urban areas has already had high social, economic and environmental costs: the prognosis is for much greater damage unless policies are altered drastically.

One of the primary impacts of expected global warming is its measurable impact on sea rise. Sea levels rose by 17 cm in the 20th century, and may rise by 22 to 34 cm in the present century (Nichols 2004, quoted in McGranahan et al., 2008: 168). This consequence is of critical relevance for urban areas, and especially for the poorer segments of their population. Low elevation coastal zones (LECZs) are particularly vulnerable. Throughout history, people have favoured city-building in coastal areas to take advantage of a ready food supply, easy access to transportation, and better defence opportunities. Overall, LECZs now contain some 2% of the world's land area, 10% of its population and 13% of its urban population; moreover, these zones also have a disproportionate share of all large cities (McGranahan et al., 2008: 172 & 174).

Asia, which is expected to account for 60% of all urban growth between now and mid-century, already has two-thirds of its urban population living in coastal areas. Given that this urban population will more than double in that interim, Asia would, in theory, still have an excellent opportunity to steer future growth away from LECZs. However, the opposite is happening: the current trend is for the number and the proportion of urban dwellers to expand briskly in coastal areas. Mega-cities such as Dhaka are growing rapidly from both rural-urban migration and natural increase in the cities, while government policies, such as in China, often favour coastal urban expansion through the creation of special economic zones, in efforts to build on the comparative advantages of coastal cities in promoting rapid economic growth.

The threats of global warming should lead decision-makers to urgently begin developing policies and strategies to prevent further urban development in risky locations. This would mean, for instance, the reversion of policies fostering rapid and massive urban growth on the coast of China. Existing cities, particularly some that are being raked periodically by flooding and whose futures are particularly endangered by rises in sea level, such as Dhaka, would need to adopt urgent measures to divert some of their rapid growth to other areas while also adopting procedures aimed at reducing the effects of sea level rise and flooding. Such approaches would, in the long run, be considerably more effective and less costly than trying to retrofit infrastructure in cities to withstand sea level rise, or to displace the enlarged urban population to other regions.

A key factor that should influence policymaking in relation to the urban impacts of climate change is that the vulnerability to these effects is particularly significant for the largest social segment of developing urban regions: the poor. Poverty, income inequality and segregation are key elements in the vulnerability of urban populations to the negative consequences of global environmental change (Satterthwaite, 2007).

More than two-fifths of the urban population in developing countries lives in areas that can be described as deprived neighbourhoods or slums. Such low-income populations are not only more vulnerable to environmental and health risks linked to poor sanitation, lack of clean water and air pollution, but they will also bear the brunt of future global climate changes.

Conclusions

Long perceived by the public as a simple issue of the pressure of numbers against resources, the impact of the population factor on environmental outcomes and on global climate change has to be seen in a more differentiated and disaggregated light. Population size and growth do matter enormously, but the threat that they present cannot be diminished quickly or easily. Moreover, their impacts are increasingly me-

diated by social organisation, especially consumption patterns. Changing configurations of population composition are surfacing as vital components of the population/environment equation that need further analysis in different contexts.

Urban growth is emerging as the primary focal point of population/environment interactions for the future. The world's towns and cities not only congregate more than half of the world's total population and four-fifths of its GNP, but they also concentrate, on a tiny portion of the Earth's surface most of its aspirations for improved social, demographic and environmental conditions. Towns and cities currently account for an inordinately large share of GHGs that underlie global warming, and also amass the most vulnerable population groups. This does not occur simply because they concentrate population, but because they are the hubs of modern civilisation's production and consumption processes. However, improved urban planning could mitigate many of the negative impacts of urban concentration; but this will require important changes in approaches and attitudes to policymaking in respect to urban growth.

Ultimately, serious consideration of climate change obliges us to adopt a more realistic outlook on the nature of the issues and to forsake the simple panaceas that would apparently release humankind from the obligation of taking unappealing but necessary decisions with regards to civilisation's current pathways. Some optimists trust market factors and technological development to resolve imbalances between the dimension of increased consumption and its environmental implications. Although it is important, technological progress alone will be grossly insufficient without accompanying changes in behaviour, consumption aspirations and social organisation. Similarly, demographic dynamics are undoubtedly critical in the climate change conundrum, but simplistic approaches delay a more piercing examination of the core choices faced by humankind with regards to development models, lifestyles, and equity issues. Hard decisions face humankind, and the window of opportunity may be more limited than is generally assumed.

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Endnotes

[1] Cf. for instance, the UNFCC framework.

[2] There are other demographic impacts of climate change that will not be considered here due to lack of space, such as increases in migration and mortality as a result of events related to climate change.

[3] The importance of controlling for types and levels of consumption in rural-urban comparisons on environmental impact is illustrated by the finding that in both China and India, total energy consumption in rural households exceeds that in urban households, because of a continued dependence on inefficient solid fuels, which contribute to over 85% of rural household energy needs in both countries (Pachauri and Jiang, 2008).

[4] All data on urban growth in this paper are taken from UN Population Division, 2008.

[5] Cf. Martine (2006) for a discussion of the concept of the "sustainable use of space".

[6] The following discussion is based largely on Martine (2008) and references therein.

How Will Climate Change Affect Trade's Potential to Foster Development?

Aaron Cosbey

Introduction

Since the demise of the strategy of development through import substitution in the 1980s, and the apparent success of the newly-industrialised countries of Asia with export-led growth strategies, it has been widely acknowledged that trade can serve as an important engine of economic growth, and through growth, development. While this dynamic is often oversold, and while even the most outward oriented development strategies involve some degree of infant industry protection, domestic institution building or government support, the basic notion of trade as a key element in the development process is still largely undisputed.

As such, over the last decade in particular, official development assistance has begun to focus on helping countries exploit the potential gains offered by trade and trade liberalisation. This focus is a keystone of the joint inter-organisational effort known as the *Integrated Framework for Technical Assistance to Least Developed Countries* (the IF), the central aim of which is to integrate trade into national development planning, and to help overcome those barriers to increased trade that hold countries back from achieving the full potential offered by access to global markets and foreign direct investment.[1]

The same philosophy is an important part of the programming of many bilateral aid agencies. The UK's DFID (2007:7) – one of the first aid agencies to focus on trade and a global leader in the field – makes the case strongly: "Trade drives growth. Rapid, sustained, growth is the most direct route to reducing poverty." The nature of this trade-growth-development linkage is explored briefly below, but the point is that it underlies a great deal of current development assistance activity. The G7 in 2005 committed to increasing expenditures on aid for trade to $4 billion (primarily through the IF)(G7, 2005). And the EU has similarly pledged aid for trade funding at EUR 1 billion per year (European Commission, 2005). The WTO's Doha Development Round mandate includes significant commitments on aid for trade as well, *inter alia* under the heading of technical cooperation and capacity building (WTO 2001: ¶ 38-41).

If we accept that trade's potential is important for development, and that development assistance has a significant role to play in realising that potential, we must pay close attention to global phenomena that alter that potential. This section argues that climate change is such a phenomenon. Cosbey (2008a) describes a number of ways

in which climate change might impact the patterns of international trade flows, and the infrastructure for transport that underlies that trade. This article follows on from there by exploring in greater detail the ways in which those impacts might alter trade's ability to act as an engine for development, and the implications for the practice of development assistance that flow from that inquiry.

What is the potential for trade to foster development?

To ask what trade's potential contribution to development might be, we must first define what is meant by development. This is no easy task. It is made easier in the present context, however, by the fact that trade's contribution to development, however defined, will centre almost exclusively on the economic: trade's ability to foster economic growth, poverty alleviation and increasing income equality. Most, if not all, definitions of development include economic growth as part of the mix, and it is here that we should expect to find the major potential. As such, it will suffice to assume that however we define development, the key contributions of interest are economic.

There is a raft of literature devoted to the question of trade's role in fostering economic growth. Then there is the follow-on question: assuming that trade leads to growth, does trade-led economic growth alleviate poverty, or decrease income inequity? While neither of these questions is settled to the satisfaction of all concerned, it is nonetheless possible to draw some broad findings from the work to date in this area.

Generally, the literature shows that trade and trade liberalisation may indeed lead to growth, and that growth will tend to increase incomes across the board. It will not, however, significantly change the incidence of income inequality within a country. But by increasing all incomes it will reduce the absolute numbers of poor. That said, in the short- to medium-term, the poor may disproportionately suffer the pains of transition associated with liberalisation, particularly in the absence of adjustment programs or social safety nets.

Another important conclusion is that while there may be a relationship between openness to trade in goods and economic growth (and thereby to increased personal incomes) the link is uncertain, or at least much weaker, in the absence of appropriate supporting policies and institutions. These include, for example, policies to achieve macroeconomic stability, honest bureaucracy, rule of law, widespread health and education. This underlines the need to pursue sustainable development as a coherent effort, rather than relying on partial approaches such as trade liberalisation alone.

In the case of openness to investment, on the other hand, it seems there is no demonstrated link between openness to investment and growth. Of the various types of investment, foreign direct investment (FDI) stands out as most likely to be significant, and there is some evidence that the combination of investment rules and free

trade agreements may bring more investment. However, even increased FDI will not lead to increased growth, absent the necessary domestic institutions.

This basic finding, which is echoed in the context of both trade and investment, bears repeating, as it will have later importance in this analysis: trade's potential to act as a driver for development depends fundamentally on the existence of prerequisites in the form of domestic policies, institutions and infrastructure.

How is trade's potential affected by the impacts of climate change?

The previous section briefly surveyed the ways in which trade might serve as a potential driver of development. This section will assume that this potential exists, and will ask how that potential might be affected, both positively and negatively, by climate change.

Figure 1: Impacts of Climate on Trade's Potential – Some Linkages

Type of Impact	Possible linkages	Examples
Direct impacts of climate change	Changes in traditional patterns of global trade	Tropical export-oriented agriculture less viable due to weather pattern disruptions
	Increased costs of trade, result of damaged trade-related infrastructure	Port facilities damaged, shifted in response to sea-level rise and increasing storm activity
	Decreased costs of trade, result of climate-related impacts	Opening up of the North-West Passage through the Arctic
Direct impacts of climate change policies	Mitigation policies increase the cost of transportation-related fuel, increasing costs of trade	GHG-intensive transport modes such as air frieght would be hardest hit
	Changes in traditional patterns of global trade	Carbon taxes increase costs of fuel and electricity used in production. Renewable mandates create new markets for low-GHG energy technologies and products.
Indirect impacts	The need to address adaptation draws resources away from investing in prerequisites to gain from trade	Underinvestment in trade facilitation, transportation infrastructure, investment promotion
	International climate-related assistance fosters more competitive exporters	Assistance to improve energy efficiency, promote new energy sources that offer greater reliability of supply.

Some of the possible linkages are illustrated in Figure 1. Climate change itself can have direct impacts, as when it shifts the existing patterns of comparative advantage, or affects the viability of trade-related transportation infrastructure. Other direct impacts may result from policies and measures taken to address the challenge of climate change. New taxes on carbon intensive fuels will add to the cost of transport, and disproportionately increase the costs of some traded goods. And trade-based measures may be used to punish GHG-intensive goods at the border. Other sorts of policies and measures will create markets for new climate-friendly goods exports, or expand existing markets.

There are also important indirect impacts. Expenditures on adaptation will make it more difficult to muster the government spending necessary to exploit the potential gains from trade liberalisation. Further, international climate change agreements might result in unprecedented levels of multilateral assistance with spin-off benefits for trade-related sectors and infrastructure. Each of these sorts of impacts is discussed in greater depth below.

Direct impacts of climate change

One of the most obvious ways in which climate change will affect the capacity of trade to contribute to development is by changing the viability of traditional export streams. This is an impact that will be felt at the national level, with some nations potentially gaining while others lose. In the area of agriculture, forestry and fisheries in particular, IPCC Working Group II (2007) notes that there will be significant changes in export patterns, driven by such direct impacts as:

- Effects of increased atmospheric CO_2 concentration: these are generally positive, resulting in increased productivity for food crops, industrial crops and forests.[2]
- Effects of increased temperatures: for food crops these are generally negative, and in many cases overwhelm the positive impacts of increased CO_2 concentration. These impacts will be more severely felt in the lower latitudes, and will vary by crop. Above 3° temperature rise, productivity falls at all latitudes.[3]
- Effects of changes in rainfall patterns: These may be severe depending on the region, and will be augmented as a force for water stress by the increased evapotranspiration induced by higher temperatures. Predictable monsoon patterns in Asia and Africa are very likely to be disrupted by increased variability. Drought stress is predicted to increase with particular strength in seasonally dry and low-latitude regions such as sub-Saharan Africa.[4]
- Effects of decreased glacial runoff, and subsequent impacts on irrigation-based agricultural systems. The receding or complete disappearance of glaciers in the

Andes and the Himalayas, after short-term flow increases, is predicted to turn even mighty rivers such as the Ganga, the Indus and the Brahmaputra into seasonal rivers by 2035.[5]

- Increases in extreme weather events: For food crops these are typically droughts and heavy precipitation; for forestry they are pests and fires. These impacts are projected to be even more economically significant than the impacts of projected changes in temperature and precipitation.[6]
- Extinction of local freshwater fish populations in response to warming trends, increased oxygen demand and increased acidity. Subsequent negative impacts on aquaculture – typically an export product – which depends heavily on capture fisheries for feed.[7]
- Changes in oceanic circulation and increases in temperature that may reduce primary production in tropical oceanic fisheries.[8]

The impacts of climate change on food and fisheries production will vary considerably by region and even by ecosystem within countries, making it difficult to generalise about impacts. However, a few general conclusions can be drawn.

For food crops, impacts will generally be felt more strongly in lower latitudes, as the result of both higher degree of impact and increased vulnerability (the latter due to the low adaptive capacity in most developing countries). The impacts will be felt more strongly in subsistence (rainfed) agriculture than in irrigated agriculture, though both will be impacted. The result of this will be detrimental in particular to low latitude net food-importing countries as they struggle with increased food insecurity.[9] The implication is a significant increase in world agricultural trade, with higher prices, almost all of which occurring to the benefit of exporters in higher latitudes. Fischer et al. (2002) estimate that by 2080 developing country cereal imports will rise by 10-40%.

For fisheries, both freshwater and oceanic, negative economic impacts again will be felt primarily in developing countries, with the greatest impact on the economies of central and northern Asian countries, the western Sahel and coastal tropical regions of South America, as well as some small and medium-sized island states.[10] In general FAO (2008:87) finds cause for concern, and notes that: "In a warmed world, ecosystem productivity is likely to decline in lower latitudes (i.e. most tropical and subtropical oceans, seas and lakes) and increase in high latitudes."

For commercial forestry, fewer generalisations are possible, and the presence of multiple disturbances (CO_2 enrichment, increased temperatures, pests, fires, water stress, increased extreme weather events, existing patterns of deforestation) makes prediction difficult. But impacts may be significant; Nepstad et al. (2004), for example, predict massive Amazon deforestation; the product of a positive feedback loop including deforestation, fragmentation, wildfires and increased frequency of drought.

Other sorts of traditional exports are also likely to be affected, particularly those based on natural resources. The export of tourism services from many small island developing states, for example (many of which are highly dependent on tourism as a source of foreign exchange), is likely to be seriously affected by the twin threats of sea level rise and coral bleaching. Gössling, Hall and Scott, in this volume, explore tourism-related issues in some detail.

These impacts will mean a highly disruptive shifting of traditional comparative advantage, usually to the detriment of developing country exporters. The significance of the impacts in those countries will be heightened by the fact that there is less capacity in developing countries to anticipate and adapt to changed circumstances than there is in developed countries.

Another direct effect of climate change is increased cost of transport. Climate change is likely to have costly impacts on transportation-related infrastructure such as ports. Stern (2006: 155) notes that:

> *"Rising sea levels will demand heavy investment in flood protection around ports and the export and import related activities concentrated in and around them. Stronger storm surges, winds and heavier rainfall already point to the requirement for stronger ships and sturdier offshore oil, gas and other installations. ... This would reverse decades of building steel mills, petrochemical plants and other energy-related facilities close to the deepwater ports accommodating bulk cargo vessels, super-tankers and ever larger container ships which have become the key vectors of rising global trade and just-on-time production schedules. Both increased protection and relocation inland would have significant capital and transport costs, and make imports in particular more expensive."*

Nicholls et al. (2008) estimate the value of port-city assets exposed to coastal flooding due to storm surge and high winds is about 5% of global GDP, and they project that unchecked climate change will substantially increase that exposure.

To the extent that transport becomes more costly, trade as a driver of economic development becomes less viable. However, the more significant driver for increased transport cost is probably indirect, through increased fuel costs as a result of government-led climate change policies. These indirect impacts are addressed below, where there is a more in-depth discussion of the implications of increased transport costs.

It is worth noting that direct impacts of climate change may also have some positive effects, over and above the positive changes in agricultural export potential of some Northern countries. One example is the opening of new and less costly trade routes through the previously impassable Northwest Passage in Canada's Arctic waters. Relatively few positive impacts have been identified to date, however.

Direct impacts of climate change policies

One of the most likely outcomes of climate change policy, whether implemented under a carbon tax, a cap and trade regime, subsidy reform, or other regulatory initiatives, is an increase in the price of CO_2-rich fuels. This will have two types of impacts of interest to the present discussion.

First, it will increase the costs of production of goods that are fossil-fuel intensive, with a result that will, as above, force changes in global patterns of trade. Some goods, such as aluminium and cement, are energy-intensive by nature, and will unavoidably see increases in production costs in regulated environments. This will benefit substitutes where they exist, and may spur relocation of industry to those locations where regulations create a less costly environment.[11] It will matter, of course, what the fuel source is: South African steel production, for example, uses almost all coal-fired electricity, which is carbon-intensive. The level of technology also matters: OECD (2007) notes that China's energy intensity of production overall is 20% higher than the OECD average, meaning significantly more GHG emissions per unit produced.

A knock-on policy impact may come from an increasing willingness to resort to trade-related measures that seek to punish carbon-intensive imported goods in particular. These measures tend to be formulated with developing country competitors in mind. A number of such schemes have been proposed, ranging from the imposition of a carbon-based border tax adjustment, to the requirement that importers purchase offsets in a domestic cap and trade scheme at the point of import (Cosbey, 2008b). In addition, a number of private sector labels have sprung up that seek to show the carbon footprint of the labelled goods, ranging from the rather narrow "food miles" concept to broader schemes based on full life cycle assessments (Brenton et al., 2008).

Such policies will also increase the cost of internationally traded services, such as the provision of tourism. As the cost of air travel rises, those developing countries that are highly dependent on tourism revenues can expect to feel the impacts.

Second, and potentially more significant, policies that increase fossil fuel prices will increase the costs of transporting goods. It has been estimated that every dollar increase in the price of a barrel of oil results in a 1% rise in average transport costs. In May 2008, when oil prices were around $120/barrel, Rubin and Tal (2008) calculated that inflated transport costs were the equivalent of a 9% tariff on all goods shipped from China to North America, and declared that the price of oil had eliminated China's cost advantage over US-produced steel. The impacts of $150/barrel oil, they calculated, were the equivalent of reversing all the tariff liberalisation accomplished by the World Trade Organization and the General Agreement on Tariffs and Trade since the 1970s. Obviously those forms of transport that are more carbon-intensive, such

as air freight, will be hardest hit, with implications for the types of goods (fresh-cut flowers, high-end perishable produce) that use such modes.

Air transport, in fact deserves special consideration as it is likely to be included in the post-2012 climate change regime in a way that it was not in the present regime. How this inclusion will take shape is as yet unclear. Muller and Hepbun (2006) propose an air levy: an idea that is popular as a mechanism to raise funds for climate-related adaptation. In the EU, air travel will be part of the emissions trading scheme for the first time starting in 2012 at the advent of the EU Emissions Trading Scheme's third phase. One way or another, it is certain that air transport will become more costly, which is a development that has implications for both goods transport and, as noted above, for those economies that are highly dependent on airline-based tourism.

While regulatory measures are designed to drive innovation, and while they look poised to do so in the context of other energy uses such as heat and power, in the short term transportation seems to have no viable substitutes for petroleum as a fuel. Until such substitutes appear, the end result of regulatory measures that increase fuel costs is therefore to blunt the ability of trade to act as an engine of development.

A third direct impact of climate change policies is the obverse of the previous effect: the rewarding of low-carbon goods and services, including those that are internationally traded. Whether by subsidies or mandates (such as mandated use of biofuels), or though the effects of cap-and-trade or carbon tax schemes, those goods that use less carbon in production will become relatively cheaper, and those forms of energy that are less carbon-intensive will be in greater demand. The result may be new sources of export revenues for developing countries. For example, Ummel and Wheeler (2008) argue that with only modest subsidies it is economic to pursue the export of electricity from North African concentrated solar thermal installations to Europe, to help fulfil the EU's commitment to achieve 20% reduction in emissions by 2020. Newell, in this volume, discusses the possibility that tariffs and non-tariff barriers to environmentally friendly goods might be eliminated, as per the WTO's Doha Round mandate on environmental goods and services (If WTO, 2001; ¶31(i)). If this can be achieved, to the extent that the list contains low-carbon goods, the effect will be similar: The overall impact of these policy effects will at first be a change in traditional export patterns, as with the direct effects discussed above. However, there will also be a dampening of the power of trade as an engine of development, at least in the short to medium term, until new low-carbon transportation technologies can be developed.

Indirect impacts

As well as the direct impacts described above, we should expect climate change to have several indirect impacts on trade's potential as a driver for development.

Perhaps most significantly, anticipating and dealing with climate change impacts will demand significant financial, technological and human resources in developing countries that have none of these in abundant supply. Adaptation is now one of the four pillars of the post-2012 climate change negotiations, and a number of ambitious financing schemes are being considered, but it is practically inconceivable that any of them will address all the anticipated challenges adequately.[12]

The result will be a burden on developing country governments that will leave them with fewer resources to devote to building the capacity to benefit from the opportunities offered by trade liberalisation. In other words, as it was noted above, the benefits of trade liberalisation, and trade's potential as a driver of development, depend crucially on domestic prerequisites that in most developing countries will demand government resources: infrastructure development, education spending, health investments, regulatory and legal reform, etc. While there are some areas of overlap, where adaptation and aid for trade may be simultaneously achieved, that overlap is necessarily incomplete. It is almost certain that the challenging task of building capacity to benefit from trade will receive less than its due in the context of adaptation's powerful demand for government attention. The result would be a smaller potential for trade to serve development.

Another sort of indirect impact may have positive effects. It is likely that the post-2012 UNFCCC/Kyoto negotiations will result in a regime or regimes that allow developing countries to make climate change mitigation commitments that align strongly with their development objectives. These would be somehow funded by developed countries, either via a carbon market that rewarded policies, or via a fund approach.[13] So, for example, a developing country could pledge to increase the average efficiency of electrical generation by a number of means including regulatory reform, higher standards for permitting new capacity, or other measures. This effort would be aided by developed countries, not only through technical assistance, but also through financial support, whether by purchase of the resulting emission reductions or straightforward "reward"-type funding. This sort of institutional innovation would in part fulfil the mandates specified in the current roadmap for negotiations – the Bali Action Plan – with respect to financing, mitigation and technology transfer.[14]

Such institutional innovation would also, moreover, benefit developing country producers, including exporters, by lowering the costs of their energy inputs and possibly increasing the reliability of energy supply. That is, these sorts of efforts to achieve emissions mitigation in developing countries might well also boost the capacity of exporters to compete in world markets, thereby helping them serve as engines of development.

Conclusions

The preceding analysis describes a number of ways in which climate change, and the policies that it will engender, may significantly affect the potential for trade to act as an engine of development. Both positive and negative influences were found, though on the whole the negative seem more likely to prevail.

Most significant among the effects noted are:

- The shifts in traditional patterns of international trade, a product of climate change impacts on natural resource-based production, and of climate change policies that will punish GHG-intensive goods and methods of production.
- The uneven burden of those shifts, falling most heavily on developing country producers and exporters that are at once harder hit by impacts and less capable of anticipating and responding to those impacts.
- The probable increase in the costs of transport, due to climate change policies and the impacts of climate change on coastal transportation infrastructure

Several strong messages emerge from the analysis as presented. Overall, the key message seems to be that if development assistance is to be effective in the long term, it will have to take into account the impacts of climate change and climate change policies. There has been a fair amount of work done to mainstream adaptation considerations into development assistance (see the chapter in this volume by Agrawala and Crick), but little or no work to try to consider the sorts of trade-related impacts highlighted here. While the results of such consideration will vary from country to country depending on the context, it seems clear that in many cases the most effective development policies will rely less on promoting traditional export-led growth as an engine of development. Certainly those programmes that focus on enhancing tourism as an engine of development need to reassess the long-term viability of their efforts, for example, in the face of such threats as sea-level rise, loss of biodiversity and looming increases in airfare costs.

The alternative might take the form of promoting non-traditional exports, where those can be developed, or on more heavily promoting regional, rather than long-distance, trade. Development efforts focused on trade facilitation, for example, tend to strongly benefit regional trade, with potential for high economic returns (World Bank 2004). Or the alternative might simply involve a stronger focus on endogenous development processes that depend less heavily on foreign markets.

In addition, as a possible third alternative, development assistance could focus on ameliorating the key predicted impacts where possible. So, for example, if climate

change impacts and policies are likely to increase the costs of international trade, development practitioners might prioritise programmes that will lower those costs. Perez and Wilson (2008) argue the primacy of the high costs of trade as an obstacle to African development, a problem that might be addressed by such initiatives as the proposed North-South corridor of improved rail and road links. The prospect of even greater costs of trade, the result of climate change impacts and policies, makes such efforts all the more important.

Clearly any approach that takes climate change into consideration will need to start from a detailed assessment of the potential linkages. It has been repeatedly stressed here that the salient linkages will vary from country to country, sector to sector. What is needed as a starting point is a careful exercise in diagnostics that maps the known climate change impacts, along with a realistic assessment of future policy measures, overlaid on the existing patterns of trade and comparative advantage, and the potential to develop new "green" export streams. This kind of information can serve as the basis for development assistance that avoids the risks, and exploits the potential opportunities, that climate change poses for trade's role as an engine of development.

It is worth noting that there are two distinct types of impacts: Those that derive from climate change *impacts* are to some extent less amenable to action, short of international action to achieve ambitious mitigation targets. Those that derive from *policy*, on the other hand, are entirely amenable to action by the implementing policy makers. That is, if policy makers understand that their policies and measures have negative impacts in particular on developing country exporters, it is always possible to alter the programme design such that it addresses those concerns. Indeed, there are obligations in the Kyoto Protocol text for developed country policy makers to do so:

"Each Party included in Annex I shall strive to implement [its GHG mitigation commitments] *in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties ..."* (Kyoto Protocol Article 3.14)

Also:

"The Parties included in Annex I shall strive to implement policies and measures under this Article in such a way as to minimize adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties ..." (Kyoto Protocol Article 2.3).

Finally, it almost goes without saying that any development assistance initiatives that can simultaneously achieve development objectives and contribute to mitigation

and adaptation goals should be pursued as a priority, given the urgent need *from a development perspective*, of successfully addressing climate change. A good example of this sort of synergy can be found in efforts such as the World Bank's Energy Sector Management Assistance Program, which supports capacity building and reform aimed at, among other things, energy efficiency and conservation objectives. These can achieve development goals (energy access, energy security, industrial efficiency, balance of payments) and at the same time reduce GHG emissions.

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Endnotes

[1] The agencies involved in the IF initiative are the IMF, ITC, UNCTAD, UNDP, World Bank and the WTO. See http://www.integratedframework.org/about.htm.

[2] The results used are derived from controlled experiments, and are generally thought to be high compared to actual field results. (IPCC Working Group II, 2007, p. 300)

[3] Ibid., 5.4, 5.6.

[4] Ibid., Section 5.4.2.

[5] Ibid., Section 10.6.2.

[6] Ibid., Section 5.8.1.

[7] Ibid., Section 5.4.6.

[8] Ibid., Section 10.4.1.3

[9] Ibid., Table 5.6, p 299.

[10] Ibid., p 292.

[11] There is a substantial literature on the competitiveness impacts of climate change policy. For a survey of the literature and the issues, see Cosbey and Tarasofsky (2007), Hourcade et al. (2007).

[12] Flåm and Skjærseth (2008) illustrate the substantial gap between adaptation needs and available financing.

[13] See UNFCCC (2009), esp. ¶159-160, for a summary of proposals submitted by the UNFCCC Parties that include a number of funding and carbon market schemes.

[14] See the relevant sections of the Bali Action Plan, UNFCCC Decision 1/CP.13, paragraph 1.

[15] These obligations have not been treated particularly seriously to date by developed country Parties to the Kyoto Protocol, perhaps in part because we are still at a stage where stringent climate change measures – i.e., those with real impact – have not yet been implemented.

The Challenges of Tourism as a Development Strategy in an Era of Global Climate Change

Stefan Gössling, C. Michael Hall and Daniel Scott

Introduction

The interrelationships between tourism, development and climate change are presenting a significant policy dilemma for many countries and agencies. Climate change is a key development issue (e.g. Kok et al. 2008, Intergovernmental Panel on Climate Change [IPCC] 2007), while tourism has the potential to contribute to economic development (e.g. Telfer & Sharpley 2008; Hall & Lew 2009), and is identified as a potential means of poverty reduction (e.g. United Nations World Tourism Organization [UNWTO] 2006). However, tourism also both contributes to and is strongly affected by climate change, leading to significant challenges with respect to its management and regulation, and to long-term development prospects (UNWTO-United Nations Environment Programme [UNEP]-World Meteorological Organization [WMO] 2008). This article sets out contemporary perspectives on tourism as a development strategy, particularly its potential to contribute to poverty alleviation in least developed countries (LDCs). The major risks climate change poses to the tourism sector, and the specific challenges these present for developing countries, are then examined, in particular attention is paid to: the regulatory risk that climate change mitigation policy will increase the cost of travel, especially to long-haul destinations; and the physical risks to key tourism products and decreased social-political stability that will adversely affect the competitive position of destinations.

Tourism and development

Tourism is more than just travel for leisure and holidays. Tourism, whether international or domestic, encompasses voluntary travel by people away from their home environment for reasons such as leisure, health, study, business and visiting friends and relations. Since by definition tourism is consumed away from the consumer's home environment, access is critical to successful tourism development. This is a major challenge faced by developing countries and peripheral and rural regions within those countries, as without transport access there can be no tourism. However, when successfully developed, the transport access afforded by tourism can also be utilised by other sectors to enhance international and domestic trade opportunities (Coles & Hall 2008).

Table 1. The Importance of Tourism to Developing Economies

Region	Visitor Spending as a % of GDP (2006)			
	>50%	25-50%	10-24%	5-9%
Eastern Africa	-	Seychelles	Mauritius, Zimbabwe	United Republic of Tanzania, Madagascar, Comoros, Eritrea, Kenya
Middle Africa	-	-	Sao Tome and Principe	-
Western Africa	-	Cape Verde	Gambia	Ghana
Northern Africa	-	-	Morocco	Tunisia, Egypt
Southern Africa	-	-	-	Namibia, Botswana
Eastern Asia	China, Macao SAR	-	Bahrain	Mongolia; China, Hong Kong SAR
Western Asia	-	-	Lebanon, Jordan	Syrian Arab Republic
Southern Asia	-	Maldives	-	-
Southeastern Asia	-	-	Cambodia	Thailand, Singapore
Central America	-	-	Belize	Costa Rica, Panama, El Salvador, Honduras
South America	-	-	-	Suriname
Caribbean	Anguilla	Aruba, Turks and Caicos Islands, Saint Lucia, Antigua and Barbuda, Bahamas, Barbados	Saint Kitts and Nevis, Saint Vincent and the Grenadines, Grenada, Dominica, Cayman Islands, Jamaica, Montserrat, Dominican Republic	-
Oceania	Palau, Cook Islands	Vanuatu	Samoa, Fiji, French Polynesia	Micronesia (Federated States of), Tonga, New Caledonia

SAR = Special Autonomous Region in UNCTAD data

On a global scale, //OR: At the global level,// tourism is an extremely significant economic activity. According to the UNWTO (2008a), international tourism arrivals expanded by 6% in 2007, to 898 million international tourist arrivals. The UNWTO (2001) has also forecast that international travel will have almost doubled to 1.6 bil-

lion arrivals by 2020. Although the vast majority of international tourism currently occurs in developed countries, the UNWTO has reported that international tourism in emerging and developing markets grew at twice the rate of industrialised countries. Between 1996 and 2006, international tourism in developing countries expanded by 6% as a whole, by 9% for LDCs, and 8% for other low and lower-middle income economies (UNWTO 2008b). The significant role of tourism in many developing economies is indicated in Table 1 (*United Nations Conference on Trade and Development* 2008). However, it should also be noted that the vast majority of tourism is domestic rather than international in nature and is not captured in these statistics.

Considering the growth of tourism in developing countries, it is therefore perhaps not surprising that international tourism is increasingly promoted by organisations such as the UNWTO, and by many government agencies in the international development community, as an important element in national poverty reduction strategies and in development financing. According to the UNWTO (2005: 3): "Tourism development, if properly developed and supported, can indeed be a "quick-win" in overcoming the economic and social conditions that prevail in LDCs and in accelerating their integration into the world economy." International tourism is perceived by policy-makers as important for developing economies, as it is regarded as representing an important avenue for competitive economic specialisation (Komlev & Encontre 2004) and an opportunity to augment foreign exchange flows (Kasahara 2004) in order to work towards poverty reduction (UNCTAD 2001). UNWTO estimates that tourism is a primary source of foreign exchange earnings in 46 out of 50 of the world's LDCs (UNWTO 2007a).

Similar perspectives have been presented by other international bodies, such as the World Travel and Tourism Council (WTTC) (2004) and the World Economic Forum (WEF) (2008), as well as the international development cooperation sector in many nations, including the British Department for International Development (DFID), German Gesellschaft für Technische Zusammenarbeit (GTZ), Canadian International Development Agency (CIDA), Swedish Agency for International Development Cooperation (Sida) and United States Agency for International Development (USAID). An accurate assessment of the level of assistance provided to sustainable tourism projects is not available.

Nevertheless, there has also long been substantial criticism of what has been perceived as the negative impacts of tourism as a development strategy (Hall & Lew 2009, Telfer & Sharpley 2008, Hall 2007). For example, the supposed comparative advantages of LDCs with respect to tourism are not evenly distributed. There are many developing countries, and regions within them, which have only a limited opportunity to benefit from tourism. It is also important to note that while tourism has been promoted by some in the development community for over 40 years, the

mid to long-term relative contribution of tourism projects to development strategies remains poorly evaluated. Overall, there has been greater tendency by international development agencies to advocate tourism projects than to holistically and critically assess the consequences of tourism-related development strategies. Tourism has also been associated with substantial environmental change and degradation (e.g., Weaver 2004; Gössling & Hall 2006a) and cultural commodification (e.g., Mowforth & Munt 2003; Hall & Brown 2006), while economic benefits may not be as great as expected because of profit repatriation by foreign investors, relatively low wages, and underemployment because of seasonal demand (e.g., Chok et al. 2007; Wattanakuljarus & Coxhead 2008, Hall & Lew 2009).

The use of tourism development as a means of poverty reduction in developing countries, often described as pro-poor tourism (PPT), has been a substantial focus for a number of development agencies, such as DFID, UNWTO, the World Bank and the Asian Development Bank. Yet, as Chok et al. (2007) emphasised in their review of poverty alleviation strategies, tourism is all too often regarded as a panacea: an economic, social and environmental 'cure-all' whose claims for sustainable development, including welfare equity and poverty reduction, need to be seriously evaluated and considered in context. For example, Wieranga's (2008: 133) detailed study of the benefits of PPT concluded: "All in all, PPT is more of a livelihood supplement than a poverty solution, and poverty elimination through ethnic tourism is the exception rather than the rule." Although the focus of many in the development community is on small-scale so-called 'alternative' cultural and ecotourism projects in more peripheral regions, the reality is that the majority of leisure tourism is what may best be described as 'mass' tourism. Development community projects are also highly dependent on mass tourism as a) they rely on the mass international transport infrastructure to bring people to a country; and b) it is often a form of secondary activity that people will undertake in addition to, rather than instead of, travel to more conventional mass tourism attractions. The difficulty faced by many tourism development projects is that their proponents have often not considered their relative inaccessibility to markets, especially in comparison with competing activities and/or destinations. For example, in some short-term situations ecotourism can provide win-win situations for local people and local nature, but there are substantial difficulties in maintaining such results over time, as a result of competition within the tourism sector, relative value of tourism in comparison with alternative resource use, and economic and environmental change. Nevertheless, despite potential drawbacks, many governments continue to perceive tourism as a key development strategy. This is understandable given the disparate perspectives that exist, and particularly for island LDCs, where tourism may represent perhaps the only development option with the exception of fishing. Taking into account the drawbacks of tourism development is

important for understanding the tourism – development – climate change nexus and the potential vulnerabilities that may arise from a focus on tourism development in an era of rapid climate change and an increasingly carbon-constrained global economy.

In order to understand how climate change could affect the prospects of tourism development, it is important that the various elements that comprise the tourism marketplace be considered. Although the focus of the development dimensions of tourism are at the destination, changes elsewhere in the tourism system (competing destinations, tourism generating countries, transportation networks) are also extremely significant (Hall 2005), as a negative impact in one part of the tourism system may constitute an opportunity elsewhere (Scott et al. 2008). Regulatory initiatives developed to mitigate climate change will have significant impacts on transport systems and thus the mobility of tourists. The potential for increased costs for the consumer arising from mitigation practices in one jurisdiction may have implications for the comparative price advantage of the destination on an international scale, as well as travel within a destination country. One possible effect is that those destinations which are the most peripheral and least accessible to markets, which typically are most in need of development initiatives, are therefore potentially the most likely to be impacted in relative terms by the costs of mitigation strategies based on distance travelled, size of emissions or energy consumed (Hall & Lew 2009). Such an observation is vital in understanding the potential impacts of international and national climate change mitigation regimes on tourism flows and destinations (Gössling et al. 2008a). While preferred environmental attributes are significant in destination choice (Gössling & Hall 2006a; Becken & Hay 2007; United Nations Framework Convention on Climate Change [UNFCCC] 2008; Scott et al. 2008), change in price structure resulting from climate policy developments, such as a post-Kyoto Protocol greenhouse gas (GHG) emission reduction framework that includes bunker fuels, or increasing oil prices, may have a significant impact for tourism development in some developing nations.

In the longer term, the direct impacts of substantially changed climate regimes and the indirect effects of climate-induced environmental change and societal impacts (i.e., reduced economic growth or political destabilisation) will also significantly affect tourism in some regions, as a result of damage to, or the complete loss of, key tourism resources that will alter the competitiveness of destinations (Scott et al. 2008). As Table 1 illustrates, those economies that are highly dependent on tourism tend to be island states, which are also some of the most vulnerable to the effects of climate change (Mimura et al. 2007). Importantly, these effects need to be considered through the various components of the tourism system, also taking into account the capacities of tourists to perceive impacts accurately (Gössling & Hall 2006b, Scott et al. 2008).

Climate policy implications for tourism patterns

Transport, aviation and climate change

Transport is the major contributor to tourism related emissions for the mid and long-haul travel that characterises most developing countries' high value tourism markets. Of the different forms of transport used for international tourism, aviation is regarded as the most significant contributor to global warming. Aviation is now the primary mode of transport for international tourists, with an estimated 43% of international tourist arrivals being by air (UNWTO 2005). A recent study concludes that 5% of global CO_2 emissions are caused by tourism, most of this (40%) by aviation (Scott et al. 2008).

Aviation's share of global emissions of CO2 may appear to be small, as is frequently pointed out by the International Air Transport Association (IATA), but most of these emissions are generated by the less than 2% of the world's population that participate in international aviation on an annual basis (Peeters et al. 2007). Furthermore, growth in emissions from this sector have been stron;, and both Airbus (2007) and Boeing (2007) are projecting continued growth in passenger numbers of 4.9% and 4.5% per year, respectively, in the period 2007-2026, with the implication that net fuel use and emissions are likely to increas ion the order of 3% per year. Significantly for understanding the implications of the relationship between tourism and climate change, they forecast that by 2026 nearly 40% of air travel will be to, from, or within the Asia-Pacific region (Boeing 2007), where most nations are currently exempt from international emission reduction targets. While it remains to be seen how these estimates will be affected by the financial crisis in 2008, it deserves mention that events of the past, such as September 11 (2001), have at best only postponed growth in aviation (see also Lee 2009).

Growth in emissions from aviation is clearly in conflict with global climate policy. Responding to the findings of the Fourth Assessment Report of the IPCC (2007), the Bali Action Plan negotiated by 180 nations at the Conference of the Parties-13 (COP-13), recognszed that deep cuts in global GHG emissions are urgently required to avoid dangerous climate change. The European Union (EU) emission policy target is a reduction of 20% by 2020 and some countries, such as the UK, are already discussing cuts of 80% by 2050 (over the base year 1990). This should include aviation, and it is thus important to note that aviation is responsible for a higher share of emissions in industrialszed countries than on a global average (e.g. Gössling & Hall 2008); with the consequence that climate policy should affect the sector more substantially in industrialszed countries. The relatively high level of economic dependence of some developing economies on international tourism (see Table 1) will mean that those

countries may be substantially affected by mitigation measures that increase the cost of air travel.

Climate policy combines command and control measures to regulate GHG emissions. International aviation is not included in the Kyoto Protocold nor was it an explicit topic of post-Kyoto emission reduction negotiations at COP-13 in Bali, Indonesia (December 2007), or COP-14 in Poznan, Poland (December 2008). Emissions from international aviation are currently not accounted for by any nation. Article 2 of the Kyoto Protocol states that the International Civil Aviation Organization (ICAO) is responsible for limiting and reducing emissions from international aviation in Annex I nations (ICAO 1997). However, ICAO has been accused of effectively preventing action towards emissions reductions in the aviation sector for over more than a decade (T&E 2007). Growth in GHG emissions from the aviation sector can be regulated nationally. Currently, this is only the case within the European Union, where all flights into and out of Europe will be integrated in the EU emissions trading scheme by January 2012.

Current climate policy is more likely to slow or delay growth in the aviation sector, at least with regard to leisure travel, than to achieve absolute reductions in emissions (Gössling et al. 2008a, Mayor and Tol 2007). Clearly, growth in leisure mobility is such that even under the best scenarios of technology and air traffic control management (Peeters et al. 2009a), there will be a growing gap between the increase in absolute emissions and post-Kyoto emission reduction needs.

Consequences of emission trading for arrivals in developing countries

So far, only one detailed study has focused specifically on the consequences of emission trading on arrivals in developing countries. In their analysis of emerging climate policy in major tourism outbound markets, Gössling et al. (2008a) assessed the direct implications of emission trading for the aviation sector and examined the potential consequences for travel costs and tourism demand in ten tourism-dependent less-developed island states with diverse geographic and tourism market characteristics.

The study assumed that additional costs per ton of CO_2 of €27.4 in 2012 and €46.9 would apply by 2020. This is certainly too high, as the study considered the inclusion of non-CO_2 emissions in the EU ETS for aviation, at was originally suggested by the EC. Furthermore, the study assumed that emissions from aviation in the EU would grow by 40% by 2011 and 100% by 2020, while there would be a cap of 90% of 2005 emission levels in 2012 and 79% of 2005 emission levels in 2020, with 25% of allowances being auctioned. Current EU policy foresees a cap of 5% by 2020, with 15% of allowances being auctioned, and these assumptions thus need to

be seen as increasing prices far more substantially than climate policy actually will. To test the consequences of a tough climate policy, the study also provided a second scenario called 'Worldwide Serious Climate Policy', where costs of €230 per t of CO_2 are introduced by 2020 (for technical details see Gössling et al. 2008a).

The results show that climate policy will affect markets of tourism-dependent developing countries, but in view of the post-2001 trends of the considerable increase in demand for holidays in most of tse locations in the study, climate policy was not projected to lead to a notable decline in tourist arrivals up to 2020. Rather, the result would be a slight delay in growth in arrival numbers. For example, in the EU ETS scenario, arrivals would be 0.2% to 5.8% lower relative to a 'Business as Usual' scenario. Only under a very strong international climate policy for aviatiorewas arrivals growth projected to decline in any meaningful way. In the Worldwide Serious Climate Policy scenario, arrivals to individual nations declined between 4% to 72% relative to the 'Business as Usual' scenario.

Table 2 illustrates differences in the carbon intensity of a number of countries. Weighted average emissions per tourist vary between a low of 635 kg CO_2 in Jamaica and 1,873 kg CO_2 in Seychelles. This is of importance, as climate policy is more likely to have an impact on countries with a heavy dependence on emission-intense markets that have strong climate policies.

Table 2. Energy Characteristics of Tourism in Case Study Islands, 2005

Country	Average weighted emissions per tourist, air travel (return flight; kg CO_2) [1)]	Internat. tourist arrivals (2005)*	Total emissions, air travel (1000 ton CO_2)	Emissions per tourist, main market (return flight; kg CO_2) Percentage: share of total arrivals [1)]
Anguilla	750	62,084	47	672 (USA; 67%)
Bonaire	1,302	62,550	81	803 (USA; 41%)
Comoros	1,734	**17,603	31	1,929 (France; 54%)
Cuba	1,344	2,319,334	3,117	556 (Canada; 26%)
Jamaica	635	1,478,663	939	635 (USA: 72%)
Madagascar	1,829	277,422	507	2,159 (France; 52%)
Saint Lucia	1,076	317,939	342	811(USA; 35%)
Samoa	658	101,807	67	824 (New Zealand; 36%)
Seychelles	1,873	128,654	241	1,935(France; 21%)
Sri Lanka	1,327	549,309	729	606 (India; 21%)

***Source: UNWTO 2007 b, c; **2004**

[1)] Calculation of emissions is based on the main national markets only, using a main airport to main airport approach (in the USA: New York; Canada: Toronto; Australia: Brisbane).

Climate change risks to tourism destinations in developing nations

With its close connections to the environment and climate itself, tourism is considered to be a highly climate-sensitive economic sector similar to agriculture, insurance, energy, and transportation (Gössling & Hall 2006, Becken & Hay 2007, Scott et al. 2008). Climate defines the length and quality of tourism seasons and plays a major role in destination choice and tourist spending. Climate affects a wide range of the environmental resources that are critical attractions for tourism in many destinations, such as wildlife productivity and biodiversity, water levels and quality, and snow conditions and glacier extent. Climate also has an important influence on environmental conditions that can deter tourists, including infectious disease, wildfires, insect or water-borne pests (e.g., jellyfish, algae blooms), and extreme events such as tropical cyclones.

Consequently, it is anticipated that the integrated effects of climate change (both shifts in climatic means and extremes), climate-induced environmental change, and climate-related societal change will have far-reaching impacts on tourism destinations; impacts which are already becoming evident at destinations around the world. The regional manifestations of climate change will generate both negative and positive impacts in the tourism sector and these impacts will vary substantially by market segment and geographic region. It is beyond the scope of this article to discuss the full range of potential climate change impacts upon the diversity of tourism destinations in developing nations.[1] However, notable impacts include a gradual shift in preferred destinations and tourist spending to higher latitude temperate nations and higher elevation mountainous areas (Scott et al. 2004, Amelung et al. 2007, Hamilton et al. 2005, Berrittella et al. 2006), significant impacts on terrestrial and marine biodiversity in many of the biodiversity hotspots in developing nations (IPCC 2007), increased risk of extreme events and attendant infrastructure damage and tourism interruption IPCC 2007), risks to World Heritage Sites (UNESCO 2008), and major risks to coastal tourism infrastructure due to longer term sea level rise (Dasgupta et al.2007). Importantly, summary assessments by different groups of international experts have consistently identified developing nations in the Caribbean, Small Island Developing States (SIDS), Southeast Asia, and Africa as the most at-risk tourism destinations for the mid- to late-21st century (Table 3).

Table 3. Estimated Climate Change Vulnerability of Tourism in Developing Regions

Study	Timeframe Assessed	Vulnerability Categories	Regions
Deutsche Bank Research 2008	2030	Negatively Affected (slightly or strongly) (a)	South America, Caribbean/Mexico, Southeast Asia (including China and India), Middle East, Africa (b)
Gössling & Hall 2006, Hall 2008	Mid-21st century	Moderately to Strongly Negatively Impacted (c)	Africa, Asia, Latin America, Small Island Nations
Hamilton et al. 2005	2025, +4°C warming scenario	Negative Impact on Tourist Arrivals (d)	Caribbean/Mexico, South America (except Chile), Africa (except Zambia and Zimbabwe), Middle East, Southeast Asia (except China)
Scott et al. 2008	Mid-21st century	Vulnerability Hotspots (e)	Caribbean, Indian and Pacific Ocean Small Island Nations (f)

a) Impact criteria considered: climatic changes, regulatory burdens, substitution effects, adaptation possibilities. Data sources and indicators for these criteria were not identified
b) Many nations in the Middle East and Africa were 'not examined', however no rationale was provided regarding availability of information for selected nations
c) Impact criteria considered: land and marine biodiversity loss, urbanisation, water security, sea level rise, regime change, fuel costs, temperature changes, disease potential
d) Impact criteria considered: change in annual average temperature
e) Impact criteria considered: summer and winter climatic change, increases in extreme events, sea level rise, land and marine biodiversity loss, water scarcity, political destabilisation, health impacts/disease potential, transportation costs, and relative importance of tourism to the economy
f) South America, Africa, Middle East, Southeast Asia were identified as potentially vulnerable, but not listed as 'hotspots' due to insufficient information on magnitude of potential impacts

While our understanding of the impacts of climate change for various destination types has continued to improve, both Scott et al. (2008) and Hall (2008) emphasise that there remain major regional gaps in our knowledge of how climate change will affect the natural and cultural resources critical for tourism in Africa, the Caribbean, South America, the Middle East and large parts of East Asia. Until more systematic regional level assessments are conducted, definitive statements on the net impacts on the tourism sector and the potential for future tourism development will not be possible.

Tourists have the greatest capacity to adapt to the impacts of climate change, with relative freedom to avoid destinations impacted by climate change. Climate, the natural environment, personal safety, and travel cost are four primary factors in destination choice, and as outlined above, global climate change is anticipated to have significant impacts on all of these factors at the regional level. It is the response of tourists to the

complexity of destination impacts that will reshape consumer demand patterns and play a pivotal role in the eventual impacts on destinations. The perceptions of future impacts of climate change at destinations will be central to the decision-making of tourists, tourism investors, governments and development agencies alike, as perceptions of climate conditions or environmental changes are just as important to consumer choices as the actual conditions. Perceptions of climate change impacts in a region are often heavily influenced by the nature of media coverage. It is therefore critical to avoid the type of media speculation and misinformation[2] that is likely to be more damaging to a tourism destination in the near-term than the actual climate impacts.

All tourism businesses and destinations will need to adapt to climate change in order to minimize associated risks and capitalise upon new opportunities, in an economically, socially and environmentally sustainable manner. However, knowledge of the capability of current climate adaptations to cope successfully with future climate change remains rudimentary (Scott et al. 2008). Climate change is slowly entering into the decision-making of a range of tourism stakeholders (e.g., investors, insurance companies, tourism enterprises, governments, development organizations and tourists). Studies that have examined the climate change risk appraisal of local tourism officials and operators have consistently found relatively low levels of concern and little evidence of long-term strategic planning in anticipation of future changes in climate (Scott et al. 2008). Considering the large information requirements, policy changes and investments required to be effective, adaptation by tourism destinations will require decades to implement in some cases: the process of adaptation must commence now for destinations anticipated to be among those impacted by mid-century (Scott et al. 2008; Simpson et al. 2008b). Development organisations in particular will need to develop a greater understanding not only of the implications of climate change for the sustainability of tourism products and supporting services (e.g., coastal zones, coral reefs, water supply, heritage assets) at the destination of tourism development projects, but also the implications of emerging climate policy regimes for relative cost and accessibility. Most importantly, a more critical perspective is required as to whether tourism will actually be the best development alternative.

Box 1: Tourism, development and climate change complexities in the Maldives

In November 2008, the Maldives made international headlines because the country had, for the first time in its history, democratically elected a president The new President announced that the country would be likely to disappear because of sea

level rise associated with climate change. As a survival strategy, the Maldives proposed to use money derived from their tourism industry to buy land in Sri Lanka, India or Australia as an eventual 'homeland'. That this nation has concluded that they will have to surrender their homeland to the sea because of collective inaction to reduce GHG emissions over the past decade, is a sombre commentary on the state of international mitigation efforts.

As a tropical island state, the Maldives can be seen as representative of many Small Island Developing States (SIDS). Tourism is the most important industry, accounting for 28% of GDP, and more than 60% of the Maldives foreign exchange earnings. More than 90% of the government tax revenue is derived from tourism-related taxes, and import duties (CIA World Factbook 2008). However, the distribution of income from tourism appears to be skewed:

"…Maldives became the richest country in South Asia, with average incomes reaching $4,600 a year. But the wealth created was skimmed off by cronies – leaving a yawning gap between rich and poor. Speedboats and yachts of local multi-millionaires bob in the lagoon of the capital's harbour, while official figures show almost half of Maldivians earn less than a dollar a day" (The Guardian, 10 November 2008).

Tourists come mostly from Europe (78%), entailing high energy use for flights and food imports, transport in the islands (helicopter, speedboats) as well as accommodation (diesel generator-driven electricity production). The flight alone (return) will usually entail emissions of about 2 t CO_2 (corresponding to Frankfurt/Germany to Male 7,940 km journey), i.e. more than half of what could currently be seen as sustainable per capita emissions over a whole year.

A number of key points can be learned from the Maldives. Income derived from tourism can boost average income, although not to levels comparable with developed countries; but the distribution is highly skewed. Furthermore, the development is based on an energy-intense, high emission tourism sector, which should be considered in the light of recent demands by SIDS for industrialised countries to cut emissions of greenhouse gases by 95% by 2050 (see Poznan UN climate talks in Poland in December 2008; Reuters 2008). Implementing such deep emission cuts would clearly also affect long-haul travel by air, and thus the economies of SIDS.

This puts the Maldives in a policy dilemma: they can either continue to develop and exploit their energy-intense tourism system to maximise income at the cost of hastening climate change and thus the eventual demise of their nation, or embark on a less carbon intense development path to become a role model for other countries to follow.

The possibility to achieve the rapid and deep emission reductions needed to limit climate change and sea level rise to levels that would allow at least some of the Maldives islands to remain habitable, has perhaps already been lost (Anderson and Bows 2008). So while some may question whether it is prudent or even ethical to support further development of energy-intense tourism in the Maldives, with no other development alternative and little international resources forthcoming to support the type of adaptation the nation will require (i.e., a new homeland), tourism development is the only way to secure the resources needed to support the eventual relocation of its citizens. This nation's historic and current emissions are not the source of its vulnerability; and the reality is that energy-intense tourism development is its best option to build adaptive capacity for its population. It is very likely that this policy dilemma will play itself out in many SIDS and other LDCs in the decades ahead.

Conclusions

Many of the less wealthy countries in the tropics, and in particular island states, depend on international tourism for a large share of their GDP and foreign exchange earnings. Scott et al. (2008) estimate that that the total number of international arrivals to LDCs corresponds to approximately 0.9% of all international tourist trips made in 2005.[3] However, as trips from industrialised countries to the LDCs are usually long-haul, the share of distances travelled and emissions associated with these trips is higher, amounting to 4.7% of the transport volume (pkm) and 4.6% of the CO_2 emissions caused by international tourist air transport. This highlights that there may be a general trade-off between tourism's development benefits in the LDCs and its contribution to climate change.

It seems clear that the current development of tourism in most countries is following pro-growth paradigms, where annual growth in arrival numbers is considered both an indicator of success and a proxy for wealth transfer to poor local populations. In the light of the results presented here, there may be reason to reconsider such strategies. Increasing energy prices over the longer-term, security concerns and growing environmental awareness among travellers make it meaningful to develop tourism systems with a strong focus on energy use and emission avoidance.

Destinations should seek to assess their dependency and vulnerability on energy intense tourism. Destinations would seem well-advised to restructure their tourism products towards low-carbon and/or high value tourism. Many models now exist to strategically reduce the energy intensity of tourism markets, with a focus on maintain-

ing or increasing yield. For instance, Gössling et al. (2005) have used eco-efficiency as an integrated indicator combining ecological and economic data. Knowledge of the energy intensity of various markets can thus help decision-makers to decide in favour of low-carbon tourism that generates high revenue (Becken 2008; Gössling et al. 2008b).

While it is clear that tourism growth has encouraged higher levels of social development for some countries, it is also clear that tourist arrival numbers as a measure of socio-economic development highly simplifies tourism production systems, omitting much of the complexity of tourism-derived income generation and the socio-economic benefit it brings. While higher tourist numbers may generally indicate the potential of higher revenue, it is clear that per tourist income varies widely among markets, tourist types and production systems. In some cases, a limited number of backpackers may actually make a more substantial contribution to livelihoods and poverty alleviation than large numbers of upscale travellers (Wunder 2003; see also Gössling et al. 2004). Upscale tourists, on the other hand, may make a more substantial contribution to government revenue, but this depends on government policies, which may often grant tax exemptions to foreign investors thereby increasing leakage from the local economic system, as well as government spending, which may favour one public expenditure over another.

The benefit of tourism to society is thus highly complex and not self-evident. Tourism may, particularly in comparably small countries with high arrival numbers, also increase prices for basic staples, and thus have negative consequences for the poorest part of the population (Gössling 2003). Therefore we would agree with Schilcher (2007) who argues that in order for tourism to bring benefits to the poorer parts of society, the focus on growth of tourism *per se* has to be replaced with a perspective on equity and developing an understanding of tourism within the broader context of economic and social development objectives.

Climate change adds a new dimension to this needed transformation, for accumulating evidence indicates that climate change, particularly high emission scenarios, would have profound implications that could fundamentally transform aspects of the global tourism sector. Climate change is already beginning to affect decision-making in the tourism sector (e.g., investors, insurance companies, tourism enterprises, governments, development organisations, and tourists); and it will be a pivotal issue affecting tourism development and management in the decades ahead (Gössling & Hall 2006, Becken & Hay 2007, Scott et al. 2008). Despite visibly increased awareness of the challenge of climate change within the tourism industry over the last five years, including the *Davos Declaration* (UNWTO-UNEP-WMO 2008) signed by delegates from over 80 nations in 2007, and the tourism industry led *CEO Challenge on Climate Change* (in Bangkok 2008), a multi-sectoral comparison of climate change risk

awareness by KPMG (2008) found that both the tourism and aviation sector rated low overall and were considered in the 'danger zone' of their climate change risk preparedness framework. Addressing the large information gaps regarding the climate change vulnerability of the tourism sector in virtually all developing nations, and better informing decision makers of the attendant risks, must be a core component of any future strategy for tourism in order to contribute to poverty alleviation and attaining the United Nations Millennium Development Goals.

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Endnotes

[1] Readers are referred to Scott et al. (2008) for a comprehensive summary of available scientific information on potential climate change impacts for destinations world-wide.

[2] See Scott et al. (2008) for a sample of such media coverage for different regions. Some of this sensationalized media coverage has been based on reports that speculate on climate change impacts on tourism, such as: Halifax Travel Insurance (2006). Holiday 2030. http://www.hbosplc.com/media/ pressreleases/articles/halifax/2006-09-01-05.asp?section=Halifax

[3] This calculation is based on UNWTO data for 2000 and extrapolated by the average annual growth rates between 1990 and 2000 to 2005 (international arrivals to the least developed countries was 6.75 million, which corresponds to 0.9% of all international tourist trips made in 2005). UNWTO (2006) calculated tourism in LDCs at 2.6% of the world market share in terms of international tourist arrivals (ITAs). However, the growth in ITAs has been faster in LDCs than in the developing countries as a whole: 42.5% in the former and 30.8% in the latter between 2001 and 2005 (15.8% for the world). Differences in the two estimates are the result of different data sets and definitions of which nations are classified as LCDs.

Agriculture in the Face of Climate Change: Shifting the Paradigm towards Sustainability

Lim Li Ching

Introduction

The challenges facing agriculture are immense. Global food supplies are under pressure from expanding demand for food, feed, and biofuels; the rising price of energy; increasing land and water scarcity; and the effects of climate change (World Bank, 2008). According to the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD, 2008)[1], climate change, coincident with increasing demand for food, feed, fibre and fuel, has the potential to irreversibly damage the natural resource base on which agriculture depends, with significant consequences for food insecurity. Climate change could also significantly constrain economic development in developing countries that rely largely on agriculture (Rosegrant et al., 2008).

The Intergovernmental Panel on Climate Change (IPCC) warns that warming of the climate system is "unequivocal", as evident by increases in air and ocean temperatures, widespread melting of snow and ice, and sea level rise (IPCC, 2007a). Agriculture will therefore have to cope with increased climate variability and more extreme weather events. Increased frequency of droughts and floods will affect crop production negatively, especially in subsistence sectors: smallholder and subsistence farmers, pastoralists and artisanal fisherfolk will suffer complex, localised effects of climate change. The impacts of climate change will fall disproportionately on developing countries, and threaten the achievement of the Millennium Development Goals (MDGs).

Such impacts will further aggravate the stresses faced by developing countries, already facing unprecedented hikes in food prices. Although prices of major cereals have since fallen from their 2008 peaks, they remain high compared to previous years. FAO estimates the number of hungry people at 923 million in 2007, an increase of more than 80 million since 1990-92 (FAO, 2008). In 2008, another 40 million were pushed into hunger, bringing the overall number of undernourished to 963 million. While several factors are responsible, the consensus is that high food prices are driving millions into food insecurity, worsening conditions for many who were already food-insecure, and threatening long-term global food security.

[1] The IAASTD is the most recent and comprehensive assessment of agriculture, co-sponsored by the World Bank, FAO, UNEP, UNDP, WHO, UNESCO and GEF.

At the same time, agriculture consumes 85% of the world's utilised water and contributes to deforestation, land degradation, and pollution (World Bank, 2008). While agriculture has been successful in meeting food demand, it also accounts for a large loss of biodiversity, the degradation of many ecosystem services, increased risks of nonlinear changes in ecosystems, the exacerbation of poverty for some, and growing inequities and disparities across groups of people (MEA, 2005).

Agriculture is thus at a crossroad. It has to find ways to feed the world while coping with climate change, at the same time being environmentally, socially and economically sustainable. Accordingly, critical reflection on the nature of agricultural development that the international community and national governments should invest in is necessary.

Agriculture in the development spotlight

The World Development Report 2008 called for greater investment in agriculture in developing countries (World Bank, 2008). It warned that the sector must be placed at the centre of the development agenda if the MDGs of halving extreme poverty and hunger by 2015 are to be realised.

Yet, while 75% of the world's poor live in rural areas, a mere 4% of official development assistance (ODA) goes to agriculture in developing countries (World Bank, 2008). The share of agriculture in ODA has declined sharply, from a high of about 18% in 1979 to 3.5% in 2004. In absolute terms, ODA declined from a high of about USD 8 billion (2004 USD) in 1984 to USD 3.4 billion in 2004.

This neglect of agriculture is all the more striking because it has occurred in the face of rising rural poverty. Yet, for the poorest people, GDP growth originating in agriculture is about four times more effective in reducing poverty than GDP growth originating outside the sector (World Bank, 2008). The large share of agriculture in poorer economies suggests that strong growth in agriculture is critical for fostering overall economic growth.

There now appears to be a resurgence of agriculture on the development agenda, culminating in broad agreement on the need to massively reinvest in agriculture. Nonetheless, this still leaves open the question of the nature of agricultural development required.

The UN Special Rapporteur on the Right to Food has highlighted the need to support smallholder farmers and means of agricultural production that are sustainable, particularly in the context of climate change (De Schutter, 2008). This is because agricultural science and technology hitherto has mainly benefited large-scale enterprises and has not focused on the specific needs of the rural poor in developing countries. Moreover, while intensive export-oriented agriculture has increased, this has been ac-

companied by both benefits and adverse consequences depending on circumstances, such as exportation of soil nutrients and water, unsustainable soil or water management, or exploitative labour conditions in some cases (IAASTD, 2008). There is little clear evidence that export-led poverty alleviation has worked as envisaged, with foreign exchange earnings from agricultural development achieved at very low prices and little value-added, and bypassing of in-country opportunities for agricultural development focused on local and regional markets (Pretty, 2006).

Additionally, the path that agriculture has been on has not been sustainable. For example, the widespread promotion of Green Revolution technologies in the 1960s, particularly in Asia and Latin America, which involved the massive introduction of agricultural inputs such as inorganic fertilizers, chemical pesticides and modern seeds, radically transformed agriculture from traditional farming systems to input-dependent systems characteristic of industrial (commercial) agriculture. Yet, in an era of climate change, the sustainability of this model of input- and energy-intensive agriculture is questionable.

Efforts are currently underway to transform African agriculture via an "African Green Revolution" (e.g. the Alliance for a Green Revolution in Africa), an ambitious approach forged by philanthropic foundations, the public and private sectors, and UN agencies. While recognizing the pitfalls of the original Green Revolution, it remains to be seen if the solutions offered are more of the same, or if they truly constitute a pro-poor, pro-environment approach (Daño, 2007).

The IAASTD clearly concluded that a radical change is needed in agricultural policy and practice, in order to address hunger and poverty, social inequities and environmental sustainability (IAASTD, 2008). The 'business-as-usual' scenario of industrial farming, input- and energy-intensiveness, damage to the environment and marginalisation of small-scale farmers was judged no longer tenable.

However, because the development choices made have in some cases excluded or marginalized key actors, such as small-scale farmers, with preference being given to short-term over longer-term considerations, some judgments have been privileged over others in decision-making, pushing agriculture along certain pathways to the neglect of other well-evidenced options, such as sustainable agriculture practiced by small farmers. Additionally, many of the technologies potentially of use in sustainable farming are not adopted because small-scale producers lack access to the means and supporting services necessary to employ the technologies profitably (IAASTD, 2008). As such, in most countries, sustainable agriculture policies remain at the margins, despite recognition of the need to support such interventions (Pretty, 2006). Most agricultural sustainability improvements in the last two decades have arisen despite existing national and institutional polices, rather than because of them.

The IAASTD therefore calls on the international community and national gov-

ernments to systematically redirect agricultural knowledge, science and technology towards sustainable biodiversity-based agriculture and agroecological sciences, while addressing the needs of small-scale farmers. (De Schutter, 2008, IAASTD, 2008). Such a paradigm shift could better meet the challenges of increasing productivity and ensuring sustainability, particularly in the context of climate change.

Climate change and agriculture

The prognosis for the impacts of climate change on agriculture is sobering (IPCC, 2007b). While crop productivity is projected to increase slightly at mid- to high-latitudes for local mean temperature increases of up to 1-3°C depending on the crop, it will in contrast decrease beyond that in some regions. More significantly, for many developing countries, at lower latitudes, especially in the seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increases (1-2°C). This would increase the risk of hunger.

On a global scale, the potential for food production is projected to increase with increases in local average temperature over a range of 1-3°C, but above this it is projected to decrease (IPCC, 2007b). Given that warming by the end of the 21st century (2090-2099) will be worse than expected and that the best estimates project a rise of 1.8-4°C, and a likely range of 1.1-6.4°C (IPCC, 2007a), the world is likely to see a decline in food production, if we continue business as usual.

For developing countries, including where some of the poorest people live and farm, the projections of climate change's impacts are dire. Agricultural production, including access to food, in many African countries and regions, is projected to be severely compromised (IPCC, 2007b). The area suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas, are expected to decrease. This would further adversely affect food security and exacerbate malnutrition in Africa. In some countries, yields from rain-fed agriculture, which is important for the poorest farmers, could be reduced by up to 50% by 2020.

In East and South-East Asia, crop yields could increase up to 20%, however, yields could decrease up to 30% in Central and South Asia, by the mid-21st century (IPCC, 2007b). Taken together, and considering the influence of rapid population growth and urbanisation, the risk of hunger is projected to remain very high in several developing countries of the region.

In drier areas of Latin America, climate change is expected to lead to salinisation and desertification of agricultural land. Productivity of some important crops is projected to decrease and livestock productivity to decline, with adverse consequences for food security (IPCC, 2007b).

While different challenges may emerge for different regions, the general indications are that climate change will adversely affect agriculture. Moreover, it is the majority of the world's rural poor who live in areas that are resource-poor, highly heterogeneous and risk-prone, who will be hardest hit by climate change. For these vulnerable groups and subsistence farmers, even minor changes in climate can have disastrous impacts on their lives and livelihoods (Altieri and Koohafkan, 2008). With a large number of smallholder and subsistence farming households in the dryland tropics, there is particular concern over temperature-induced declines in crop yields, and increasing frequency and severity of drought, which will lead to the following general impacts: increased likelihood of crop failure; increased diseases and mortality of livestock and/or forced sale of livestock at disadvantageous prices; increase livelihood insecurity, resulting in sale of other assets, indebtedness, out-migration and dependency on food aid; and a downward spiral on human development indicators such as health and education (Easterling et al., 2008).

The relationship between climate change and agriculture is however a two-way one; climate change in general adversely affects agriculture and agriculture contributes to climate change in several major ways.

Agriculture releases into the atmosphere a significant amount of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). It accounted for an estimated emission of 5.1-6.1 $GtCO_2$-eq/yr in 2005, about 10-12% of global anthropogenic emissions of greenhouse gases (Smith *et al.*, 2007). Of global anthropogenic emissions in 2005, agriculture accounted for about 60% of N_2O and about 50% of CH_4. If indirect contributions (e.g. land conversion to agriculture, fertilizer production and distribution and farm operations) are factored in, some scientists have estimated that the contribution of agriculture could be as high as 17-32% of global anthropogenic emissions (Bellarby *et al.*, 2008).

In this context of climate change, two questions thus arise: Can agriculture and farmers, particularly in developing countries, adapt to the adverse impacts of climate change, and are there ways to mitigate the impacts of agriculture on the climate?

Sustainable agriculture has both adaptation and mitigation potential

Rethinking agriculture in an era of climate change requires a new agricultural development paradigm, one that has to deal with the multiple challenges of climate change, ensuring productivity to provide for food security, particularly for the poorest and most vulnerable, and ensuring environmental sustainability. Sustainable agriculture, which is also variously called ecological agriculture, agroecology, or biological agriculture, and includes organic agriculture, could hold the key to this new paradigm.

The overarching priority is therefore to put the idea of sustainability at the centre of agricultural policies rather than at the edge (Pretty, 2006).

What is required is for all agriculture to shift towards more sustainable practices. Sustainable agricultural approaches can be in many forms, but generally integrate natural, regenerative processes; minimise non-renewable inputs (pesticides and fertilisers); rely on the knowledge and skills of farmers and depend on locally-adapted practices to innovate in the face of uncertainty (Pretty 2006, Pretty and Hine, 2001).

Any comprehensive strategy for addressing climate change must include both adaptation and mitigation (IFAD, 2008). For the most vulnerable people, whose livelihoods are being impacted now, adaptation is urgent. However, concerted and sustained mitigation efforts are also needed to prevent further deterioration in the medium term. Since adaptation becomes costlier and less effective as the magnitude of climate change increases, mitigation remains essential (Rosegrant et al., 2008).

Climate change adaptation

Adaptation can be both autonomous and planned. Autonomous adaptation is the ongoing implementation of existing knowledge and technology in response to the changes in climate experienced; planned adaptation in the increase in adaptive capacity by mobilising institutions and policies to establish or strengthen conditions that are favourable to effective adaptation, and investment in new technologies and infrastructure (Easterling, 2007).

Autonomous adaptation is highly relevant for smallholder farmers in developing countries (IFAD, 2008). Crucially, many of these autonomous adaptation options are met by sustainable agriculture practices. By increasing resilience within the agroecosystem, sustainable agriculture increases its ability to continue functioning when faced with unexpected events such as climate change (Borron, 2006).

Practices that enhance biodiversity allow farms to mimic natural ecological processes, enabling them to better respond to change and reduce risk. Resiliency to climate disasters is closely linked to farm biodiversity, so farmers who increase interspecific diversity via sustainable agriculture suffer less damage compared to conventional farmers planting monocultures (Altieri and Koohafkan, 2008, Borron, 2006, Niggli *et al.*, 2008). Moreover, the use of intraspecific diversity (different cultivars of the same crop) is insurance against future environmental change.

Sustainable farming practices that preserve soil fertility and maintain or increase organic matter can reduce the negative effects of drought while increasing productivity (ITC and FiBL, 2007, Niggli *et al.*, 2008). Water holding capacity of soil is enhanced by sustainable agriculture practices that build organic matter, helping farmers withstand drought (Altieri and Koohafkan, 2008, Borron, 2006). In addition, water-

harvesting practices allow farmers to rely on stored water during droughts. Other practices such as crop residue retention, mulching, and agroforestry, conserve soil moisture and protect crops against microclimate extremes. Organic matter also enhances water capture in soils, significantly reducing the risk of floods (ITC and FiBL, 2007, Niggli *et al.*, 2008).

Indigenous and traditional knowledge are a key source of information on adaptive capacity, centred on the selective, experimental and resilient capabilities of farmers (Altieri and Koohafkan, 2008, Borron, 2006, IAASTD, 2008, ITC and FiBL, 2007, Niggli *et al.*, 2008). Many farmers cope with climate change, in different ways: by minimising crop failure through increased use of drought-tolerant local varieties, water-harvesting, extensive planting, mixed cropping, agroforesty, opportunistic weeding and wild plant gathering. Traditional knowledge, coupled with the right investments in plant breeding, could yield new varieties with climate adaptation potential.

Development options for adaptation

Many autonomous adaptation measures found within sustainable agriculture are effective against climate variability, while also contributing to poverty reduction, and need to be urgently supported by the development community and integrated into development projects. Supporting and facilitating farmers' knowledge on such measures needs to be critically enhanced, as they have been by-passed in the past (IAASTD, 2008). This requires creating space for diverse voices and perspectives and a multiplicity of options.

Nonetheless, in the face of accelerating climate change, a longer-term planned approach for adaptation is also necessary (IFAD, 2008) and requires integration into development projects, policies and strategies. There is urgent need to increase adaptive capacity and enhance resilience through purposeful biodiversity management; options include irrigation management, water harvesting and conservation technologies, diversification of agriculture systems, protection of agrobiodiversity, and screening and breeding germplasm for climate change tolerance (IAASTD, 2008).

These efforts need to be supported by appropriate policy and decision-making options, integrated spatial planning, and early warning and communication infrastructure that support the generation and dissemination of adaptation knowledge, technologies and practices (IAASTD, 2008). In terms of technical options, the planned approach has to include many forms of land use and land use change, new cultivation practices, new seed varieties, etc. (IFAD, 2008). Insurance, safety nets and cash transfers to reduce vulnerability to shocks are also part of the solution.

Development cooperation will have to address the following issues: enhancing the capacities of smallholder farmers and their organisations beyond autonomous

adaptation, engaging in longer-term planned adaptations to effectively address the uncertainties of climate change, and options to make planned adaptation a part of a longer-term development process (IFAD, 2008).

Adaptation policies in many cases are extensions of development policies that seek to eradicate poverty and food insecurity; thus synergies should be maximised (Rosegrant et al., 2008). General policies that should be supported include promoting growth and diversification; strengthening institutions; protecting natural resources; investing in research and development, education and health; creating markets in water and environmental services; improving the international trade system; enhancing resilience to disasters and improving disaster management; and policies promoting risk-sharing.

Climate change mitigation

Agriculture has the potential to change from being one of the largest greenhouse gas emitters to a much smaller emitter and even a net carbon sink, while offering options for mitigation by reducing emissions and by sequestering CO_2 from the atmosphere in the soil. The solutions call for a shift to more sustainable farming practices that build up carbon in the soil and use less chemical fertilizers and pesticides (Bellarby *et al.* 2008, ITC and FiBL, 2007, Ziesemer, 2007).

There are a variety of sustainable farming practices that can reduce agriculture's contribution to climate change. These include crop rotations and improved farming system design, improved cropland management, improved nutrient and manure management, improved grazing-land and livestock management, maintaining fertile soils and restoration of degraded land, improved water and rice management, fertilizer management, land use change and agroforestry (Bellarby *et al.*, 2008; Niggli *et al.*, 2008, Smith *et al.*, 2007).

Niggli *et al.* (2008) estimate that a conversion to organic agriculture would considerably enhance the sequestration of CO_2 through the use of sustainable techniques that build up soil organic matter, as well as diminish N_2O emissions by two-thirds due to no external mineral nitrogen input and more efficient nitrogen use. Organic systems have been found to sequester more CO_2 than conventional farms, while techniques that reduce soil erosion convert carbon losses into gains (Bellarby *et al.*, 2008, ITC and FiBL, 2007, Niggli *et al.*, 2008). Organic agriculture is also self-sufficient in nitrogen due to recycling of manures from livestock and crop residues via composting, as well as planting of leguminous crops (ITC and FiBL, 2007).

Development options for mitigation

Some mitigation measures could provide new opportunities for smallholder farmers, pastoralists and forest dwellers in developing countries, through their roles as sequesters of carbon, through changes made in land use and cultivation practices to reduce emissions, and as small-scale producers of clean energy (IFAD, 2008). Of particular relevance to smallholder farmers is the potential of agroforestry in mitigation.

There is significant room for promoting pro-poor mitigation measures through increasing the profitability of sustainable agriculture practices (Rosegrant et al., 2008). Incentives for smallholder farmers from developing countries to adopt mitigation practices need to be enhanced, including payment for environmental services (IFAD, 2008; Rosegrant et al., 2008). At the same time, because some options may not have favourable outcomes for smallholder farmers, these need to be critically assessed, and mechanisms to buffer farmers against negative impacts are essential.

Furthermore, it may be worthwhile exploring the potential contribution of agriculture in developing countries to mitigation and mobilising resources from the carbon market for investment in pro-poor and sustainable agricultural development (Rosegrant et al., 2008).

The productivity question

A key question that is often asked about sustainable agriculture, including organic agriculture, is whether it can be productive enough to meet the world's food needs. However, evidence shows that in general, yields from sustainable agriculture can be broadly comparable to conventional yields in developed countries. In developing countries, sustainable agriculture practices can greatly increase productivity, particularly if the existing system is low-input, which is largely the case for poor subsistence farmers.

Evidence from global modelling

A recent study examined a global dataset of 293 examples and estimated the average yield ratio of different food categories for the developed and developing world (Badgley et al., 2007). On average, in developed countries, organic systems produce 92% of the yield produced by conventional agriculture. In developing countries, however, organic systems produce 80% more than conventional farms. Organic methods were also found to hypothetically produce enough food on a global per capita basis to sustain the current human population, and potentially an even larger population, without putting more farmland into production.

Evidence from reviews of sustainable agriculture projects

In a review of 286 projects in 57 countries, farmers increased agricultural productivity by an average of 79%, by adopting "resource-conserving" agriculture (Pretty, 2006, Pretty et al., 2006). A variety of sustainable technologies and practices were used, including integrated pest management, integrated nutrient management, conservation tillage, agroforestry, water harvesting in dryland areas, and livestock and aquaculture integration.

The above study built on earlier research, which found that for 89 projects for which there was reliable yield data, farmers had, by adopting sustainable agriculture practices, achieved substantial increases in per hectare food production: the yield increases were 50-100% for rain-fed crops, though considerably greater in a number of cases, and 5-10% for irrigated crops (Pretty and Hine, 2001). Disaggregated data show that average food production per household rose by 1.7 tonnes per year (up 73%) for 4.42 million small farmers growing cereals and roots. There was an increase in food production of 17 tonnes per year (up 150%) for 146,000 farmers cultivating roots. Meanwhile, total production rose by 150 tonnes per household (up by 46%) for the larger farms in Latin America.

The database was reanalysed to produce a summary of the impacts of organic and near-organic projects on agricultural productivity in Africa (Hine and Pretty, 2008). The average crop yield increase was even higher for these projects than the global average: 116% increase for all African projects and 128% increase for the projects in East Africa. Moreover, all case studies that focused on food production where data have been reported showed increases in per hectare productivity of food crops, challenging the myth that organic agriculture cannot increase agricultural productivity.

Evidence from specific sustainable agriculture interventions

Data from the Tigray Region in Ethiopia, where a sustainable agriculture project has been implemented since 1996, demonstrate the benefits of compost on productivity. Data from 2002-2004 showed that, on average, composted fields gave higher yields, sometimes double, than those treated with chemical fertilizers (Araya and Edwards, 2006). Statistical analysis on a larger data set over 2000-2006 inclusive confirms that compost use increased yields (generally doubled) in all the crops analysed, compared to crops grown without inputs (Edwards *et al.*, 2008). Compost also gave higher yields than chemical fertilizer for all but two crops, where the yields from both interventions were similar.

There are many other examples of increased yields following the application of sustainable approaches, with concrete benefits for smallholder and subsistence farm-

ers and their households (Hine and Pretty, 2008, Parrott and Marsden, 2002, Pretty and Hine, 2001, Scialabba and Hattam, 2002). Benefits include a shift from cereal deficit to producing annual surpluses; reduction in chemical use with ensuing health and environmental benefits; soil fertility improvement and conservation of traditional seeds; diversification of food sources; and increased incomes.

Conclusion

Rethinking agricultural development in an era of climate change entails investing more resources, research and training into, providing appropriate policy support to, and implementing national, regional and international action plans on, sustainable agriculture. Doing so will not only be beneficial in terms of climate adaptation and mitigation, but will also be a paradigm shift towards increasing productivity while ensuring sustainability and meeting smallholder farmers' food security needs (IAASTD, 2008).

Maximising the synergies between adaptation and mitigation means that these strategies should be developed simultaneously (Rosegrant et al., 2008). Financial support for smallholder farmers for implementing adaptation and mitigation options has been lacking, and access to many existing funds by smallholder farmers has been limited (IFAD, 2008). In particular:

- There should be more research and action on adaptation measures in agriculture, especially in developing countries in order to assist farmers there to reduce the adverse impacts of climate change on agriculture.
- Action plans for mitigation measures for agriculture should be urgently researched and implemented.
- Financing assistance for adaptation and mitigation measures in the agriculture sector in developing countries should be prioritized.
- Arrangements should be made for the sharing of experiences and the transfer of good practices in agriculture that can constitute mitigation and adaptation.
- Given the many advantages of organic farming and sustainable agriculture, in terms of climate change as well as social equity and farmers' livelihoods, there should be a much more significant share of research, personnel, investment, financing and overall support from governments and international agencies that should be channeled towards sustainable agriculture. Promotion of sustainable agriculture can lead to a superior model of agriculture from the environmental and climate change perspective, as high-chemical and water-intensive agriculture is phased out, while more natural farming methods are phased in, with research and training programmes also promoting better production performances in sustainable agriculture (p.9-10, Khor, 2008).

Priorities for development agencies and governments moving towards sustainable agriculture include investing in research and extension for agricultural sustainability, as these are essential for adapting and transferring technologies; technical assistance and capacity-building for relevant ministries; land reform to encourage investment in asset building; agricultural development programmes that build rural social capital, particularly for women to access credit; supporting small-scale agribusinesses in rural areas; supporting urban agriculture; working with farmers' and rural people's organisations; and establishing appropriate economic and regulatory incentives to encourage transitions towards sustainability (Pretty 2006). These priorities can be addressed by, among other things, developing partnerships and using participatory approaches; integrating the concept of agricultural sustainability into poverty reduction strategies and policies; and increasing support for research that addresses the needs of the rural poor.

With appropriate focus by the development community on sustainable agriculture as providing adaptation, mitigation and increased productivity options, a 'win-win-win' scenario for agricultural development is possible.

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Forests, Development Cooperation, and Climate Change – Is There Room for Win-Win Situations?

Markku Kanninen

Why forests matter

It is almost impossible to exaggerate the importance of the world's forests. According to the World Bank, 1.6 billion people rely heavily on forests for their livelihoods. Over 2 billion people, a third of the world's population, use biomass fuels, mainly firewood, to cook and heat their homes, and billions rely on traditional medicines harvested from the forests. In some 60 developing countries, hunting and fishing on forested land supplies over a fifth of protein requirements (World Bank, 2004; Mery et al., 2005).

Forests have an important role to play in alleviating poverty. In many developing countries, they play a vital role as safety nets, helping rural people avoid poverty, or helping those who are poor to mitigate it. In addition, forests have great potential to increase rural incomes and thus lift people out of poverty (Sunderlin et al., 2005). Forests, both natural and planted, make an important contribution to national and local economies. In 2003, the international trade in sawn wood, pulp, paper and boards amounted to almost USD150 billion, or just over 2% of world trade, with the developed world accounting for two-thirds of production and consumption. In many developing countries, forest-based enterprises provide at least a third of all rural non-farm employment and generate income through the sale of wood products, enriching private companies, governments and rural communities. The value of the trade in non-wood forest products, for example, pharmaceutical plants, mushrooms, nuts, syrups and cork, has been estimated at USD11 billion (Mery et al., 2005). There is no doubt that many more useful forest and tree products will be discovered in the future.

The total forest area of the world is just under 4 billion ha, which represents nearly 30% of the planet Earth's total area. Approximately 56 % of the world forests are located in tropical and subtropical areas. The forest cover in the world is unevenly distributed; only seven countries possess about 60%, 25 countries about 82% and about 170 countries share the remaining 18% of the world's forest cover. There are 51 countries with less than 10% of their land covered with forest; they are recognised as "low forest cover countries" (FAO, 2007).

Annual financial flows (ODA and investments) to the forest sector in developing countries are estimated at the level of 12 to 24 billion USD per year. The annual for-

est sector ODA is about 0.5 to 1.7 billion USD, representing about 0.5% to 1.5% of the total annual ODA (El Lakany et al., 2007). Plantation forestry dominates both public and private sector funding, thus reflecting the increasing importance of tropical fast-growing plantations in the industrial wood production. In the future, climate change-related funding, both for mitigation and adaptation is expected to match, or even surpass, the "traditional" forest sector financial flows. Are we ready for that? Is there room for win-win situations?

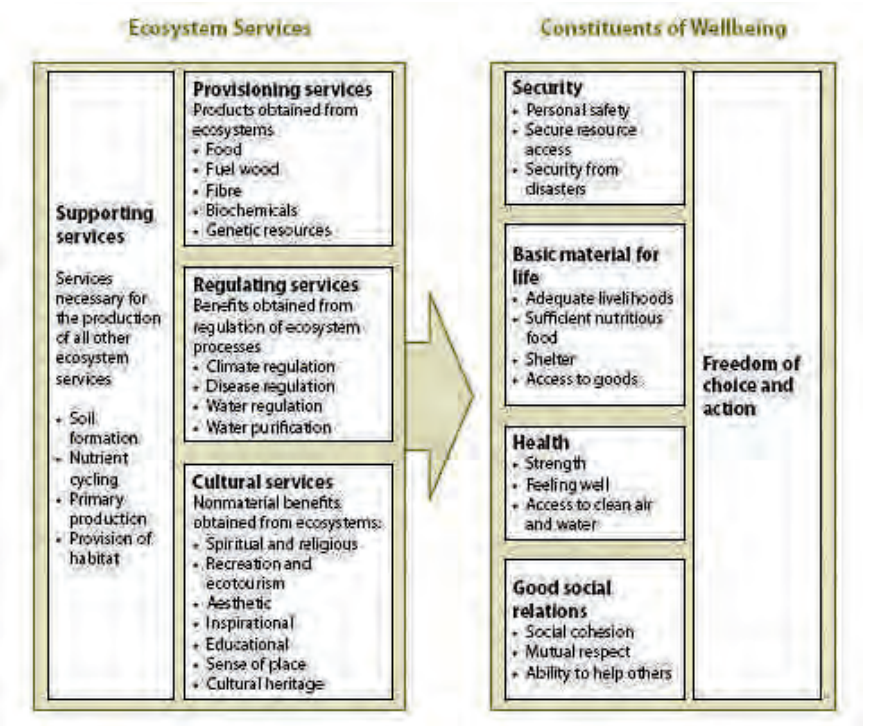
Ecosystem services: Linking human well-being and forests

Forests provide a range of ecosystem services fundamental to the planet's wellbeing and environmental sustainability. For example, they play an important role in stabilising soils and protecting land from erosion by wind and water, and they help to maintain a steady supply of clean freshwater. Trees and forest soils also lock up atmospheric carbon, and forests thus have an important role to play in reducing the concentrations of one of the main greenhouse gases which cause global warming. Forests also support much of the world's biodiversity. Although tropical forests cover less than 15% of the planet's land surface, they contain over half the world's terrestrial species (Mery et al., 2005). Tropical forests are important providers of ecosystem services at various scales, from local (e.g. timber and non-timber forest products, pollination services and scenic beauty) to regional (e.g. hydrological services) and global (e.g. carbon sequestration).

The Millennium Ecosystem Assessment (2003) defines ecosystem services as the benefits that people obtain from ecosystems. We can separate three types of forest ecosystem services that *directly* contribute to human wellbeing: (1) provisioning services (also called ecosystem goods), such as wood, food and fuel wood; (2) regulating services, such as regulation of water, climate or erosion; and (3) cultural services, such as recreational, spiritual or religious services (Figure 1). In addition to these three types, supporting services represent a fourth type of *indirect* service to humans, This includes services that are necessary for the production of other services: for example, primary production, nutrient cycling and soil formation (see Figure 1).

However, Poverty Reduction Strategy Papers (PRSPs) and other poverty alleviation policies have overlooked forest ecosystem services. In national development programmes, the links between the forest ecosystem services and the alleviation of poverty should be better emphasised and articulated (Angelsen and Wunder, 2003). There is also an urgent need to include ecosystem services into planning and prioritisation for meeting different conservation objectives focusing on human wellbeing (Egoh et al., 2007). In these efforts, all institutional levels will be affected by the loss of ecosystem services, from households through local communities and local firms, to national or international organisations (Hein et al., 2006).

Figure 1. Forest ecosystem services (left) and their link to human wellbeing (right) (original in Millennium Ecosystem Assessment, 2003, adapted from Locatelli et al., 2008).



According to a recent FAO's Global Forest Resource Assessment, the global forest loss is estimated to be about 13 million hectares annually, amounting to a net loss of 7.3 million hectares per year for the period 2000-2005 (FAO, 2007). The highest rates of deforestation occurred in South America, with 4.3 million hectares per year, followed by Africa with 4 million hectares per year. Forest degradation is another result of human action, which is changing the structure, composition and integrity of forest ecosystems, which could further seriously jeopardise the production of ecosystem services and the social role of forests. The expansion of desertification in some arid and semi-arid conditions is a serious threat to societies and to sustainable use of forest resources.

Climate change will most likely exacerbate the pressures on forests and their ecosystems services in the future (Fischlin et al., 2007). Projected climatic changes will have a wide range of impacts on species and ecosystems, and thus may result in a drastic decline in the capacity of forests to produce ecosystem services. The loss of ecosystem services will reduce human wellbeing at all levels and on all scales (Locatelli et al., 2008).

Forests for climate change mitigation

Land use, land-use change and forestry (LULUCF) activities are a major source of carbon emissions and active contributors to global warming. The Intergovernmental Panel on Climate Change (IPCC) estimates that 1.6 billion tons of carbon (6 billion tons of CO_2) is released annually due to land-use change, of which the major part is traced to tropical deforestation (Penman et al., 2007). This represents about onefifth of current global carbon emissions, which is more than originates from the fossil fuel-intensive global transport sector. Finding ways to reduce carbon emissions from land-use change will be one of the key elements in the future negotiations on the UNFCCC and the Kyoto Protocol which expires in 2012. This could have large-scale implications on forestry sector, land-use, and on rural livelihoods in many developing countries (Kanninen et al., 2007).

Reducing emissions from deforestation and forest degradation (REDD) is recognised as one of the major national/international actions on mitigation of climate change. REDD offers new opportunities to promote sustainable forest management as an integral component of sustainable development. Whatever form the international REDD mechanism takes in the post 2012 climate regime, significant financial resources could flow from developed world to developing countries to alter the current economic landscape that promotes liquidation of forest assets. An international REDD mechanism, if properly implemented, could promote economic development in rural areas based on protection and sustainable use of forests.

Reducing emissions from deforestation and forest degradation (REDD) is based on the idea of rewarding individuals, communities, projects, and countries for actions that reduce greenhouse gas (GHG) emissions from forests. In many developing countries, REDD has the potential to deliver large cuts in emissions at a low cost within a short time frame and, at the same time, contribute to reducing poverty and sustainable development (Angelsen, 2008).

To complement actions to reduce emissions from deforestation and degradation, there is a need to further reinforce measures aimed at increasing terrestrial carbon pools by promoting afforestation and reforestation (through Clean Development Mechanism (CDM) or other mechanisms), improved forest management, cropland management, agroforestry, grazing land management, and re-vegetation. Promoting tree and forest planting can be a win-win option in many cases, by simultaneously producing ecosystem goods and services for local livelihoods and industries on one hand, and carbon sequestration services for climate change mitigation on the other. There are also possible synergies between carbon sequestration and adaptation measures, e.g., through afforestation of vulnerable areas, watersheds, and rehabilitation of degraded lands.

The Stern Review (2006) emphasises the prevention of further deforestation as one of four "key elements" of future international climate frameworks. The argument for inclusion of forests in a future climate agreement is twofold: forests are the largest emitter not included in the current Kyoto agreement, and the costs of reduced emissions compare favourably with most other sectors. At this stage it is impossible to estimate the cost or volume of financial flows needed for the implementation of a global REDD regime. Based on modelling, the current estimates indicate that halving deforestation rates by 2050 would require an investment of about 7 to 30 billion USD per year (Lubowski, 2008). This is about onethird of the volume of current global carbon markets in 2008 (New Carbon Finance web site) or about the same order of magnitude as the annual financial flows (ODA & investments) to the forestry sector in developing countries (El Lakany et al., 2007). For global carbon markets, REDD may not become a major player any time soon, but for the forestry sector in developing countries this can represent a major increase in forest funding.

REDD is not only a question of volume of investment, it is also a question of timing. Early emission reductions through REDD have particular value as a global insurance policy for maintaining climatic options in light of scientific uncertainty, and allowing time for other solutions. Because tropical forests are disappearing, REDD is also a cost-effective opportunity for reducing emissions that is available now and for a limited time only (Angelsen, 2008).

However, the implementation of REDD will not be an easy task. For decades, many donors worldwide have invested billions of dollars in conservation and development efforts to save tropical rainforests, with disappointing results. Why would conservation work now? As research by the Center for International Forest Research (CIFOR) and others has shown, deforestation normally occurs not primarily to harvest the trees or manage forests, but from causes lying outside the forest sector, many of them related to overall development and globalised economies. For instance, the Amazon forest is being cleared mainly due to agricultural expansion of cattle and soybean (Wertz-Kanounnikoff et al., 2008). In Asia, most of the tropical forests are under pressure of over-exploitation and conversion to plantations of oil palm and fast-growing timber for the pulp industry (Kanninen et al., 2007; Eliash, 2008). Understanding these external causes is crucial to identifying appropriate incentives to curb deforestation. Financing REDD may require significant international funding to target these underlying causes of deforestation and forest degradation, e.g. those described above (Kanninen et al., 2007).

The success of REDD in reducing emissions will depend on tackling profound market and governance failures. REDD policies will have to strengthen the institutional alignment of economic actors and the public interest, a challenge made more difficult by the complexity of the issues behind deforestation and the fact that many

of the causes are external to the forestry sector. Policies need to be tailored to address diverse local situations while removing subsidies that encourage forest conversion, ending unsustainable extraction, devolving rights and responsibilities to local forest users, and promoting the other benefits and ecosystem services of forests besides carbon storage and sequestration (Kanninen et al., 2007).

Forests for adaptation to climate change

Many sectors that are vulnerable to climate change, including agriculture, forestry, energy, housing, transport, etc., benefit from diverse ecosystem services provided by forests (see Fig. 1). This is because the vulnerability of these sectors depends directly or indirectly on the vulnerability of ecosystems surrounding them. The major challenge is to reduce the vulnerability of these climate sensitive sectors in all future development activities. This will require developing and implementing "best practice" guidelines for developing appropriate strategies. In practice, this requires a major paradigm shift in the formulation of national development policies towards: (a) mainstreaming and integrating climate concerns into national development planning and sectoral policies, and (b) (re)directing investments in ways that increase adaptive capacity and reduce the vulnerability of society to climate change. For instance, investments in reforestation, afforestation, and forest management should consider better the role of forests in watersheds and in providing clean water for human consumption and agriculture. Considerable international funding through the Adaptation Fund under the UNFCCC or other channels is required to assist the least developed and most vulnerable countries in this process.

Mainstreaming forests into national adaptation policies and programmes is a challenge that needs attention. Currently, the role of forests for adaptation, and the importance of adaptation of forests to reduce vulnerability of the society, have not been well reflected in the national communications and action plans for adaptation (NAPAs) prepared under the UNFCCC (Locatelli et al., 2008). Forests play a secondary role (if any at all) in adaptation policies (Kalame et al., 2008), despite their importance for livelihoods and their interlinkages with other sectors. In most cases, forests and forestry are not a priority in the NAPAs. Overcoming these challenges is not an easy task. It requires long-term commitment in demonstrating the benefits of forests for adaptation of the societies. And that is not enough: in addition it requires that societies take climate adaptation seriously enough to modify their national development plans and programs accordingly.

In search of win-win situations

Finally, some 15 years after signing the UNFCCC in Rio de Janeiro, policy makers around the world have recognised the need to integrate thinking about climate change into all areas of development and public policy making. Although most of the efforts have been directed towards mitigation (reducing emissions), the need to develop polices and funding mechanisms for adaptation to a changing climate is now widely acknowledged, even in the UNFCCC process.

It is also becoming evident that adaptation and mitigation are interlinked in many ways. For instance, any substantial new mitigation commitments in the post-2012 climate regime (e.g. through REDD) may be feasible only if they are accompanied by stronger support for adaptation of forests to climate change, e.g. through control of pests and diseases (Kurtz et al., 2008) and forest fires (Guariguata, 2008; Locatelli et al., 2008). These are examples of synergies and win-win situations that have to be pursued in the future.

The role of forest in the global carbon balance is important, as onefifth of global carbon emissions originate from forest destruction and forest conversion. In the current situation of urgency in terms of curbing climate change, we cannot afford to leave some 20% of the problem outside our potential solutions. At the same time, increased investments into protection and sustainable management of forests (e.g. through REDD, CDM and similar mechanism) offer an excellent opportunity to foster economic development in rural areas, based on sustainable use of forest resources. In addition to their role in climate mitigation, forests play an important role in adaptation to climate change through provision of ecosystem services, such as energy and clean water, that are of paramount importance for the livelihoods of millions of people in developing countries, both in rural and in urban areas.

Successful implementation of these measures will often require strengthening the stake of local communities in protecting their forest assets and allowing them to use and benefit from these resources. Governments will need to create new institutions and adopt a new paradigm to handle these challenges, and to include climate change mitigation and adaptation as an integral part of their development plans and policies. Investors and development agencies need to adjust their portfolios to match the constantly increasing challenges that climate change creates for sustainable development.

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Linking Development, Peacebuilding and Climate Change

Dan Smith and Karina Kristiansen

A double-headed problem

In April 2007, the United Kingdom used its presidency of the UN Security Council to convene a special debate on climate change, security and conflict. Though this put the links between climate and peace issues on the international agenda, the linkage was not universally understood. There was a mixed reaction, including criticism of the UK for mixing separate issues together. In the relatively short period since then, the conflict aspect of the climate change problem has gained an increasing foothold in the international debate. That is important, but increased awareness alone, of course, is not enough. The international debate has already started to include the need to design a policy response to the climate-conflict linkage.

This article explores the double-headed problem of climate change and conflict, and argues that there is a unified solution. The line of argument presented here was first laid out in International Alert's 2007 report *A Climate of Conflict*.[1] We will not explore the science of global warming and climate change but, rather, take the Fourth Assessment Report (AR4) of the Inter-Governmental Panel on Climate Change as our starting point.[2] The AR4 reflected a broad scientific consensus that climate change is already unfolding as a result of global warming, itself the consequence of human activity, and that, without remedial action, the likely consequences are more serious than had previously been projected.

Our argument is that the consequences of climate change will interact with other aspects of the social, economic and political realities of affected countries and in some cases heighten the risk of political instability and violent conflict. This effect will be especially marked in countries that face problems such as poor governance, state fragility, recent armed conflict, and poverty. For these countries, climate change may simply be a pressure that is too much for them to take, coming on top of all the other pressures they face.

Even though the world has seen a significant decline in the number of armed conflicts over the past two decades, the decline has now plateaued out and new, severe global stress factors have arisen.[3] The medium-term impact of the global economic crisis and the longer-term impact of climate change threaten to affect the room to manoeuvre allowed the UN, as well as the enhanced focus on the importance of sustainable development for long-term peace that followed the end of the Cold War. In

short, after a period of 15 years of relative improvement, we are now entering a period of enormous risk for violent conflict worldwide.

This article argues that the best response to the double-headed problem of climate change and armed conflict is to combine peacebuilding and adaptation to climate change. The capacities that communities need, and the processes that are relevant in order to adapt to the unavoidable consequences of climate change, are very similar to the capacities that communities need in order to reduce the risk of violent conflict. This approach offers a unified solution to the linked, double-headed problem of climate change and violent conflict.

Climate change and insecurity

On the issue of linkages between climate change and insecurity, some confusion has been caused by statements that have simplified a complex question – or appear to have, or have been interpreted as if they did. There is no simple causal link that allows us to say of any armed conflict that it was caused by a single problem. Armed conflicts, insecurity and political instability arise from a variety of interacting factors, some of which lay the basic foundations for conflict, some of which drive the political motivations of the key actors, and some of which shape the triggers that detonate an explosion of violence. Thus, to understand the linkages between climate change and armed conflict, we must look at how the *consequences of the consequences* of climate change play out in relation to the rest of the social, economic and political reality of affected countries.

A productive way to understand the issue and lay the groundwork for preparing a policy response is in terms of risk management. Just as it is impossible to know whether any given hurricane or cyclone was caused by climate change, so it is impossible to identify a specific number of conflicts that will ensue from climate change if corrective action is not taken. However, just as a pattern of changing incidence and intensity of typhoons is a predictable (and already unfolding) consequence of global warming, so a heightened risk of conflict and instability is a predictable consequence of climate change.

The factors that generate risk and shape its nature, scale and intensity depend on local conditions. Climate models show these will be extremely diverse but there are some key themes that emerge, of which the most important is to do with water. We depend on water as a basic condition for life as well as for agriculture and industry, so changes in its availability and quality can have a fundamental impact on all societies, whatever their level of development. The impact is likely to be especially important in relation to agriculture and health. Negative developments in these fields have important but diverse links to conflict risk.

Experience shows that needs caused by water and temperature changes, such as

food insecurity, often generate clashes with government forces or with other communities that also face increased livelihood pressure. In the Philippines, for example, the rice crisis of increased price and decreasing supply, exacerbated by changed weather patterns, is not only leading to malnutrition, but also increases the risk of continued and potentially more widespread conflict.[4] There are less direct but no less severe consequences if projected changes in disease patterns and prevalence are borne out by events, with consequent epidemics. Health systems will come under unprecedented stress, which will be made worse if there are food shortages because of problems in agriculture, and if people are injured or made homeless by natural disasters. An almost inevitable result is reduced economic output, which has been definitively shown to be closely correlated with increased risk of violent conflict.[5]

All these consequences interact and create severe challenges for development, peace and security. What is going on here is that in many areas of the world, the human habitat is becoming less habitable. What we must now look at is the social effects of this. These – the *consequences of consequences* – can be illustrated by looking at some of the most significant transmission mechanisms that link developments in the natural world to the arena of politics and potentially of conflict. We look here at three dimensions of insecurity: livelihood, food and demographics, and their relationship to the quality of governance.

Livelihood insecurity: Poorer countries tend to be agrarian states and will be very susceptible to falling crop yields, extreme weather conditions and migratory movements. They have no insurance, either private or state-based, against the effects of crop failure, and the impacts of climate change will therefore hinder economic development, which in turn will hinder the ability to adapt to climate change – another negative cycle. Declining coffee production in Uganda is an example of the vulnerability of developing countries whose economies often rely heavily on one or two agricultural products. A temperature increase of 2 degrees would have a dramatic effect on the coffee production upon which some five million people rely directly or indirectly.[6] The total area suitable for growing Robusta coffee would be dramatically reduced, and only higher altitude areas would remain. Developments such as these will lead to widespread difficulties in people securing their basic livelihoods.

Food insecurity: Uncertainty and shortages in food supply are the results of losing arable land to desert and of shorter growing seasons. These losses may be significant for one country even if they occur elsewhere, because of dependence on food imports, not least rice, in many developing countries. There are also indirect causes of food insecurity, such as the loss of roads through flooding and the loss of rivers through persistent drought. These changes in the food supply chain will interact with consequences of the international economic downturn, following in the wake of the economic disruption and widespread hardship caused by rising oil costs and food prices in the first half of 2008.

Demographic insecurity: Loss of food security and livelihood security, combined with uncertainty about the physical viability of continuing to dwell in low-lying coastal regions and other areas harmed by extreme weather events, will produce pressures to migrate. Some of these pressures may be strengthened by conflict erupting between different groups over access to diminishing resources.[7] The arrival of migrants does not need to be a destabilising factor as it often brings economic and social benefits to the communities that receive immigrants. However, problems do arise, particularly when newcomers are seen as an unwanted burden in areas that are only just viable. This is especially important because most migration related to climate changes will be within and between poor countries, not a movement from poor to rich countries. Whether migrants go largely to cities or rural areas, there is a risk that the response of social and political leaders could generate conflict. Moreover, when urban migration is considered, it is important to note that some of the world's mega-cities are on the coast and are themselves at risk over time from rising sea levels. The combination of population growth, inward migration, declining water supply, other basic shortages and rising sea levels in a city of 15-20 million or more inhabitants adds up to a challenge that even the most effective city and national governments would find hard to cope with.

Quality of governance: Governance is one of the key links in the chain of *consequences of consequences*. Climate change will put increased pressure on basic state functions such as the provision of basic health care and the guarantee of basic food security. Where governance is effective, these challenges are important but manageable. In the winter of 2007 the North Sea experienced its highest surge ever, without the low lying areas of the UK's east coast and the Netherlands being in any way badly affected.[8] The same natural event in the seas off poor and weakly governed states could kill hundreds. Failed states, fragile states and states in transition, where the institutions to provide for the basic needs of their citizens either do not exist or can barely function, will not only find it next to impossible to respond to the challenges of nature: they are also likely to be unable to respond to the social pressures and political instability that will be unleashed by the consequences of the consequences of climate change.

It is on this that the double-headed challenge of climate change conflict is founded. Access to livelihood and food are key determinants of human security. In their absence, where government cannot make up the deficiencies, conflict and migration are almost inevitable consequences. The key challenge, then, is to identify and manage the combined and interacting risks of violent conflict and climate change.

Adaptation

The importance of the quality of governance in the chain of consequences brings us to the issue of adaptation. This is the key to determining how these issues will play

out. Yet the issue of adaptation has been the poor cousin of mitigation in the climate change debate for many years. It is fortunate that this has begun to change.

Mitigation of global warming and climate change by reducing carbon emissions over the long term is unarguably crucial. Ambitious targets must be set and met. But however effective the international effort at mitigation is, the next two to three decades will see the consequences of climate change unfold because of past carbon emissions.[9] During these next two decades, there will be serious negative consequences which will have a particularly severe impact on poorer countries. The result will be to hold up development and risk widespread social upheavals, political instability and violent conflict. To meet and manage these risks, adaptation to climate change is essential.

Discussion of adaptation tends to emphasise humanitarian disasters and sudden shocks, such as cyclone Nargis which hit Burma in May 2008, killing more than 140,000 and leaving an estimated 2.4 million homeless.[10] This emphasis on sudden shocks has been at the expense of recognising the equally important risk of slow onset changes. Such changes occur year to year and are, individually, almost imperceptible. They might even seem like random occurrences, yet taken over time they add up to, for example, a ten-year drought in Australia that has reduced the country's rice output by 98%.[11] A twenty-year drought played a major role in intensifying grievances in Darfur (though this alone does not explain the conflict).[12]

At the same time, adaptation is usually discussed in terms of preparing flood defences, changing crop cycles and crop selection in the face of a dryer climate, building houses differently, and so on. In other words, the emphasis has been largely technical. However, in order for people in local communities to understand the need to change their crops, or their way of building their homes, or to put in the work to build flood defences, they need to participate in the process of adaptation. They need to be involved in discussing issues, working out plans and implementing changes. In other words, adaptation is a social process. It is easiest where there is good governance, hardest where there is an effective absence of governance.

Some of the processes of adaptation that climate change will necessitate will seem to have little to do directly with climate change. If there is large scale migration as most observers think probable, the arrival of migrants will likely put stress on places where the people living there are already under considerable pressure. Migration does not necessarily or always produce conflict, but it often does; and there always seem to be politicians available to exploit and exacerbate the initial tensions and problems. To avoid potentially dangerous conflicts, societies will need to adapt so they can accept the newcomers peacefully. Adaptation to climate change will almost certainly include other examples of social change.

Vulnerability to climate change is usually treated as the product of three factors: exposure, sensitivity and adaptive capacity.[13] The first factor is the degree of expo-

sure to physical effects of climate change such as an increased frequency of extreme weather. Secondly, vulnerability is defined by the sensitivity of the location: heavy rainfall is more of a problem in low lying areas, for example, while gale force winds may pose a greater threat in hilly regions. The third factor is adaptive capacity. Where there is exposure and sensitivity to the effects of climate change, low adaptive capacity equates to high vulnerability. Examples of adaptive capacity include those cases in which community authorities have built flood defences and are ready with quick and safe evacuation plans, while the national government has prepared to care for those who are displaced and can swiftly allocate resources for repair and rebuilding when the floods recede.

If we look at social adaptation to migration, we could use the same terminology. Vulnerability is established by exposure to physical effects. Sensitivity is determined by the nature of the social consequences. Adaptive capacity determines whether the society will thrive despite the challenges. Examples of adaptive capacity might be city governments working with research centres to forecast the scale of the challenge, working with NGOs to look after arriving immigrants and provide them with short-term accommodation, education and basic services, and working with the building industry to construct decent housing and improve the physical infrastructure, drawing on investment resources from international donors.

It is often argued that human society has long experience of adapting to changes in climate. This is true but, as the IPCC's AR4 noted in 2007, the changes that are unfolding due to climate change are without precedent in their speed and intensity.[14] At the same time as the challenge is becoming increasingly greater, the resilience that traditional societies could fall back on has diminished under the impact of development. Farming communities in many African countries are half in and half out of the modern market system; their resilience against the forces of economic change and political pressure is already very limited. Accordingly, a focused effort is required to engage local communities as well as provincial and national authorities in adapting to climate change.

Linking adaptation with peacebuilding

In over 40 countries,[15] the greatest obstacle to successful climate change adaptation is the fragility of the state. Taking the three-part formula of exposure, sensitivity and adaptive capacity that defines vulnerability, it is the adaptive capacity that is in principle the point of entry for reducing vulnerability. It needs to be strengthened. It can be, but to do so requires a system of governance and a relationship between citizens and state that makes it possible. That is what is lacking in many countries, especially poor, war-torn, and badly governed countries. Their governments are either unwilling

or unable to place enough long-term priority on developing the appropriate measures. In these countries, the already daunting task of adaptation has to address the issue of state fragility as well as the challenge of climate change.

The best way to approach this problem is by explicitly linking peacebuilding with adaptation and focusing as far as possible on the idea that these can be one task, with synergies between its elements, rather than two largely separate tasks.

The goal of peacebuilding is for a society to move from a situation of danger and instability due to violent conflict, whether through the actual experience or only the risk of it, to greater safety. This might mean preventing armed conflict or it might mean recovering after war: often the two are barely distinguishable because of the risk of relapsing into violence after a peace process has begun. To move towards greater safety involves changes in attitudes, behaviour and social structures so that a self-sustaining peace is steadily created. This means strengthening the peace factors in society: security for the population, adequate income and assets, equal access to justice, a fair and effective system of government and leadership, and peaceable relations between different groups in society.

Like adaptation, peacebuilding is a social process. If it does not engage the energies of ordinary citizens and communities, it will not succeed. The fact that both adaptation and peacebuilding are social processes means that the two can be synergistic.

More than this, climate change can offer an opportunity for peacebuilding. In divided communities, it poses a threat against which to unite, while adaptation offers a task on which to cooperate. It is in this positive relationship between adaptation and peacebuilding that the benefits of a unified solution are to be found. In the longer term, a society that can prepare itself to meet the challenge of climate change will, in that process, be strengthening its capacities to manage conflict peacefully. Likewise, a society that can develop the means to address deep-seated conflicts without violence is one that will not be destabilised by the challenges of climate change.

The resilience that such a society is developing is a good way of thinking about the purpose of combining adaptation and peacebuilding. And a society that is growing more resilient is, by definition, on the road to sustainable development. Oxfam touched upon these inter-linkages in their recent report on climate change and poverty in Uganda from July 2008.[16] They argue that the right strategies to adapt to climate change will also be the right strategies for truly sustainable development, which necessarily implies and is built on a sustainable peace. Thus poverty reduction, adaptation to climate change and peacebuilding can be combined into a single coherent approach.

Identifying the synergies

Coherence between different related components is to be found by identifying the key

points of synergy. There are two that need to be targeted: *good governance* and *local participation*. These are the two fundamental elements for generating social resilience.

Governments are meant to provide security for their citizens. If they fail in this, the basic governance contract between state and society breaks down, leading to instability and uncertainty. As the problems government has to solve get deeper, because the demands for resources are becoming more desperate, so the task for government becomes more difficult, and the likelihood that it will fail in its basic functions accordingly increases. Thus, in attempting to foster adaptation to climate change in a context of state fragility and conflict, what is needed is an effort to support the governance contract from both sides: by supporting the development of a responsible and response state and of an active and creative civil society.

The two sides of the contract are equally important. Good governance cannot be implemented top-down. When facing up to climate change, much of the technical knowledge, such as complex climate modelling, would need to be transferred from states with more advanced research and development capacity; but figuring out what to do could and should be an inclusive and participatory process. The community is the vital level for action, which will be more effective if it is based in part on an encounter between the hard science of climate modelling and local knowledge. This can combine to generate well-targeted actions and initiatives. Solutions to the problems of climate change must be home grown, but external help will make them more effective.

Local perspectives are not always adequate, however. Simultaneously addressing peacebuilding needs and climate change adaptation means taking different sectors, regions and actions into account. Improving basic services for only part of the population can fuel new grievances, for example. Focusing attention and resources on hydropower without considering domestic water supply could be a source of inefficiency and, at worst, conflict. Making plans for flood defences without planning the provisions of the necessary materials, which may have to be transported over some distance, will lead to frustration and ineffectiveness. Planning to change harvest cycles and choice of crops means involving farmers, suppliers and traders in a rounded discussion of the issue. Developing the resilience of communities so they can adapt successfully to climate change will include developing the capacity to understand these linkages and to act on them.

Implications for climate change

Taking the conflict and peacebuilding implications of climate change into account has only just begun, but it is moving quite quickly. Some European governments' international development budgets are now prioritising climate change adaptation as an essential part of development aid, and the conflict angle is being given increased attention.

The state of the debate, however, is not yet satisfactory. Even though adaptation has gained more ground in the policy world and played a significantly larger role at the climate conference in Poznan in December 2008 than in earlier such talks, the emphasis is still mainly on mitigation. This is particularly evident in preparation so far for the December 2009 Copenhagen conference, intended to prepare the terms of a new international treaty on global warming. A disproportionately strong emphasis on mitigation may make sense in order to obtain agreement on the new treaty, but it will be highly regrettable if people and institutions working on this at a world level become accustomed to treating mitigation as the main issue at stake. The farmers whose crops are ravaged and the villagers whose houses have been flooded cannot wait for the global community to decide on a sustainable emissions deal. Climate change policy should therefore to a larger degree equalise the two climate change aspects: mitigation and adaptation. This will not diminish the overall impact of mitigation efforts, it will strengthen them by clarifying the many levels of risk that climate change poses.

It is also important to be aware of the risk of negative consequences of efforts to promote mitigation of global warming through new and cleaner energy sources. It is now well documented that the global biofuels boom could increase landlessness among rural poor in developing countries by forcing them off land they depend on for agricultural production. Several recent studies, including one by the World Bank that has not yet been released, show how large-scale biofuel production is affecting poor farmers' access to land in widespread geographic locations: Africa (e.g. Mozambique, Tanzania), Asia and the Pacific (India, Indonesia, Papua New Guinea) and Latin America (e.g. Colombia)[17]. It is argued that the diversion of food crops and land use for the production of biofuels in these places accounts for up to 30% of the recent rise in food prices. Moreover, higher food prices have pushed 105 million more people into poverty and have threatened the livelihoods of almost 300 million according to Oxfam. Indonesia's crucial palm-oil sector, for example, is threatened by the biofuels production. The government has stipulated that 40% of palm-oil production should be set aside for biofuel. This is placing millions of people at risk of losing land and is leading to land conflict as the interests of politicians, plantation companies, indigenous peoples, and resettled communities collide. Other analyses suggest that the production of biofuels could allow poor groups to increase their access to land and improve their livelihoods if the right policies are in place.[18] It seems that a more rounded analysis of the side-effects of the move towards biofuels is needed.

A continued predominant focus on mitigation is therefore not expedient. There are too many risks linked to climate change as it unfolds; and there is an additional set of risks in mitigation efforts themselves. Millions of people in the developing world are very likely to suffer in the next couple of decades – not least from conflict – if adaptation does not continue to move up the global policy agenda. The Adaptation

Fund is a step in the right direction, but clear policies on the actual implementation of adaptation are still needed.

When development and adaptation have been considered alongside each other in terms of funding, one feature of the argument has often been the insistence that international support for adaptation by developing countries must be additional funding over and above normal Official Development Assistance.[19] This is based on the argument that the importance of adaptation should not allow rich countries out of the commitments they have made to support development in poorer countries.

However, adaptation is not an *additional* task in development, but a change *in the core* of development.[20] Helping local communities understand and identify with confidence the challenges they face and the tasks they can undertake means looking at local participation, the quality of governance, the way that development strategy is shaped, where the emphasis of development assistance falls and how it is delivered. In other words, because adaptation should be a part of development, what will happen is that ODA will be spent differently.

The scale of spending required for adaptation in developing countries is wholly unclear, as currently available estimates range from USD 4 – 109 billion annually.[21] What is clear, though, is that adaptation will require international financial support. It seems likely that adaptation will impose additional costs on developing countries. Investing in them will not only be economically productive but will also have other benefits in terms of development, peacebuilding, and resilience to climate change. Further research is required here to identify the degree to which an adaptive development strategy calls for not just new but additional activities.

Some policy recommendations

The broad conclusion of an assessment of the links between climate change and conflict, and between adaptation and peacebuilding, is that international support is required for national governments, local authorities and communities to develop and implement practicable ways of adapting to climate change. This is not the place to put forward a detailed policy list of options to illustrate what this broad message means in practice, but some recommendations for the new policy agenda of adaptation and peacebuilding could be as follows:

- *Build capacity to research the indirect local consequences of climate change:* These will be different in each place, both because the physical effects are different, and because the social structure and economic base are different. The consequences of climate change in Kathmandu are different from the consequences in rural Nepal, let alone in Bangladesh, the Nile Delta, or Peru. Researching in detail how these

effects will play out in regions, countries and localities is the basis for beginning to define the necessary scope of adaptation. Because research and action are so closely linked, it is necessary to ensure that long-term research competence exists in regions and countries that are likely to be affected.

- *Prioritise adaptation over mitigation in fragile states:* As argued above, in fragile states, adaptation to climate change is the most pressing need. With limited international funds and capacity available among donors and national governments to address climate change, priority in fragile states should be given to understanding and addressing the social consequences, so as to prevent the even greater international problem of climate-related violent conflict.
- *Develop the right institutional context:* the key *motif* is good governance for climate change. The research competence, local participation and multiple levels of dialogue outlined above will lead nowhere unless they feed into the right institutional context – political parties, leaders and government departments that can both understand and absorb the hard and social science, as well as appreciate the validity of local perspectives and knowledge. Developing competence on climate change issues, including adaptation, needs to be seen henceforth as an integral part of good governance in all the states facing the combined risk of climate change impact and violent conflict or instability. Good governance is an increasingly important part of development cooperation, which means that donor governments have every possibility to act on this.
- *Align adaptation, development and peacebuilding:* This begins as a strategic discussion about development paths, not as a technical discussion about development assistance. The discussion will be at its most difficult in the countries with the greatest vulnerability to climate change, because they are the ones with least adaptive capacity, which means they are also likely to be at risk of political instability or violent conflict. In other words, where the discussion is most needed, it is hardest. There are several different internationally agreed upon frameworks that can help with the necessary inter-linkages: for example, the OECD/DAC guidelines on development in fragile states, National Adaptation Programmes of Action, and Poverty Reduction Strategy Papers, disaster risk reduction frameworks such as Hyogo and the International Strategy for Disaster Reduction, as well as the Global Environment Facility and its various funding mechanisms. A concerted effort is needed in a variety of different international forums to ensure that these different frameworks are coherent with one another and mutually supportive, which will be achieved when they recognise the full climate-development-peacebuilding linkage.

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Opportunities to Change Development Pathways for Climate Change Mitigation

Jayant Sathaye

Introduction[1]

The concept of sustainable development has its roots in the idea of a sustainable society (Brown, 1981) and in the management of renewable and non-renewable resources. The World Commission on Environment and Development adopted the concept and launched sustainability into political, public and academic discourses. The concept was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987; Bojo *et al.*, 1992).

While there are many definitions of sustainable development, the international sustainability discourse is helping to establish some commonly held principles of sustainable development. These include the welfare of future generations, the maintenance of essential biophysical life support systems, ecosystem wellbeing, more universal participation in development processes and decision-making, and the achievement of an acceptable standard of human well-being (WCED, 1987; Meadowcroft, 1997; Swart *et al.*, 2003; MA: Millennium Ecosystems Assessment, 2005).

Much of the IPCC mitigation assessment and its underlying literature focuses on climate change mitigation that considers climate change programmes and policies in their own right ('climate first'). Recent literature has focused more broadly on treating climate change mitigation as an integral element of development policies ('development first'). Co-benefits or local benefits of mitigation measures, particularly those related to energy efficiency, are often synergistic and can thus lead to substantial improvement in broader development objectives of a country.

Making development more sustainable recognises that there are many ways in which societies balance the economic, social, and environmental dimensions of sustainable development, including climate change,. It also admits the possibility of conflict and trade-offs between measures that advance one aspect of sustainable development while harming another (Munasinghe, 2000). For a development path to be sustainable over a long period, however, wealth, resources, and opportunity must be

[1] This article is based on Chapter 12 of the IPCC (Sathaye et al. (2007)) on Sustainable Development and Mitigation. It represents a condensed version of the chapter with a focus on development pathways and a concrete list of priorities for action.

shared so that all citizens have access to minimum standards of security, human rights, and social benefits, such as food, health, education, shelter, and opportunity for self-development (Reed, 1996).

This article explores ways to make development more sustainable. It explores the relationships of development paths with carbon and energy intensity and the opportunities to change these paths at the sectoral level, and discusses ways to mainstream climate change mitigation into development choices. Both synergies and tradeoffs between mitigation options and sustainable development and adaption activities are explored.

Development paths and emissions scenarios

Historical evidence of changes in carbon intensity

Economic activity is a key driver of CO_2 emissions. How economic growth translates into new emissions, however, is ambiguous. As the economy expands, demand for and supply of energy and of energy-intensive goods also increases, pushing CO_2 emissions upward. On the other hand, economic growth may drive technological change, increase efficiency and foster the development of institutions and preferences more conducive to environmental protection and emissions mitigation. Also, economic growth may be associated with specialisation in sectors with low (or high) emissions per unit of output, such as services, manufacturing or heavy industries, thus resulting in a faster (or slower) de-linking between domestic emissions and GDP.

There is a growing empirical literature on the relationship between economic growth and CO_2 emissions. Studies using GDP and emissions data over *multiple countries* and multiple time-periods consistently find that GDP per capita and emissions per capita move in the same direction among most or all of the sample (e.g., Schmalensee et al., 1998; Ravallion et al., 2000; Heil and Selden, 2001). A one percent increase in GDP per capita was found to lead to an increase in CO_2 emissions per capita between 0.5% to 1.5%. These studies also find evidence that this coefficient is not constant but varies as per capita income rises. Until recently, these studies consistently found a relationship between per capita GDP and per capita CO_2 emissions such that, beyond a certain level of GDP per capita (usually, higher than the highest per capita GDP in the sample considered), per capita CO_2 emissions would start decreasing as income increase. However, Harbaugh et al., 2002 and Millimet et al., 2003 cast doubt on this last finding, claiming that the econometric relationship between GDP and emissions data is less robust than previously thought.

Studies using time-series *at the country level* typically find less robust relationships between GDP per capita and CO_2 emissions per capita. For example, Moomaw and

Unruh (1997) show that international oil price shocks, and not per capita GDP growth, explains most of the variations in per capita emissions in OECD countries. Similarly, Coondoo and Dinda (2002) find a strong correlation between emissions and income in developed countries and Latin America, but a weaker correlation in Africa and Asia. This is consistent with recent findings on the relationships between GDP per capita and pollution. For example, Dasgupta et al. (2006) show that the relationship between GDP per capita and pollution mostly disappears when other explanatory variables, notably governance, are introduced. Neither taking trade into account as a new explanatory variable nor correcting emissions for trade effects, however, significantly increases the robustness of the correlation between observed levels of GDP per capita and observed levels of emissions.

To sum up, the econometric literature on the relationship between GDP per capita and CO_2 emissions per capita does not support an optimistic view that "the problem will take care of itself" because richer people will automatically emit less. On the other hand, the monotonically increasing relation between economic activity and CO_2 emissions that emerges from the data does not appear to be econometrically very robust, especially at country level and at higher GDP per capita level. In other words, the pessimistic interpretation that growth and CO_2 emissions would be irrevocably linked is not supported by the data either. There is apparently some degree of flexibility between economic growth and CO_2 emissions.

For example, CO_2 emissions from fossil-fuel combustion in China remained essentially constant from 1997 to 2001 despite a +30% growth of GDP due to *inter alia* a combination of closing of small-scale, inefficient power plants, shift in industry ownership away from the public sector, and introduction of energy efficiency and environmental regulation (Streets et al., 2001; Wu et al., 2005).

Another example of how different development paths can unfold in relatively similar countries is given by Hourcade and Kostopoulou (1994) who analyse how France, Italy, Germany and Japan – countries with similar levels of GDP per capita in 1973 – responded to the first oil shock. France moved aggressively to develop domestic supply of nuclear energy and a new building code, while Japan made an aggressive shift of its industry towards less energy-intensive activities and simultaneously used its exchange-rate policies to alleviate the burden of oil purchases, whereas Germany built up industrial exports to compensate the trade balance deficit in the energy sector. Much of the variations of CO_2 emissions per unit of GDP from 1971 to 1990 can be attributed to these choices. Yet CO_2 emissions per unit of GDP diminished by half in France, by a third in Japan, and "only" by a quarter in Germany. At the same time the macroeconomic performances of these countries have been relatively comparable from 1973 to 1990 (Figure 1 right), suggesting that widely different environmental outcome can be obtained at similar welfare costs in the long-run.

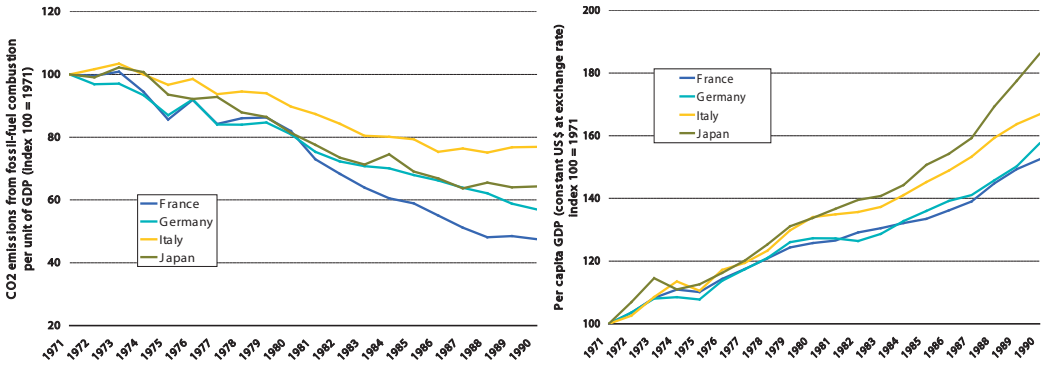

Figure 1: (left) Evolution of CO_2 emissions from fossil-fuel combustion in France, Germany, Italy and Japan between 1971 and 1990; (right) Evolution of GDP per capita in France, Germany, Italy and Japan between 1971 and 1990. Data source: IEA (2004a)

Historical evidence of changes in energy intensity

Energy intensity is defined as energy use per unit of GDP and is an aggregate measure of the energy productivity of an economy. Changes in energy efficiency are one factor that explain changes in energy intensity. Energy intensities vary by country and are influenced by other factors such as natural resource endowments, economic structure and climate regimes. Figure 2 shows the changes in energy intensity since 1970 for several developed and developing countries. Oil price shocks in the 1970s were a key driver for improved vehicle fuel economy, shift away from oil-fired power plants, and the tightening or initialisation of efficiency standards in OECD countries. These resulted in a sharp decline in energy intensity that has continued since then. Over the period 1973-1998, the IEA (2004) estimates that the decline in energy intensities – driven both by policies and by autonomous technical improvements – have resulted in energy savings corresponding to almost 50% of 1998 IEA-11 energy consumption levels. In other words, absent these savings, energy use (and CO_2 emissions) in 1998 would have been almost 50% higher than observed. The Chinese economy promoted and implemented strict energy efficiency regulatory measures that resulted in an energy/GDP elasticity of 0.5 until 2002. Energy intensity of the Indian economy, on the other hand, only started to decline since the early 1990s after the economic liberalisation in 1991, and has accelerated since 1997. A rapid capital stock turnover brought about by faster economic growth and the advent of the information technology sector both contributed to this decline.

Figure 2: Primary energy supply per unit of GDP (excl. biomass); (MJ/US$2000 Market Exchange Rate (MER); Indexed to 1971, using IEA data)

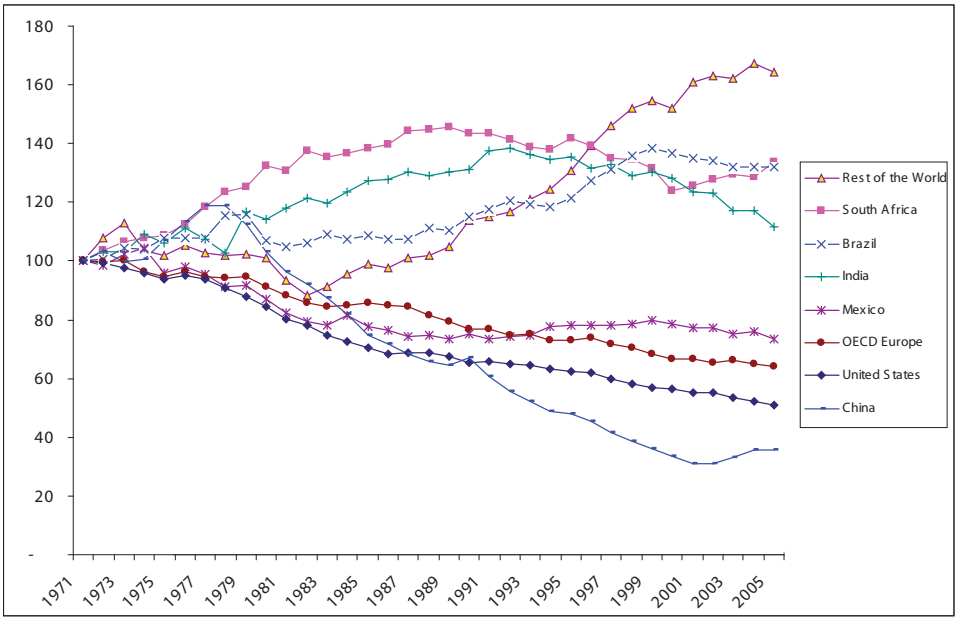

Figure 3 highlights the relationship between changes in electricity intensity and sustainable development attributes and illustrates that it is not a rigid connection and can be decoupled. A high human development index (HDI) (>0.85) may be achieved at a level of annual electricity consumption that stretches from about 7,000 to 30,000 kWh/capita/year. On the other hand, a wide range of human development is seen at low levels of electricity consumption – but not the highest. In the case of South Africa, for example, high electricity consumption does not necessarily result in a high HDI. The structural factors driving energy intensity – a focus on the minerals-energy complex and low levels of efficiency – and lower life expectancy due to HIV/AIDS has outweighed any shifts towards less energy-intensive economic activities over time in that country.

Opportunities to change development paths at the sectoral level

In previous sections, we have argued that the link between GHG emissions, energy use and economic activity was not rigid at the *macro* level: There are examples of countries with comparable economic performances and very different GHG emissions. In the present section, we provide examples of de-coupling between GHG emissions and increased and/or improved activity -- i.e., changes in development paths -- at the *sec-*

2005, MJ/thousand US $	
China	33.1
India	24.6
Rest of the World	21.8
South Africa	11.1
Brazil	9.6
United States	8.6
OECD Europe	7.7
Mexico	4.4

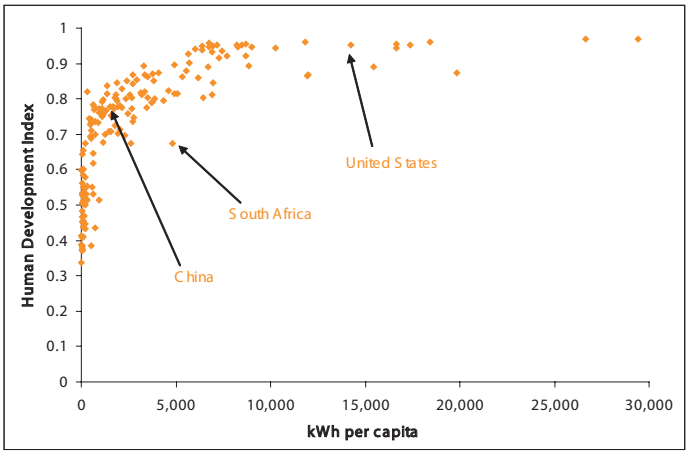

Figure 3: Human development compared to electricity consumption
Source: UNDP (2007)

toral level. To be as relevant to decision-making as possible, we group these examples by *policies* that are susceptible to lead to a shift in development path. In line with the general topic of this article, we draw examples mostly from the energy sector -- but use transportation to show how the same logic applies to other sectors as well. Finally, though some policies, such as energy efficiency or energy subsidy removal, lead mostly to reduced emissions, we also present examples where the link is more ambiguous.

Policies that increase ***energy efficiency*** – both on the demand and on the supply side – aim at reducing demand for energy without affecting, or while increasing, output at very low costs. However, some of the direct gains might be offset by increased demand due to lower energy costs per unit of output (rebound effect), either directly or via macroeconomic adjustments. Empirical estimates vary, but suggest that the rebound effect is in general small to moderate (e.g., Greening et al., 2000, Small and Van Dender, 2007). The impact on CO_2 emissions, in turn, tends to be positive, but depends heavily on the carbon content of the energy supply. For example, Gillingham et al. (2006)) estimate that the annual energy savings generated by all current Demand-Side Management (DSM) programs in the U.S. represent about 6% of the country's non-transportation energy consumption, and lead to reductions in CO_2 emissions equivalent to (at most) 3.5% of the country's total.

In the energy sector, implications ***of improved access to commercial fuels*** on GHG emissions are ambiguous. Emissions from fossil-fuels increase, albeit by a small margin. But unsustainable use of fuelwood and related deforestation decreases (Davidson and Sokona, 2002). Similarly, ***electrification*** increases emissions as a result of easier access and induced economic benefits. But emissions per unit of energy consumed might decrease if the carbon content of the electricity that is newly provided is lower than the carbon content of the fuel it displaces (de Gouvello and Maigne, 2000).

The impact of ***energy subsidies removal*** on CO_2 emissions is likely to be positive in most cases, as higher prices trigger lower demand for energy and induce energy conservation. Removal of energy subsidies has been identified as instrumental in reducing GHG emissions relative to business-as-usual in China and India over the past twenty years (Chandler et al., 2002). However, subsidies removal may result in increased emissions if poor consumers are forced off-grid and back to highly carbon intensive fuels, such as non-sustainable charcoal or diesel generators.

The impact of ***energy security*** policies on emissions is ambiguous, depending in particular on the fuel sources being favoured. For example, in response to the first oil shock, Brazil launched in 1975 the National Alcohol Fuel Program to increase the production of sugarcane ethanol as a substitute for oil, at a time when Brazil was importing about 80% of its oil supply. This program resulted in an estimated 1.5 Mt CO_2/yr emission savings (Szklo et al., 2005). However, Brazil also provides an example where emissions increased as a result of energy-security driven policies. During the 90s, Brazil faced lack of investment in the power system and a growing supply-demand imbalance, culminating in electricity shortage and rationing in 2001. This forced the country to install and run emergency fossil-fuel plants, leading to substantial a increase in GHG emissions (Geller et al., 2004).

Emissions from the ***transportation*** sector result from the combination of the amount of travel that goods and people make, and of the set of technologies with which those trips are undertaken. A wide array of policies affect both demand for transportation and technologies. For example, Nivola (1999) argues that the differences in urban forms of transportation in American and European cities – sprawled vs. compact – cannot be explained only by differences in demography, geography, technology or income; a significant part of the difference also stems from major differences in public policies in the U.S. relative to Europe: preference in public financing of roads against other modes of transportation; dedicated pools of resources for highway construction; lower taxes on gasoline; housing policies geared towards supporting new homes; a tax system more in favour of homeowners; lower support from the federal Government to local governments; and the quasi-absence of regulations favouring small in-city outlets against shopping malls. These differences in urban planning policies, in turn, generate widely different patterns in transport services, energy consumption, and CO_2 emissions.

Although the examples discussed above are very diverse, some general patterns emerge from the literature. First, any country is likely to have opportunities to adopt "win-win-win" policies, i.e. policies that free up resources and bolster growth, meet other sustainable development goals and also, incidentally, reduce GHG emissions relative to baseline (for example, improving efficiency in sectors using highly energy inefficient equipment). Conversely, the closer one gets to the production frontier, the

more trade-offs are likely to appear between reducing emissions and meeting other goals (Hourcade et al., 1996). Second, because some of the key dynamics for GHG emissions, such as technological development or land-use patterns, present a lot of inertia, and thus need sustained effort to be oriented, what matters is not only that a "good" choice is made at a certain point in time, but also that the initial policy persists for a long time – sometimes several decades – to truly have effects. For example, Nivola (1999) points out that sustained policies over time are critical to change the dynamics of urban forms. This raises deep institutional questions about the possibility of governments to make credible long-term commitments (Stiglitz, 1998). Finally, it is often not one policy decision, but an array of decisions that are necessary to influence emissions. This raises, in turn, important issues of coordination between policies in several sectors, and at various scales.

Mainstreaming climate change into development paths

The sections above have highlighted that development policies in various sectors can have strong impacts on GHG emissions. The operational question is how to harness that potential. In other words, how can climate change mitigation considerations be mainstreamed into development policies?

Mainstreaming means that development policies, programs and/or individual actions that otherwise would not have taken climate change mitigation into consideration explicitly include these. The extent to which mainstreaming leads to a sustainable development path will depend on the technological, social, economic and political processes that affect the current and future development path trajectories. Merely piggybacking climate change onto an existing political agenda is unlikely to succeed (IPCC 2007, p. 711).

The ease or difficulty with which mainstreaming is accomplished will depend on both the mitigation technology or practice, and the underlying development path. No-regrets energy efficiency options, for instance, are likely to be easier to implement than others that have higher direct cost, require coordination among stakeholders, and/or require a trade-off against other environmental, social and economic benefits. Weighing other development benefits against climate benefits will be a key basis for choosing development sectors for mainstreaming climate change considerations. In some cases, it may even be rational to disregard climate change considerations because of an action's other development benefits (Smith, 2002).

Development policies, such as electricity privatisation, can increase emissions if they result in construction of natural gas power plants in place of hydroelectric power, however, they can reduce emissions if energy efficiency (demand-side management) programs avoid coal or other fossil-fuelled power plants from being built. Judicious

and informed choices will be needed when pursuing development policies in order to ensure that GHG emissions are reduced and not increased.

There are many different types of non-climate development policies in which climate mitigation activities can be mainstreamed. Examples of these include (1) rationalised energy and water pricing and ban on import of inefficient equipment, (2) forest conservation and sustainable forest management practices that can contribute to conservation of biodiversity, watershed protection, rural employment generation, increased incomes to forest dwellers and carbon sink enhancement, (3) increased market penetration of cost-effective energy efficiency technologies in electricity generation, transmission, distribution, and end-use which will also reduce local pollution, (4) reducing oil imports as a strategy to improve energy security while minimising the use of coal as a substitute, and increasing use of less-carbon-intensive energy sources and reducing energy intensity of the economy (IEA (International Energy Agency), 2004b), (5) provision of incentives by multilateral development banks (MDBs) in their own lending to directly and indirectly influence the emissions of borrowing countries, and (6) insurance premiums differentiated to reflect vehicle fuel economy; liability insurance exclusions for large emitters; improved terms to recognise the lower risks associated with green buildings; or new insurance products to help manage technical, regulatory, and financial risks associated with emissions trading (Mills, 2003).

Mainstreaming mitigation options will depend on the mitigative capacity of each country. Winkler et al. (2007) have suggested that mitigative capacity (MC) be defined as "a country's ability to reduce anthropogenic greenhouse gases or enhance natural sinks."

Higher levels of development tend to increase mitigative (and adaptive) capacity (Sathaye et al. 2007). To show this, capacity can be assessed on the basis of objective factors such as costs, institutions and technology, together with more subjective factors such as political willingness (Winkler et al. 2007). Mitigative capacity of different countries is shaped by two economic factors: namely average abatement cost (or mitigation potential; high cost means low potential); and ability to pay, as approximated by GDP per capita. A significant portion of the mitigation potential would be realised through energy efficiency.

Implications of mitigation choices for sustainable development goals

Mitigation options often have positive effects on aspects of sustainability, but may not always be sustainable with respect to all three dimensions of SD -- economic, environmental and social. For example, removing subsidies for coal increases its price and creates unemployment of coal mine workers, independently of the actual mitigation (IPCC ,2001). In some cases the positive effects on sustainability are more indirect,

because they are the results of side-effects of reducing GHG-emissions. Therefore, it is often difficult to assess the net outcome of the various effects.

The sustainable development benefits of mitigation options vary over sectors and regions. Generally, mitigation options that improve productivity of resource use, whether it is energy, water, or land, yield positive benefits across all three dimensions of sustainable development. In the agricultural sector for instance, improved management practices for rice cultivation and grazing land, and use of bioenergy and efficient cook stoves enhance productivity, and reduce the burden on women of finding and gathering fuel wood often in harsh environments. Other categories of mitigation options have a more uncertain impact and depend on the wider socioeconomic context within which the option is being implemented. Some energy efficiency mitigation activities with GHG benefits may be of limited duration without the persistent replacement and long-term use of the efficient device.

Evaluation of mitigation policies typically focuses on cost estimates that may be reported for each sector at both the global and country-specific levels. Yet mitigation costs are just one part of the broader economic impacts of SD. Other impacts include growth and distribution of income, employment and availability of jobs, government fiscal budgets, and competitiveness of the economy or sector within a globalising market. It is important to fully understand all three aspects of SD -- -- economic, environmental and social.

Environmental impacts include those occurring in local areas on air, water, and land, including the loss of biodiversity. Virtually all forms of energy supply and use, and land-use changes cause some level of environmental damage. The emission of greenhouse gases (GHG) is often directly related to the emissions of other pollutants, either airborne, e.g. sulphur dioxide from burning coal which causes local or indoor air pollution, or waterborne, e.g., from leaching of nitrates from fertilizer application in intensive agriculture.

The social dimension includes issues such as gender equality, governance, equitable income distribution, housing and education opportunity, health impacts, and corruption. Most mitigation options will impact one or more of these issues, and both benefits and tradeoffs are likely.

Conclusion

Changing development paths will be critical to stabilising climate change because research to date shows that climate mitigation alone will not solve the climate problem. This will require that development be made more sustainable, i.e., address both its local and global deleterious impacts. Historical data at the global and country level illustrate that it is indeed possible to decouple economic growth from energy

use and carbon emissions. An important step in this regard would be to identify relevant non-climate policies in every sector including trade, finance, rural and urban development, insurance, and forestry. Examples from the past suggest that sectors far away from their production frontier may have more opportunities than sectors that are close to the production frontier to adopt policies that bolster growth, meet other sustainable development goals and reduce GHG emissions relative to baseline. Past experience also suggests that shifting development paths towards less carbon-intensive trajectories usually results from an array of coordinated policies and measures that are sustained over time, and not from a single, one-off decision in one sector. Thus, such steps will of necessity be context specific and will work only within local and national contexts.

Mitigation options can be synergistic or create tradeoffs between carbon emissions reduction and other sustainable development criteria. Synergies and tradeoffs also exist between mitigation and adaptation approaches to climate change and capacity building, which suggests that the two should be considered simultaneously in the development of sector policies. This implies the establishment of institutional links and a governance structure between the now often disparate policy domains of government, business and civil society. In the last few years, industry and other businesses have begun to investigate and take responsibility for their carbon and energy "footprints". Communicating the footprint data in a reliable manner to help inform consumer purchase decisions is still being debated. The way forward requires that development choices that display synergy between climate mitigation and adaptation, and local sustainable development characteristics, be identified, evaluated, and mainstreamed in order to make development more sustainable.

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Does Human Development Really Require Greenhouse Gas Emissions?

The greenhouse gas emissions take-off in rapidly industrialising countries and possibilities for averting it

Axel Michaelowa and Katharina Michaelowa

Introduction

It is commonly assumed that greenhouse gas emissions are inextricably linked to human and industrial development. This is based upon the historical experience that countries able to embark on industrial development rapidly increased their greenhouse gas emissions.

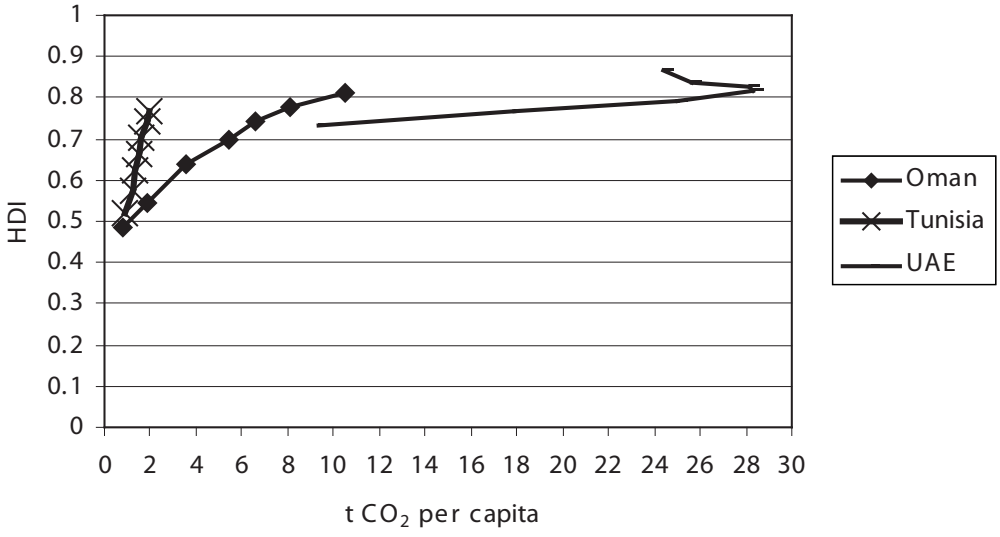
A key question in current climate policy is whether today's developing countries need to follow the same development path, or whether high levels of human development can be reached at low levels of per capita emissions. A large body of literature has tried to determine an environmental "Kuznets Curve" relating per capita income to per capita greenhouse gas emissions (see e.g. Holtz-Eakin and Selden 1995). However, so far no level of per capita income has been found that would unambiguously determine a maximum level of per capita emissions (see Moomaw and Unruh 1997, Azomahou et al. 2006). Some researchers even say that per capita emissions would continue to increase with per capita income (Galeotti et al. 2006).

Income is only a partial indicator for the degree of human development. Therefore, it is desirable to delink the discussion from the level of per capita income, by asking whether the level of human development is also linked to per capita greenhouse gas emissions. Here, the UN Human Development Index (HDI) will be used as a generally accepted measure of human development[1], and an assessment will be made of the extent to which improvements in the HDI were accompanied by increases in per capita emissions. The take-off phases of per capita greenhouse gas emissions in rapidly industrialising countries will then be analysed to determine the drivers for emissions increases. Subsequently, different policy options for slowing down emissions growth during rapid industrialisation processes will be considered. Finally, we discuss whether high levels of human development can be reached and sustained with low greenhouse gas emissions. In this context, the role of consumption patterns will be highlighted.

Links between human development and greenhouse gas emissions

For the period 1975 to 2005, data for HDI and per capita emissions are readily available for over 100 countries (HDI data from UNDP 2007 and per capita CO_2 emissions from fossil fuel combustion from IEA 2007). This period is sufficiently long to show success stories in development. Our data comprise all countries with an improvement of HDI by more than 10 percentage points, which will be called a "development success". Looking at the pattern of development of the HDI in relation to per capita emissions, three main patterns can be distinguished: emissions-extensive development, emissions-intensive development and a pattern where emissions-extensive development over time becomes emissions-intensive (see Figure 1 for typical country examples from the Middle East/North African region)-

Figure 1. Emissions-extensive versus emissions intensive development 1975-2005



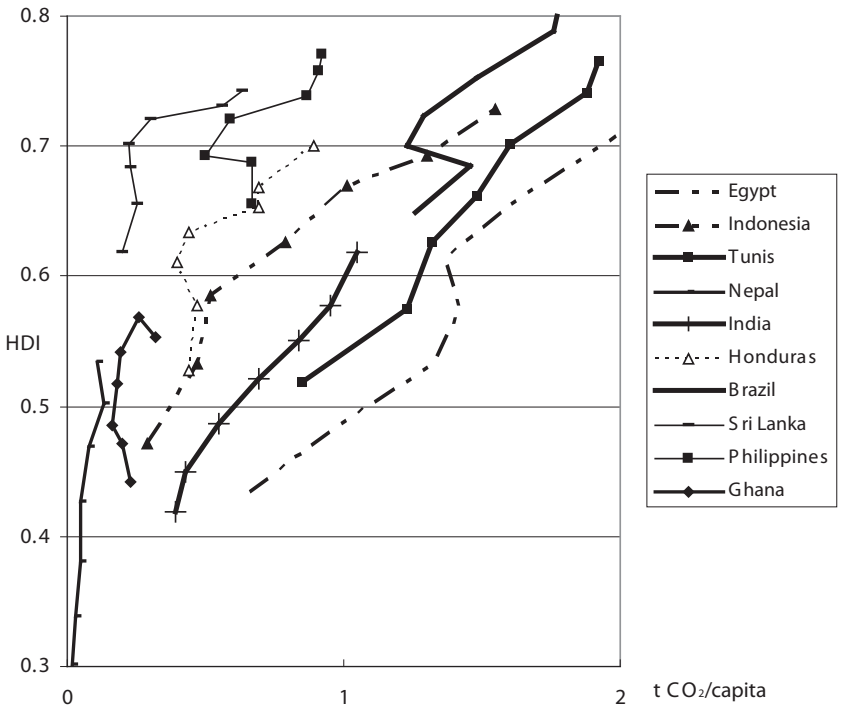
Note: emissions-extensive: Tunisia; emissions-intensive: United Arab Emirates (UAE); transition: Oman. The vertical line denotes world average per capita emissions in 2005.
Source: HDI data from UNDP (2007), per capita emissions data from IEA (2007)

These three different patterns will be analysed below to try to explain why countries have chosen such different emissions paths at similar levels of development. We begin with the ***emissions-extensive*** category which is defined as countries that reached a HDI level of at least 0.5 and kept their per capita emissions level below 2 t CO_2

(Figure 2). This group includes countries from all continents, ranging from very large (India, Brazil, Pakistan) to small. Latin America is somewhat overrepresented. The most intriguing feature of the graph is a group of four countries with negligible per capita emissions: Bangladesh, Cameroon, Ghana and Nepal. Sri Lanka belonged to that group until the mid1990s even at a HDI of over 0.7, but has since switched to a more emissions-intensive path. A number of small Latin American countries has remained in the bracket of 0.5 to 1 t CO_2 per inhabitant, while several large countries in the group (India, Pakistan and Egypt) appear to be in transition to a more emissions-intensive development.

How do countries achieve an emissions-extensive development path? The main reason seems to be a low carbon energy system. Most countries in the group have a high share of hydropower in electricity generation. Moreover, they do not have heavy industry and are not fossil fuel producers. The notable exceptions are countries with a large population which is still mainly engaged in subsistence agriculture. This is the case for India, Indonesia, Pakistan, Bangladesh and Egypt. India is the outlier in terms of a sizeable heavy industry as well as a very carbonintensive electricity generation system; however, these factors are still small with respect to India's sheer population size.

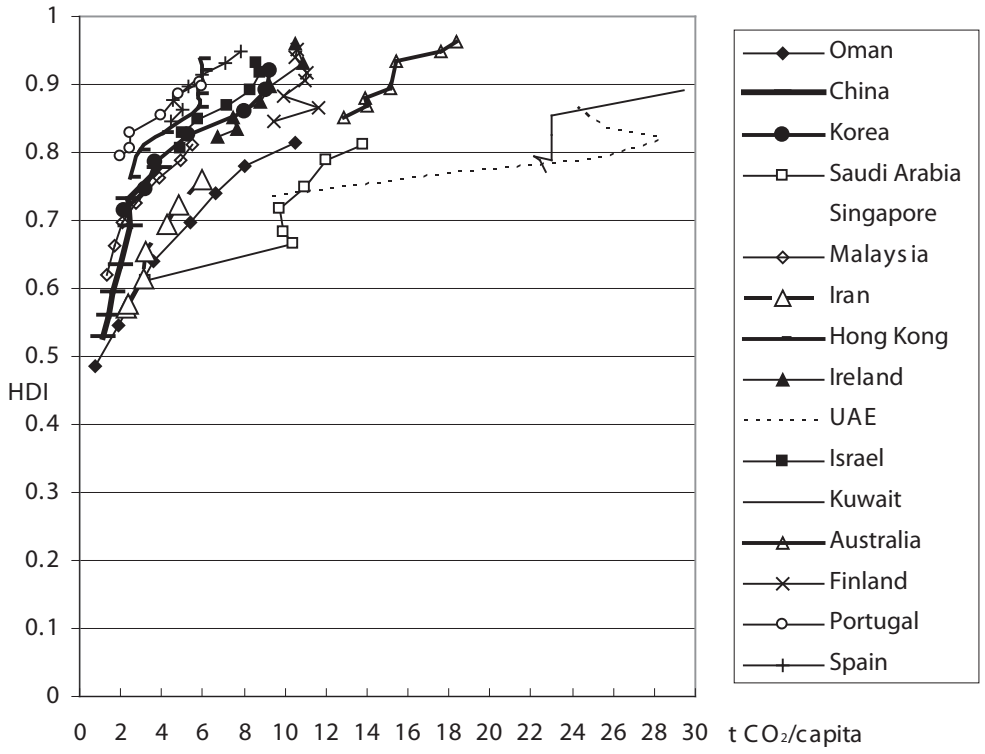
Figure 2. Emissions-extensive development



Source: HDI data from UNDP (2007), per capita emissions data from IEA (2007)

At the other end of the classification, all countries that have exceeded the average global per capita emissions level fall into the ***emissions-intensive*** category. Such a development path is frequently built on the extraction of fossil fuels. The archetypical examples are the sparsely populated countries in the Persian Gulf region which were catapulted from a medieval zero-emissions lifestyle towards world record per capita emissions levels almost overnight. For example, already in 1975, Kuwait's per capita emissions were above 20 t CO_2! For the more populous countries such as Iran and Saudi Arabia, emissions increased consistently over time as emissions-intensive industrial and domestic infrastructure was commissioned. Moreover, highly subsidised energy prices led to wasteful behaviour. Outside the oil producing-countries, Australia exhibits a similar pattern.

Figure 3. Emissions-intensive development



Source: HDI data from UNDP (2007), per capita emissions data from IEA (2007)

Another group that has recently emerged in the emissions-intensive category are the rapidly industrialising countries who build their success on a large manufacturing base. This development approach was pioneered by Korea, whose emissions increased from 2.1 to 9.3 t CO_2 per capita between 1975 and 2005. Korea focused on heavy

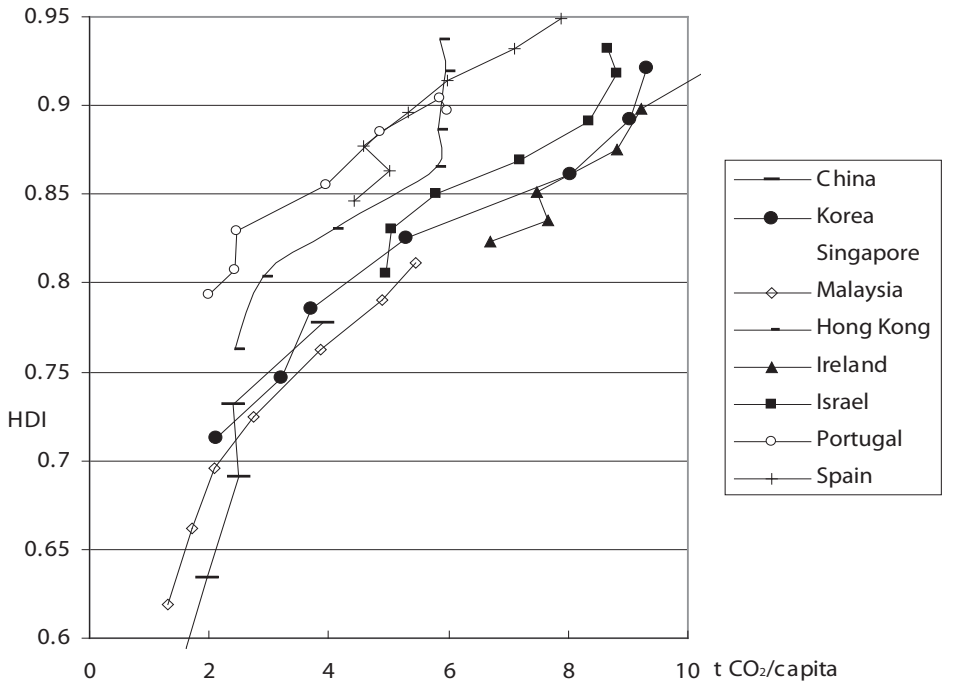
industries such as basic chemicals and shipbuilding. Only recently has it switched to higher value-added productions, and thus emissions growth has slowed. China is now following on the same path as Korea, and it is intriguing to see how Chinese emissions growth has accelerated within the last 5 years. Interestingly, also the European states of Portugal and Spain also follow this pattern: once per capita emissions have reached around 4 t CO_2, they rapidly increase.

Even the city states Singapore and Hong Kong exhibit similar emissions-intensive features: a rapid emissions growth after reaching a HDI level of 0.8, which stops once the HDI approaches the level of 0.9. Probably this emissions growth was linked to the substantial increase in private car and apartment ownership and stopped as policy measures were introduced to rein in utilisation of private cars.

The takeoff of per capita emissions in rapidly industrialising countries

What are the reasons for the spurt of per capita emissions in rapidly industrialising countries which is shown in Figure 4 in more detail?

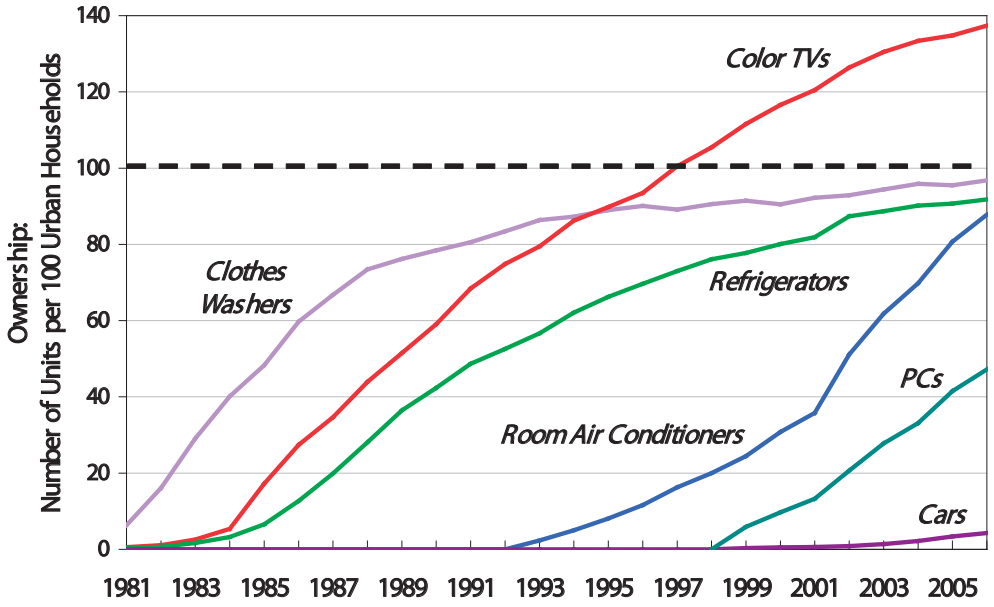
Figure 4. The transition to high per capita emissions for rapidly industrializing countries



Source: HDI data from UNDP (2007), per capita emissions data from IEA (2007)

There are evidently two main reasons. Once industrialisation has reached a certain level and wages begin to increase, there will be a rapid growth of a middle class. Typically, this middle class lives in or moves to cities and quickly adopts energy-intensive lifestyles. This trend is documented by the explosive growth in electricity-consuming household appliances and private cars in China (see Figure 5) and all over South East Asia. In China, all urban households acquired air conditioning within a decade. This occurred during a period in which urban population grew by 150 million people (Allard 2007, p. 3). The same phenomenon is now starting in India, where air conditioner sales grow by 20% per year. Neill and Letschert (2008, p. 7) predict a take-off of air-conditioner sales at around USD 4000 per capita GDP.

Figure 5. Penetration of household goods in urban China



Note: According to current trends, penetration in rural areas starts 10-15 years later.
Source: Fridley et al. (2007, p. 8).

Given the low purchasing power of populations in developing countries, appliance manufacturers try to keep sales prices as low as possible, while not putting any focus on energy efficiency. The average energy efficiency of Chinese air conditioners in 2005 reached just 53% of Japanese air conditioners of the same type (Koizumi 2007). In addition to the direct demand for appliances, the shift to more value added production in industry (see Price 2008), and the growth of cities and the middle class in general, leads to a strong demand for infrastructure improvement. Building up an

Infrastructure	Increase 1990-1995	Increase 1995-2000	Increase 2000-2004
Residential buildings (billion m^2)	1.1	1.3	5.2
Commercial buildings (billion m^2)	0.7	0.6	2
Heated space (billion m^2)	0.4	0.5	1.1
Road surface (km^2)	360	550	1620
Gas pipelines (1000 km)	17.5	14.5	99.6
Wastewater pipes (1000 km)	53	32	77

Table 1: Increases in infrastructural elements in Chinese cities 1995-2004
Source: Allard (2007)

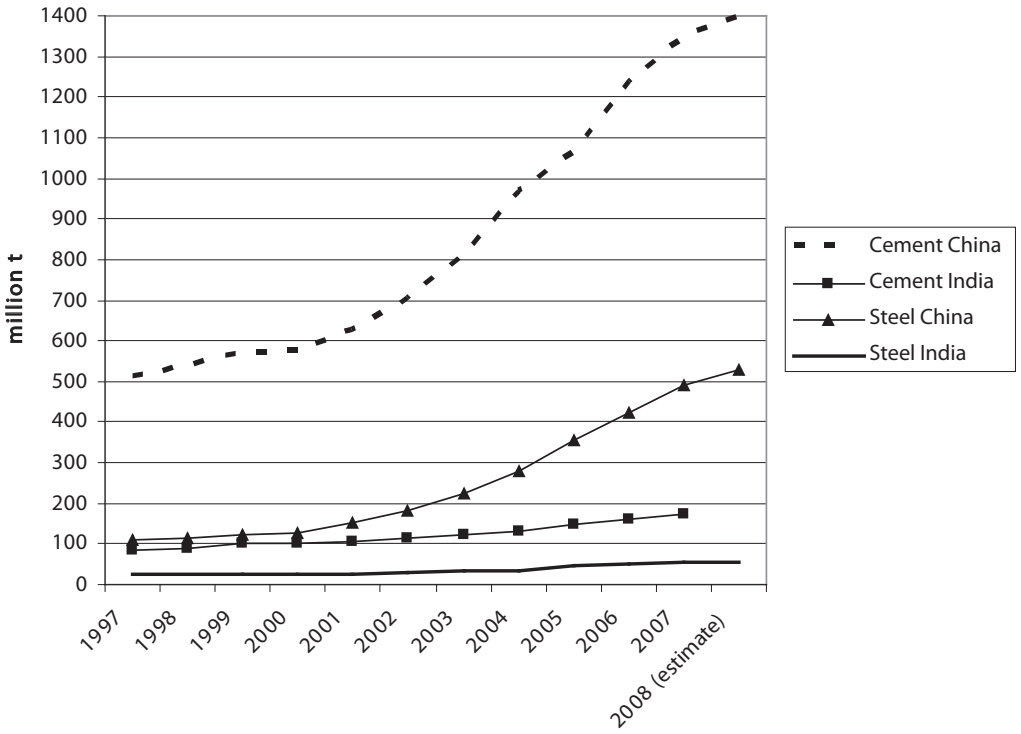
infrastructure is very resource intensive and thus leads to high emissions. The Chinese urbanisation process provides very impressive figures (see Table 1).

Nevertheless, the average floor space by inhabitant in China has only increased from 10 to 14 m^2, so further growth can be expected. Given the frenetic speed of building, the quality of the new buildings is often doubtful and thermal insulation non-existent.

Roads have also been built at a frantic rate in China, making car use attractive. Total length of paved roads increased from 0.69 million km in 1990 to 1.09 million in 2000, and 1.54 million in 2006. Motorway length literally exploded from 500 km in 1990 to 16,300 km in 2000 and 45,300 km in 2006 (National Bureau of Statistics of China 2007). As one can see in Figure 6, private cars have begun their take-off in Chinese cities, where as late as the mid-1990s, twothirds of all trips were made on foot or bicycle. Although urban car ownership averaged only 4% of households in 2005, Beijing had already reached over 10%. In 2007, the number of cars in China grew by 15 million to reach 57 million (Chinese Car Times 2008). This development corroborates research by Chamon et al. (2008) who have found a remarkably stable relationship between GDP per capita and car ownership. Up to per capita incomes of about USD 5000, car ownership is low; it then takes off very rapidly. China is currently nearing this threshold; India is still quite far from it. However, the recent announcement of the Indian car manufacturer, Tata Motors, of their new mini car set at a price of USD 2200 might shift the Indian car take-off threshold to a lower income level.

Production of steel and cement is a necessary requirement for building urban and transport infrastructure. Figure 6 shows the enormous increase in production of those carbon-emissions intensive commodities (see also Zhou et al. 2008). It also shows the difference between China and India, where urbanisation and development of transport have not yet reached the take-off level.

Figure 6. Cement and steel production in China and India 1997-2008



Data sources: Steel: International Iron and Steel Institute (2008), China cement: US Geological Service, Mineral Commodity Summaries, different issues of the journal Cement, India cement: Government of India, Department of Economic Affairs, Economic Division: Monthly Economic Report from certain months of each year.

Policy options to prevent emissions takeoff

What can be done to prevent a take-off phase of emissions on a level similar to that of Korea in the past and China in the present? A cornerstone of a low-emissions path would be an integrated planning policy that prevents haphazard urbanisation and related take-off of car traffic. While not numerous, there are some successful examples of such policies. The Brazilian city of Curitiba was able to keep car use at 25% of comparable cities by developing an urban master-plan that prevented urban sprawl, along with a high-capacity public bus system (Rabinovitch and Leitman 1996). In Tokyo, Seoul, Singapore and Hong Kong, early restraint of car ownership and/or use, which began before car ownership reached 10% of households, provided a time period in which high quality public transport could be built, and in which a public transport-friendly urban infrastructure could develop (Barter and Kenworthy 1997).

Hong Kong has been able to limit per capita emissions to 6 t CO_2 despite a fossil-fuel dominated electricity generation system (see Figure 4). Obviously, such a path requires public transport infrastructures, but these can be relative emissions-extensive as the rapid bus transport system of Curitiba shows.

The second component of a low emissions path would be a far-reaching energy efficiency policy for domestic appliances. Even before appliance penetration starts, appliance efficiency standards should be set at levels comparable to those of industrialised countries. If China had used the Japanese top runner approach for air conditioners and had reached the average efficiency of the Japanese models, over 10 million t CO_2 per year for the 50 million installed units could have been avoided (Koizumi 2007). After achieving an almost 100% penetration of air conditioners, China is improving its air conditioner standards (see Fridley et al. 2007) and manufacturers are marketing their efficient models under the motto "Energy-saving, healthy, and stylish" (He and Wu 2008). A necessary condition for such a path is a high electricity price. At prevailing, subsidised Chinese electricity prices, investment in a higher efficiency air conditioner that costs USD 250 more than low-efficiency models would not make sense (Koizumi 2007). Given the initial low purchasing power of potential appliance buyers, creative financing models such as revolving funds would have to be developed (Taylor et al. 2008).

It should be noted that the window of opportunity for appliance energy standards stands is open for only a short period, because once saturation with appliances has been reached, replacement will take a long time. While for China, the window of opportunity seems to be already closing, in India it should remain open for another decade. Therefore, the future climate policy regime should focus on options that prevent emissions take-off. Given the financing challenges at the beginning of such a take-off phase, industrialised countries will be asked to provide financial and technical support. For example development of energy efficiency standards and a credible enforcement structure could be supported by development cooperation. German technical cooperation supported the Indian government in setting up a Bureau of Energy Efficiency, which is now developing efficiency standards. Currently, these Indian standards are still voluntary, but future cooperation could help with making them mandatory. Development of air conditioner efficiency standards has been done in Ghana with the support of the World Bank. For energy efficiency improvement of consumption goods, a revised version of the Clean Development Mechanism (CDM) could also be a good vehicle to provide the necessary financial flows. The first activity of this type has just started in India, where production of highly efficient refrigerators by the company Godrej will earn CDM credits. It uses a new, substantially simplified methodology for calculation of emission reductions.

One component of a low-emissions path depends on the availability of carbon-

free energy sources. Countries with high hydropower potential are advantaged; in the future countries with a high potential in wind or solar thermal energy might have a similar advantage.

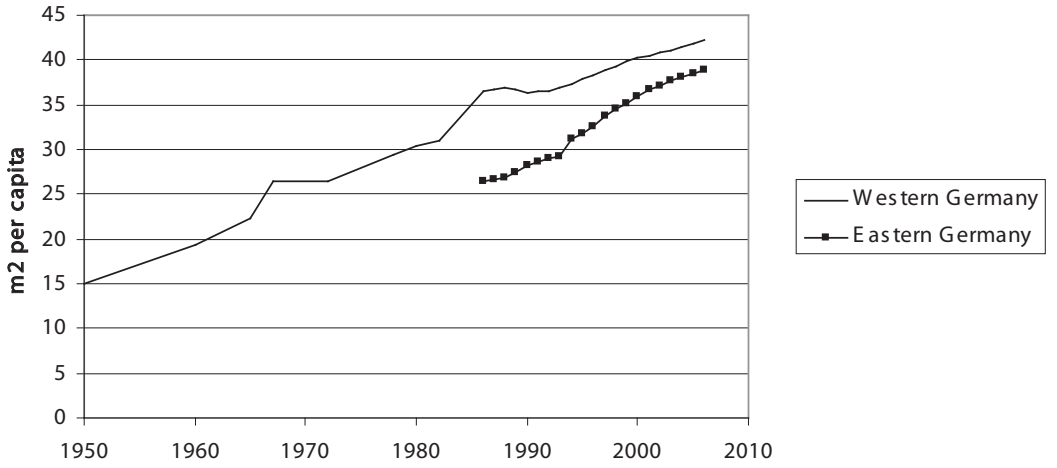
Obviously, countries that are the "workshop of the world" and provide cheap industrial goods will have a high emissions profile. Currently, it is impossible to operate heavy industry at a low carbon emissions level. Zhou et al. (2008) show this nicely in the Chinese case. This means that it is not possible to keep global emissions low if global consumption of industrial goods continues to increase, unless technological breakthroughs for carbon-free industrial production are made.

High human development with low greenhouse gas emissions: A dream or a real possibility?

As our data have shown, it is possible to achieve a medium level of human development at very low per capita emissions levels. A HDI of 0.8 has been reached by a number of countries at per capita emissions levels of 0.5 – 1.5 t CO_2. This however requires refraining from entering into the consumption age and keeping heavy industry at bay. As soon as an urbanised middle class develops, emissions surge. While there are policy options to limit this emissions increase, no country has managed to reach a HDI level above 0.9[2] at an emissions level below 5.5 t CO_2 per capita. This means that world emissions would have to grow by at least 30% if the goal is universal human development of over 0.9. People will always be able to invent new forms of consumption[3] and thus all estimates of future emissions based on current consumption patterns will be too optimistic. However, all available scientific assessments indicate that to avoid a temperature increase of more than 2°C from preindustrial times, global emissions have to peak within the next 10-15 years and then decline in all regions (Gupta et al. 2007, p. 776). There are three possible options for achieving this: we can try to increase demand side energy efficiency, we can decarbonise all energy sources, or we can limit consumption of greenhouse gas intensive goods and services.

The first option has been paid lip service in many countries but it has not been possible to increase energy efficiency sufficiently to embark on a real downward emissions path. At best, energy efficiency has only just been able to keep up with the expansion of consumption. For example, the improvement of car engines was only able to offset the impact of increased engine strength required by consumer demand for heavier, more quickly accelerating cars. Similarly, the improvement of building energy efficiency in many industrialised countries has been eaten up by a strong increase in the per capita dwelling space (see Figure 7 for the case of Germany).

Figure 7: Development of per capita dwelling space in Germany 1950-2006



Data source: German Statistical Yearbook, various issues

Politically, the second option is the most palatable, but an energy system fully based on renewables has not yet been introduced successfully anywhere. The country that has come closest to it is Brazil, with an electricity system built on hydropower and a transport system built on ethanol from sugarcane bagasse. These two factors have allowed Brazil to keep its per capita emissions at less than 2 t CO_2. The recent turmoil on the food markets due to the attempts to increase the share of land devoted to biofuel production clearly shows the limitations of decarbonisation of transport fuels. While having made some inroads in industrialised countries, renewable electricity generation has not achieved cost parity with fossil fuel electricity production; and the storage problem for intermittent electricity sources remains unsolved. Currently, carbon capture and geological storage is seen as the magic bullet for decarbonisation of the electricity sector which would allow the continued use of coal in countries like China and India (Michaelowa 2005). However, its large-scale applicability is doubtful and its costs are likely to be high. Nuclear power is seen by some as a baseload carbon-free electricity source. The huge cost overruns in the recent Finnish reactor development project and the problems witnessed in nuclear power plant operation in Japan, as well as the still unsolved final waste disposal, show the limitations of this technology.

This leaves us with the third and rarely discussed option of limiting consumption (for an exception see Pan 2005, who however only addresses the issue from the angle of determining emissions commitments for developing countries). No politician in industrialised countries and even less in developing countries dares to propose such a

strategy to his voters. Even researchers are obfuscating the issue by framing it in terms of "sustainable consumption" (see e.g. Hobson 2002) or "lifestyle changes". Usually, in assessments of greenhouse gas mitigation potential, neither the availability of new, hitherto unimagined consumer goods or services, nor the limitation of consumption, is taken into account.[4] Eventually the climate challenge will confront us with the need to decide whether limitless travel, instant global communication, or a living space of 100 m^2 per person is acceptable. Pan (2005, p. 92ff) has listed basic needs for a decent level of human development; an in-depth discussion of this concept is required. We will need a "sufficiency revolution" to keep our planet in a climatic range that is manageable.

Conclusions

Reaching a decent level of human development is possible at a low per capita greenhouse gas emissions level, as has been shown by a number of countries. However, development of a typical, industrialised, middle class lifestyle with car-oriented urbanisation and penetration of low energy-efficiency appliances leads to a rapid emissions take-off. Such a take-off has occurred in China in the last decade and is likely to be repeated in India. Policies are urgently required that address urban planning and appliance energy efficiency before the take-off starts. The future climate policy regime and support strategies for rapidly industrialising countries should focus on such policies. Nevertheless, in the long run a limitation of consumption is inevitable to prevent a dangerous level of climate change.

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Endnotes

[1] The HDI measures the average achievements in a country in three basic dimensions of human development: a long and healthy life; access to knowledge; and a decent standard of living. Parameters are life expectancy at birth, adult literacy and combined gross enrolment in primary, secondary and tertiary education, and gross domestic product (GDP) per capita. The HDI scale ranges from 0 to 1. See UNDP (2007, p. 225).

[2] A HDI of 0.9 has been reached by 28 out of 177 countries and typically corresponds to a life expectancy of over 78 years, full adult literacy and full primary and secondary enrolment, as well as GDP per capita over 22,000 $ (PPP, 2005) (UNDP 2007, p. 229-232).

[3] Air travel and 24 hour internet accessibility are just the tip of the iceberg.

[4] The IPCC (2007, p. 16) noted dryly that lifestyle changes were not addressed in its estimate of mitigation potential. Interestingly, IPCC chairman Pachauri raised reduction of consumption in an interview and called for less meat consumption and less car use (see AFP 2008).

Fit for Purpose: Towards a Development Architecture that Can Deliver

Peter Newell

Background

This is a key moment for both the development community and the climate community. There is a growing recognition that the onset of further climate change has the potential to dramatically reverse progress made in alleviating the suffering of the world's poorest people (World Bank Group 2003; Grice 2003). At the same time, today's development paths, promoted by some of the world's most powerful institutions in the areas of trade, aid and finance, continue to fund and encourage activities which accelerate the onset of dangerous climate change (Newell 2008).

It is this central issue which forms the focus of this paper: how to construct a development architecture that is fit for purpose in a carbon constrained world. Clearly, an analysis as brief as this can only highlight problems and float key ideas, rather than elaborate concrete proposals. In doing so, however, I hope to prompt critical and timely engagement with a huge governance gap in the climate regime that needs to be addressed if the Copenhagen Protocol or indeed any international agreement among nations is to make a difference.

Having established the centrality of these issues, I identify key problem areas in the current development architecture before outlining some alternative ideas and concrete propositions.

Climate and poverty

Our collective understanding of the severity of climate change improves with each report on the state of scientific knowledge. The latest Fourth Assessment Report of the IPCC (Intergovernmental Panel on Climate Change) spelt out the gravity of the situation in no uncertain terms. What has become particularly clear is the impact of climate change on the poor. Indeed, a multi-donor report on *Poverty and Climate Change* rightly acknowledges that 'Climate change is a serious risk to poverty reduction and threatens to undo decades of development efforts' (World Bank Group 2003). The development community: donors, regional and multilateral development banks and investors in the developing world have moved centre stage.

This is just as well. Energy is clearly pivotal to development. Yet meeting the development needs of the majority of the world's people in a carbon-constrained world

presents a global challenge of staggering proportions. Today 1.6 billion people are without electricity. Electricity demand in developing countries is projected to increase three to five times over the next 30 years (Davidson et al. 2003) and 57% of future power sector investment will occur in developing countries (UNFCCC 2007). Without a significant change of course, most of this will be fossil-fuel based electricity production that will exacerbate climate change. A recent UN report notes that of the 'substantial shifts in investment patterns' required to mitigate climate change, 'half of these should occur in developing countries, which will require incentives and support for policy formulation and implementation' (UNFCCC 2007: 26).

We encounter a situation in which we have never known so much about our condition and collective fate yet never felt less capable of facing up to the scale of the challenge that we must now address. The scale of economic re-structuring that is required and the challenge the issue poses to conventional ideas of progress and economic growth seem overwhelming. However, this paper attempts to suggest ways in which threats to business as usual and development as usual could be re-positioned as opportunities. It does not under-estimate the power of those whose interests are threatened by actions to address the threat of climate change, but it looks to the possibility of new coalitions of actors in favour of change.

A series of factors suggest that this may be an opportune moment to consider the question of the development architecture in relation to climate change.

(i) *First*, the World Bank is looking to define its role and mission in new ways. Since climate change threatens to undo much of the progress the World Bank seeks to achieve as the world's largest development actor, it is unsurprising that the institution has sought to carve out for itself a leading role in response to the issue, most recently through the launch of the World Bank-administered Climate Investment Funds and the Bank's increasing portfolio of carbon finance funds, amongst a raft of other activities (World Bank 2008). There can be no more timely mandate than steering the world towards a low carbon future with all the development opportunities that might bring. It is argued below, however, that for this to happen the World Bank in particular will have to change fundamentally the way it operates.

(ii) A *second* opening is provided ironically by the economic recession currently enveloping the global economy. Rising fuel and food costs affected by the escalating price of oil provide an opportunity to address energy saving as well as carbon-intensive import dependency. It is estimated that every dollar increase in the price of a barrel of oil results in a 1% rise in average transport costs.[1] The current down-turn in the global economy has focussed attention on the need to guarantee security of energy supply and the desirability of measures which dramatically reduce energy consumption and transport use. In the US, a country embroiled in ongoing conflicts around the world in areas upon which it depends for its fossil fuels, the human cost of oil

import dependency from volatile regions of the world may strengthen the environmental case for reducing use and developing safer renewable supplies closer to home. Many have called for a 'New Green Deal' echoing President Roosevelt's programme to lift the US out of an economic crisis, but this time emphasising an environmental and particularly climate change focus (NEF 2008). *Such measures include creating and training a 'carbon army' of workers* to provide the human resources for a vast environmental reconstruction programme, and *establishing an Oil Legacy Fund*, paid for by a windfall tax on the profits of oil and gas companies as part of a wide-ranging package of financial innovations and incentives to assemble the tens of billions of pounds that need to be invested in transitions to a low carbon economy. The window of opportunity to re-think energy security should also direct attention towards global as well as national reform proposals including an important role for development cooperation as part of a potential climate 'Marshall plan'.

(iii) *Third*, the crisis in world trade talks may provide an opportunity to go for a carbon markets and services agreement aimed at reducing barriers to trade in energy technologies and products that help to reduce GHGs,[2] perhaps cast as a broader 'energy round'. The recent breakdown of the world trade talks (the Doha development round) in many ways results from failure by developed countries to open up their markets to agricultural products from the south and their refusal to relinquish subsidies to their own domestic producers. One way of garnering trust would be to develop an agreement in energy technologies and services that sought to reduce barriers to trade in low-carbon technologies. Such an agreement would allow market leaders like China, Mexico and India, also a country with one of the world's highest levels of poverty despite its new found wealth, to export the latest in renewable technologies. These countries are already among the top 10 exporters of environmental goods relevant to climate change mitigation. This is discussed further below.

A more difficult question is whether the world trade system needs to adapt to the reality of climate change by ensuring that countries do not gain a competitive advantage from forms of production that are hugely carbon or energy intensive. Expressing this concern LeQuesne notes;

> *'current WTO rules provide an inadequate framework for sustainable development precisely because they do undermine governments' ability to legislate in favour of environmental sustainability… current trade rules discourage governments from pursuing a strategy of internalising costs precisely because they prohibit governments from protecting their domestic industry from cheaper competition from countries who have not internalised costs to the same extent' (LeQuesne 1996:73-74).*

Given what was said above about energy pathways in the developing world in particular, this is a hugely sensitive issue. Trade is one way in which policy signals can be

sent, in a coordinated manner through international institutions about what counts as legitimate comparative advantage in a carbon-constrained world. For example, trade negotiators may need to agree on the terms on which countries may employ border-tax adjustments (or Border Carbon Adjustments) as has been proposed by some in the US and EU.[3] These take a range of forms, but essentially serve as a way of deterring carbon leakage whereby investors shift their production to areas of the world not subject to emissions reduction obligations under the Kyoto Protocol or act as a driver for developing countries to accept emissions reductions (Cosbey 2008). The effect of their use would impose higher taxes on products which are produced in a highly energy or carbon-intensive fashion. Fears on the part of export-led developing countries, that the use of such measures may signal the rise of climate protectionism, will need to addressed if such measures are to gain traction. They will also be opposed by powerful sectors most likely to be affected by the measures, such as steel, aluminium, paper, chemicals and cement. In the past, the WTO has maintained a separation between measures aimed at final products as opposed to the process by which they were made where the former, under certain circumstances, was considered compatible with free trade rules and the latter not. The issue of climate change may force us to reconsider these distinctions, but to do so in a way which does not trigger a new round of trade conflict. For such proposals to progress they will need to overcome a range of concerns regarding competitiveness, legal compatibility with WTO rules, administrative feasibility and ultimately, effectiveness (Cosbey 2008).

The current architecture: Problems and limitations

The first thing to note is that we do not really have a development architecture. It is more the case that we have a dispersed, disparate, uncoordinated set of actors pursuing competing agendas. That, in part, is the problem. Neither is there a global regime of energy governance akin to that which we have for trade and in a disaggregated way, for the environment. There are bilateral and regional energy agreements. There is the IEA (International Energy Agency) and the World Energy Council and of course there is OPEC. But until now we have lacked the means of promoting and providing sustainable energy: a body or agreement that sets out a strategy for the international system that seeks to reconcile the at times competing goals of affordable, reliable and sustainable supplies and use of energy. A consortium of European governments is currently developing the world's first International Renewable Energy Agency *(IRENA)*. The agency plans to offer technical, financial, and policy advice for governments worldwide, according to its founders, Germany, Spain, and Denmark (Block 2008). Alongside this there is REN21 which describes itself as 'a global policy network that provides a forum for international leadership on renewable energy. Its goal is to bolster

policy development for the rapid expansion of renewable energies in developing and industrialised economies. Open to a wide variety of dedicated stakeholders, REN21 connects governments, international institutions, non-governmental organisations, industry associations, and other partnerships and initiatives' (REN21 2008).

However, instead of coordinated strategies between global bodies working in relevant areas and across levels of governance from local government up to the global, we find high levels of incoherence. The activities of one set of body systematically undermine those of others. New trade agreements increase the transport of goods over longer distances, adding to the emissions that climate negotiators are struggling to reduce (NEF 2003). Multilateral Development Bank lending supports projects that commit vast amounts of greenhouse gases to the atmosphere. For instance the World Bank supported the USD 4.14 billion coal powered 'Ultra Mega' 4,000 mega watt power plant in Gujarat, India, which will emit more carbon dioxide annually than the nation of Tunisia according to the US Department of Energy (Swan 2008). While the US demands that developing countries commit to emissions reductions as a condition for its own participation in global efforts to reduce greenhouse emissions, it uses its own tax payers' money to support World Bank projects in developing countries which lock them into fossil fuel dependent development pathways.

The problem here is that the climate impacts of World Bank policies, including policies of energy market deregulation, are not factored into their formulation. The Bank concedes 'unregulated electricity markets are likely to put renewable energy technologies at a disadvantage in the short-run because they favour the cheapest energy as determined purely by price, but do not capture environmental and social externalities' (Tellam 2000: 33). One report found that during the past three years, less than 30% of the World Bank's lending to the energy sector has integrated climate considerations into project decision-making. As late as 2007, more than 50% of the World Bank's USD 1.8 billion energy-sector portfolio did not include climate change considerations at all (WRI 2008). In 2006 the World Bank raised its energy sector commitments from USD 2.8 to USD 4.4 billion. The oil and gas sector received a 93% increase in funding, while the power sector (largely transmission, generation and distribution) increased by 130%. In comparison, investment into 'new renewables' increased by only 1.4%. While oil, gas and power sector commitments account for 77% of the total energy sector programme, 'new renewables' account for only 5% (Practical Action 2007).[4]

Addressing the role of the big public actors in development and their role in tackling climate change is just part of the story, however. If we seek to address the problem of climate change through public international law without addressing the blindspots and governance deficits that exist with regard to flows of private investment and finance, then we run the risk of creating 'islands' of formal climate governance in a

sea of un-regulated, un-governed flows of trade and finance unguided by the imperative of addressing climate change. The Clean Development Mechanism created by the Kyoto Protocol oversees only a fraction of the global flows of public and private investment that need to be steered towards the construction of a low carbon economy.

In overall terms then, only a small percentage of trade, aid, production and finance is governed by public bodies charged with tackling climate change. Official Development Assistance (ODA) funds are currently less than 1% of investment globally (UNFCCC 2007). Hence there is a real danger that while we fight over public flows and resources in climate negotiations, the global economy continues on a business as usual trajectory. Of course there is an element here of trying to control those things which we are in a position to control. But we need to extend the governance for clean development to a much broader range of areas. This means going beyond *public governance of public finance*, to the *public governance of private finance* as well as *private governance of private finance*. The first refers to aid money and public expenditure on activities that impact on the climate change. The second refers to mechanisms for overseeing private flows: oversight of what the World Bank's International Finance Corporation is doing or the criteria employed by Export Credit Agencies, for example. The third area refers to the forms of private and self-regulation that have been set up in recent years, whether it is the CDM Gold Standard, the Carbon Disclosure Project or the Voluntary Carbon Standard. What this means in practice is identifying a series of policies, strategies and interventions which are able to steer financial flows, public and private, to where they are most needed, but in ways that are consistent with the goal of reducing greenhouse gas emissions. For those countries most integrated within the global trading system (OECD plus BRICS), an agreement on trade in energy services and the use of energy-intensity indicators may make sense. For others, such as countries in sub-Saharan Africa, less well integrated into the global economy and more aid dependent, important support can be provided by donors to enable clean energy transitions. The World Bank and regional development banks meanwhile can play a key role in screening public and private flows going into countries that are already attractive investment locations, as well as provide inducements that reduce the risk of investors entering new markets in parts of Asia, Africa and Latin America that have not received such flows to date.

This implies the vertical alignment of actors working in this area. Even amongst public bodies working on climate change there are poor levels of coordination, duplication of activities and waste of resources. I discuss this further below. Perhaps most alarming of all is the fact that the governments and leading international institutions charged with serving the public interest on climate change continue to promote a model of economic development that is clearly unsustainable, one that is energy intensive, export-oriented, and produces widespread social and environmental exter-

nalities. Rather than being part of the solution, through their own activities many of these actors are exacerbating the problem.

Outline of an alternative

Calling for a development architecture that is up to the challenge of tackling climate change is not the same as proposing a new institution. Previous such proposals for a World Environment Organisation (WEO) have fallen on deaf ears for reasons of political will, inefficiency, transaction costs and the fact that creating a new institution will not necessarily solve the problem (Newell 2002), even if we do require a new way of doing politics.

The need instead is for greater coherence, coordination, accountability and representation among those institutions we already have. These are political challenges about what and whom the institutions serve, how they function and align their activities with other bodies working in the same area, whose voices and interests shape policy and how they can be held to account for their actions and inactions. Increasingly global bodies will have to justify their role in relation to efforts to tackle climate change. Though it may sound overly drastic to say it, those that fail to should ultimately be disbanded. The gravity of the situation is such that global institutions whose activities actively undermine global efforts to tackle climate change cannot justify their existence. The only way these institutions and actors can retain legitimacy in a carbon-constrained world is to align, in some cases transform, their goals and means of operation towards the goal of facilitating a transition to a low-carbon future. In some cases this may not just be about doing things differently, it may be about doing less of them or not doing them at all.

This is not a demand for more money, therefore. The UNFCCC report on investment and financial flows to address climate change argues that: 'With appropriate policies and/or incentives, a substantial part of the additional investment and financial flows needed could be covered by the currently available sources.' It also suggests, however, that: 'The Carbon market ...would have to be significantly expanded to address needs for additional investment and financial flows' (UNFCCC 2007: Executive summary). My argument is that fewer, targeted and demand-driven interventions may be more effective. If the wealth to be re-distributed by banks and donors derives from unsustainable climate change accelerating activities (from their own or others), it is detrimental to the purpose of tackling climate change. This is one of the problems at the moment: demands for further money for action on climate change, whether mitigation or adaptation, imply enhanced production and consumption of fossil fuels given their current centrality to the way wealth is generated. Proposals for the adaptation fund to be financed through a tax on aviation tie the ability of the poorest to

survive the effects of climate change to increased flying by the world's wealthiest citizens, an act which itself exacerbates the vulnerability of the poor to climate change. In other words, unless generated from funds withdrawn from destructive investments, there is a danger that the process of generating the funds will exacerbate the problem they were intended to address.

These then are just some of the deeply sensitive issues that need to be addressed. They relate to the very sustainability of the way we produce and consume and measure economic growth. The challenges facing such a shift should not be under-estimated given the interests at stake and the vast amounts of money that continue to be made from fossil-fuel dependent growth trajectories. The following section, nevertheless, spells out some near-term modest but concrete steps that could be taken to begin to address these issues.

Next steps

The following are just four areas where important progress could be made. While supportive of the conclusion of a strong agreement at Copenhagen and beyond, it is important to note that such measures can be negotiated and undertaken alongside the climate negotiations and will need to continue long after a deal has been struck.

(i) ***Concrete proposals for an energy round in the WTO*** aimed at addressing energy needs through access to services and technologies that simultaneously seek to meeting the needs of the poor and address climate change. If the WTO is to demonstrate its credibility as an institution responsive to poorer countries and able to promote sustainability, it needs to rise to the challenge of climate change. Indeed the WTO is aware of the issue. It states:

> *'Facilitating access to products and services in this area can help improve energy efficiency, reduce greenhouse gas emissions and have a positive impact on air quality, water, soil and natural resources conservation. A successful outcome of the negotiations on environmental goods and services could deliver a triple-win for WTO members: a win for the environment, a win for trade and a win for development' (WTO 2008).*

Many of the technologies needed to combat climate change involve products that were being negotiated in the Doha negotiations. These include wind and hydropower turbines, solar water heaters, tanks for the production of biogas, and landfill liners for methane collection. A submission by the European Communities and the United States in December 2007 proposed to give priority in the WTO negotiations to climate-friendly goods and to services linked to addressing climate change. These 'climate-friendly products' as the WTO labels them comprise about one-third of the

environmental goods already identified by a group of delegations (WTO 2008). According to the World Bank the removal of tariffs for four basic clean energy technologies (solar, wind, clean coal and efficient lightening) in 18 developing countries with high levels of greenhouse gas emissions would result in trade gains of up to 7%. The removal of both tariffs and non-tariff barriers could boost trade by as much as 13% (World Bank 2007). Many developing countries were initially sceptical about proposals for an agreement on environmental products and services, but amid demands in the climate negotiations for technology transfer as part of the Bali action plan, developing countries could benefit as both recipients and providers of clean energy technologies.

What is missing from this positive statement is the net effect on climate change of trade agreements that increase the distances over which goods are transported, challenges to national regulation which actively discriminates in favour of clean production or intellectual property provisions which prevent the diffusion of key technologies. While recognising the potential for important gains, a net assessment has to be undertaken about policy areas to be enhanced and those to be reformed if we are to achieve a degree of policy coherence (Sampson 2004). We also need to recall that trade liberalization is just one of a range of factors that affect the trade and diffusion of climate mitigation goods, which also include FDI, technical assistance and frameworks of environmental regulation. Investment frameworks and IPR-related costs also determine access to, and affordability of, climate mitigation technologies (IISD 2008). To be successful, such a round would need to ensure the strength of the developmental dimension of this package to avoid a situation whereby:

'The liberalization of climate mitigation goods will bring benefits mainly to developed and a few middle-income developing countries, and may not lead to any environmental benefits in developing countries that lack purchasing power or have other import priorities' (IISD 2008).

(ii) ***Review*** of what roles the ***World Bank*** and other multi-lateral and regional development banks might realistically play in facilitating a shift to a lower carbon economy. This would have to include a holistic assessment of the investment profiles of these institutions to identify areas of incompatibility with climate policy objectives and an openness and commitment to change in light of this. The issues raised above would have to be systematically addressed, including incentives to loan big when, for example, support to micro-energy provision for the rural poor may be more appropriate. It will certainly imply a phased end to support for large-scale fossil fuel development. Long-standing commitments to privatisation and the removal of subsidies where these may be supporting renewable energy access for the poor may have to be revised.

(iii) ***Mapping of the climate change work of bilateral donors*** towards identifying synergies, reducing overlaps, building on strengths and identifying sustainable forms

of financing (generated by economic activities compatible with climate policy goals). As more funds from governments, foundations and the private sector become available for work on climate change, there is a 'honey pot effect' where actors gravitate towards new sources of funding on an issue where they sometimes do not have a track record or the capability to deliver effective action. The assessment being proposed here needs to be able to answer the question: which actors are best placed to address which aspect of the climate change problem. Moving from a crowded and competitive market to a division of labour which allows each actor to do what they do best is critical. Providing a consolidated assessment of who is doing what, and how effectively is an important first step in that direction. The United Nations Environment Programme may be the appropriate body to take a lead in undertaking such an assessment in the first instance.

(iv) Given that 86% of global investment and financial flows in this area come from the private sector (UNFCCC 2007), an ***assessment*** of which ***incentives*** and ***disincentives*** are necessary to get ***businesses*** of different sizes, sectors and from different regions fully engaged in a transition to a lower carbon future, would be invaluable. Similar such studies and guides have been produced for specific areas of private finance, exploring leverage points for generating change (Ganzi et al 1998). This would build on existing practice and look forward to what forms of support, regulation and screening may be required to engineer this shift. It is clearly critical to get business on board in efforts to tackle climate change. But businesses need clear signals. Different elements of the business community respond to different incentives over different time-frames, so a broad suite of measures will be needed to target specific areas of the private sector for reform. These might include a combination of taxes (pollution taxes and tax breaks), subsidies, codes of conduct, guidelines, certification schemes and of course private and state-based regulation. Voluntary efforts and market based instruments need rules, procedures and sanctions to be effective, however, despite frequent claims to the contrary. It has to be made absolutely clear that only those firms that have business models consistent with enabling a transition to a low carbon future have a long term future. For some, the transition away from business models incompatible with this will be longer than others and will require substantial government assistance to help with upgrading and re-training of employers and employees. But it has to happen in all cases and, therefore, the sooner the transition takes place, painful as it may be, the easier it will be to manage the adjustment in socially and economically acceptable ways.

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Endnotes

[1] Rubin and Tal (2008) calculate that the impact of USD150/barrel of oil would be the equivalent of reversing all the tariff liberalisation accomplished by the WTO and GATT since the 1970s. Cited in Cosbey this volume.

[2] Indeed the World Bank (2007) has proposed the accelerated liberalisation of products, technologies and services used in CDM projects aimed at reducing equipment and transaction costs.

[3] For example in the Warner-Lieberman bill in the US and, initially by the EC mandated High Level Group on Competitiveness, Energy and Environmental Policies, although in its second report the BCA proposal was dropped. Some proposals would require importers to purchase offsets in a domestic cap and trade scheme at the point of import.

[4] According to the World Bank, 'new renewable energy' applies to energy from biomass, solar, wind, geothermal, small hydro (under 10MW).

Fair Wealth: Pathways into Post-Development

Wolfgang Sachs

The rise of Europe to world dominance in the 19th century has excited the curiosity of historians for a long time. Why was Europe able to leap ahead of the rest of the world? A variety of answers has been offered by several generations of researchers. Europe was thought to have benefitted from its rational spirit, its liberal institutions, or its temperate climate. A few years ago, however, Kenneth Pomeranz of the University of California at Los Angeles advanced an "environmental" hypothesis (Pomeranz 2000). Putting the question more specifically, he wondered how England had succeeded in moving ahead of China, notwithstanding the fact that China had been on a level of development comparable to England as recently as around 1750. According to Pomeranz, at the end of the 18th century both the Yangtze Delta and England were constrained in their economic development by the scarcity of land available to grow food, supply fuel, and provide raw materials. But it was only England that succeeded in overcoming this limit. England was able to tap into new stocks of resources; it began to massively import agricultural goods from North America, and, above all, set out to systematically utilize coal for industrial processes. Only as foreign land replaced domestic land and carbon substituted for wood, were the natural resources constraints left behind and the English economy was able to take off. In contrast, China neither developed colonies overseas nor mobilised coal reserves in distant Manchuria. Put more generally, access to fossil resources from the crust of the Earth and to biotic resources from colonies was essential to the rise of the Euro-Atlantic civilization. Industrial society would not exist in today's form, had not resources been mobilised from both the depth of geological time and the expanse of geographical space.

The development dilemma

In hindsight, Europe's development path turns out to be a special case; it cannot be repeated everywhere and any time: the wealth of fossil and renewable raw materials at Europe's disposal in the 19th and 20th centuries is no longer available. The use of fossil resources, apart from gradually depleting supplies, is destabilising the Earth's climate, just as is the use of the biotic reserves of the planet that are still left. Resources, now and in the foreseeable future, are neither easily accessible nor cheaply available. Climate chaos as well as the Peak Oil phenomenon suggest that the past 200 years of Euro-Atlantic development will remain a parenthesis in world history.

Yet the end of conventional development has thrown the world into a tragic dilemma since fossil-driven development cannot simply be called off: it has already spread worldwide in both structures and minds. Obviously, urban life is underpinned almost everywhere by fossil-based systems of energy, transport, and food production. But more importantly, the meme of fossil-driven development has colonised the minds of people across the globe, even the minds of those who live in slums, villages or forests and are excluded from enjoying the fruits of economic progress. Partly through imposition, partly through attraction, the Euro-Atlantic development model has shaped Southern desires, offering tangible examples not only of a different, but of a supposedly better life. Countries in general do not aspire to become more "Indian", more "Brazilian" or for that matter more "Islamic"; instead, assertions to the contrary notwithstanding, they long to achieve industrial modernity. More often than not the idea prevails that shopping malls and steelmills, freeways and factory farms indicate the path to a successful society. Despite decolonisation in the political sense, which has led to independent states, and despite decolonisation in the economic sense, which has made some countries into economic powers, a decolonisation of the imagination did not occur. On the contrary, worldwide hopes for the future are fixed on Euro-Atlantic patterns of production and consumption. It is the tragedy of the 21st century that the imagination of the world is shaped by the Euro-Atlantic civilisation, yet the means for everyone in the world to live in such a civilisation are ever less available.

China provides the most visible example of where the world stands in the scramble for colonies and carbon today. No doubt, the rise of China is a success story in terms of conventional development. It has not only continuously achieved high growth rates, but also dramatically reduced the share of poor people earning less than one dollar a day, from 33% of the population in 1990 to 10% in 2006. Yet, what is a success for China is a failure for the planet. In absolute terms, China has become the world's second largest emitter of carbon dioxide after the United States, as well as the second largest importer of oil. Even more marked than the pressure Chinese economic growth has put on global resources has been the stress on local habitats: cities sick from polluted air, shrinking areas of cultivated land and dwindling water stocks are the emergency signs of a gathering environmental crisis. The annual economic costs of environmental damage as a result of economic growth were estimated in the 1990s between 8% and13% of China's domestic product (Smil/Mao 1998): this means that the losses were higher than the growth-rate of the national economy! Furthermore, China is increasingly a burden on the rest of the world: it can be compared to a vacuum cleaner sucking up resources around the globe, be it copper from Chile, soya from Brazil or oil from West Africa. To be sure, China stands out because of the size of its population, but similar tendencies are at work in Brazil, India, Malaysia, Mexico, Indonesia and other 'take off' countries. With conventional development, the exit

from poverty and powerlessness leads straight into overuse and overexploitation. A higher income beckons, but in reality these riches just represent a greater share in the environmental robber-baron economy.

Indeed, it is difficult to see how, for instance, the automobile society, high-rise housing, chemical agriculture, or a meat-based food system could be spread across the globe. The resources required for democratising these models of wealth globally would be too vast, too expensive, and too damaging for local ecosystems and the biosphere. Since the Euro-Atlantic model of wealth has grown under historically exceptional conditions, it cannot be transferred to the world at large. In other words, the model is structurally incapable of social justice. Development, therefore, is at a crossroads. Either well-being remains confined to a global minority because the prevailing styles of production and consumption cannot be generalised across the board, or sustainable models of well-being gain acceptance, opening the opportunity of sufficient prosperity for all. Since industrial affluence and global equity cannot be attained at the same time, politics in both North and South faces a crucial challenge. Countries can either opt for affluence along with oligarchy or for sufficiency with a view to equity. Production and consumption patterns will not be capable of justice unless they are resource-light and compatible with living systems. For that reason, there will be no equity without ecology in the 21th century (Sachs/Santarius 2007).

Contraction and convergence

In order to picture which development paths might bring the world to a greater level of resource justice, it may be useful to employ the model of 'contraction and convergence' (Meyer 2000). This model schematically envisages two different development paths: one for industrial countries, one for developing countries. All nations of the world would adjust their use of resources so that in half a century from now they no longer overstretch the absorption and regeneration capacity of the biosphere. The model assumes no nation has the right to a disproportionate share of the global environment, so each one endeavours – though with individual variations – to achieve the common goal of material and energy consumption compatible with the demands of other countries, while remaining within the carrying capacity of the biosphere. In the end, there is no justification for any other distribution of globally important resources; the right of all nations to self-defined, self-determined and equal development permits it only to make claims that are socially and ecologically sustainable at a global level. This is what the contraction and convergence argument inspired by Kant comes down to: institutional patterns of resource consumption should be considered unjust if they rest upon rules which cannot in principle be adopted by all other nations.

Consequently, the model requires that the industrial countries contract – that is, that they reduce their consumption of resources drastically. Resource justice in the world crucially depends on whether the industrial countries are capable of retreating from overconsumption of the global environment. The example of greenhouses gases may serve to illustrate the path of shrinking resource consumption. By the middle of the century, the overconsumers must reduce by 80% to 90% the strain they put on the atmosphere by burning fossil fuels, in order to do justice to the precepts of both ecology and fairness. It goes without saying that this figure refers to the global North, i.e. the consumer class in the countries of the South is placed under the same responsibility. On the other hand, developing countries appear in the model as tracing an upward curve in resource consumption. First, poorer countries have an unquestionable right to attain at least a 'dignity line' of resource consumption which should apply to all citizens of the world. Without access to kerosene or biogas, without an energy and transport infrastructure, it is hard to satisfy even the basic needs of modern human life. Moreover, each country will try to achieve different images and forms of a prosperous society – an ambition that in turn requires access to resources such as energy, materials and land. However, this upward movement ends at an upper line of ecological sustainability for all; natural limits set the framework for justice. As it happens, a number of emerging economies are already about to hit that limit in the coming decade. The conceptual model of 'contraction and convergence' thus combines ecology and justice. It begins with the insight that environmental space is finite, and it ends with a fair sharing of the environment by the citizens of the world.

The triad of efficiency, consistency and sufficiency

How can the transition to a low-carbon and resource-saving economy be achieved? Over the last thirty years, a host of engineers, managers, activists, thinkers and scientists have been busily investigating the challenges of such a transition. What can be extracted from all their endeavours adds up to a conceptual triad: efficiency, consistency and sufficiency.

First, with regard to efficient resource consumption, the idea is to reduce the use of materials and energy per unit of goods and services, through improved technology and organisation, recycling and waste avoidance. There are numerous examples: washing-machines that save on water and electricity, lightweight motor vehicles, frequency-controlled industrial motors, high-efficiency power stations, recyclable products such as newspapers or chairs. Resource-efficient initiatives concentrate on the design of products for greater durability and repeated use, on the reduction of energy and material flows in the production process, and on corporate strategies to promote the extended use of products over numbers of physical sales (Weizsäcker/Lovins/Lovins

1997; Hawken/Lovins/Lovins 1999). In particular, there is considerable potential to raise the efficiency of energy use, as there is hidden scope at every level of the chain from production to consumption. Whereas for more than a century utilities have seen their profits as existing in expanding supply, today, under an 'efficiency strategy', they are expected to be as successful at avoiding waste. Instead of responding to ever increasing demand, they will have to learn to keep it flat. This change of perspective implies that the rational conversion and use of energy will take priority over its production.

But the efficiency strategy has an Achilles heel: it may score major successes in cutting the use of resources per unit of output, but it does not prevent greater overall consumption. The sum total of all resource and energy savings may be eaten up and even exceeded by global growth in demand for goods and services. In fact, that is what has been happening. And so, although the efficiency strategy has the greatest potential as the first step on the road to sustainability, it reaches its limits as soon as the increased production of goods combined with increased consumption of resources outweighs the total savings.

With regard to consistency, the key question is the compatibility of technology with the environment. The principle is that industrial metabolic processes must not disturb natural cycles; the two should as far as possible complement or even reinforce each other. Where this is not possible, substances damaging to the environment should be placed in a fail-safe technical circuit of their own or – if that is not successful – taken out of service altogether (Braungart/McDonough 2002). An economy can be organised in such a way that – except for the inevitable entropy – the waste from one activity is used as raw material for the next (Pauli 1999). In this organisation, it is less important to reduce energy consumptions and material flows than to manage them in an ecologically sound manner. This is precisely the charm of renewable energies: solar collectors and solar cells for the production of heat and current directly use the sun's rays; wind and water power are indirectly derived from solar energy; heat pumps draw on heat from the surrounding air, water and soil; and geothermic power stations use the energy stored in the earth. Even solar-generated hydrogen might one day make it possible to have an energy supply that does not damage the atmosphere. There is a similar potential in bionics, a technology which takes nature as a model to be imitated.

The consistency strategy is not a panacea, either. Agrofuels, for example, may not pollute the atmosphere, but they require arable land that is available only to a limited degree. Indeed, for all biomass applications, it is land which turns out to be the ultimate scarce resource. Furthermore, not all waste can become raw material for new products. There are some natural substances such as carbon dioxide or liquid manure which, in large quantities, cause ecological problems.

Sufficiency, on the other hand, raises the question of how much is enough, what is good for the economy and patterns of life. The etymology gives us a clue: the Latin *sufficere*, derived from *sub* and *facere*, means in its transitive use 'laying the ground', and in its intransitive use 'to be disposable, to be enough, to be able or capable'. The point of sufficiency, then, is not to fall victim to excess and overstretching, but to take only as much as is beneficial for the well-being of individuals and the whole. Whereas, to borrow from Paul Hawken, efficiency requires us to do things right, sufficiency calls for the right things to be done. It is doubtful whether the expectations raised in the age of resource abundance can be sustained in the age of resource saving. Strawberries in winter, four by fours in city traffic, hot water on tap day and night: such comforts add little but cost a great deal. A resource-light economy would therefore be better advised to adjust itself to an intermediate level of performance. For instance, if the target for a country like Germany is to use 50% less primary energy by the year 2050, efficiency and sufficiency will have to work together. Quantitative limits on the use of fossil fuels, as envisaged in the European emission trading system, will be defined for purposes of putting a cap on the use of vital resource stocks. Likewise, in transport, the avoidance of travel is part of a sufficiency strategy. Transport-saving urban planning cuts down on the need for moving around, walking and cycling can again gain ground, and initiatives such as car sharing (with the slogan 'access instead of ownership') offer the opportunity to downgrade the private transport option, to save costs, but to keep access to a car for special situations.

At any rate, the question 'How much is enough?' cannot be avoided (Sachs 1998, Segal 1999, Linz 2004). Since it is necessary to change behaviour and the way people relate to goods and services, eco-sufficiency is closely connected with what has been known since antiquity as the 'due measure', the good life, the art of living. And it may well be that the reasons for eco-sufficiency also stem from that wise ancient maxim: 'Nothing in excess'. The transition to a sustainable economy, therefore, moves on two tracks: the reinvention of means as well as the moderation of ends.

Ecological leapfrogging

Two main obstacles stand in the way of greater environmental justice in the world: the resource-intensive models of prosperity in the North, and the drive in the global South to copy those models. Skyscrapers in Shanghai, motorways in India, shopping malls in Morocco: historically outmoded types of construction, technology and marketing are spreading around the globe. Yet they embody the hope of escaping from poverty and powerlessness. It is precisely the challenge of sustainable development to achieve greater international equity without endangering the biosphere.

Such forms of development will aim both to ensure a livelihood for all citizens

and to maintain and renew the country's resource base. However, the historical pattern of scarcity, which has shaped economic development so far, is today outdated. While in the old days the world appeared full of nature, but empty of people, today the world is empty of nature, but full of people. The satisfaction of needs and wants is not constrained so much by the paucity of hands and brains, but by the scarcity of resources and ecosystems. Nature is now more of a limiting factor than money, given that development is more and more restricted not by the number of fishing boats, but by the decreasing numbers of fish; not by the power of pumps, but by the depletion of aquifers; not by the number of chainsaws but by the disappearance of primary forests (Daly 1996). In particular for Southern countries, the relevant question will be: How can both the abundance of people and the scarcity of natural resources be addressed by making the right choices?

The answer is to move out of an industrial economy wasteful of both natural resources and people, and head for a regenerative economy mindful of resources and in need of people. An economy that is based on the assumption that there are "free goods" in the world – pure water, clean air, hydrocarbon combustion, virgin forests, veins of minerals – will favour large-scale, energy and material intensive production methods; and labour will remain marginalised. In contrast, if an economy discourages profligate resource use and privileges non-fossil resources, a decentralised and smaller-scale production pattern requiring more labour and intelligence is likely to prosper. Rather than laying off people, greater gains can come from laying off wasted kilowatt-hours, barrels of oil, and pulp from old-growth forests. People will in part have to be a substitute for natural resources; such an economy, evolving with a minimum input from the natural environment, will have to rely much more on the strength, the skill, and the knowledge of people. Indeed, it will be post-industrial in the true sense of the word: finding new balances between hardware, biological productivity, and human intelligence.

This is even more true when it comes to changing the resource base altogether, from fossil-based to solar-based energies and materials. Apart from the obvious environmental benefits, the point here is that fossil resources usually imply long supply chains that make countries dependent on distant energy sources. Most countries and cities, finding themselves at the downstream end of the chain, are strangled by the high cost of fuel and resources imported from abroad. They pay, but most gains and jobs arise elsewhere. However, a change in resource base would turn this logic around (Scheer 1999). Reliance on photo-voltaic, wind, small hydropower, and bio-mass of all sorts, implies much shorter supply chains, not just for the energy resource, but often also for the conversion technology involved. As a result, income and jobs would largely stay at the local/regional level, recycling money within local economies. Furthermore, since sunshine and bio-mass are geographically diffused, they lend themselves to decentral-

ised structures of production and use, unlike fossil resources that are concentrated in a few places and give rise to centralised large-scale structures. The industrial pattern of squandering nature instead of cherishing people would be reversed; a solar economy holds the prospect of both encompassing people and saving resources.

Indeed, Southern countries have the opportunity to leapfrog into a solar economy, much earlier and much more solidly than Northern economies. In fact, it would be self-defeating for them, both in terms of livelihoods and in terms of the environment, to go through the same stages of industrial evolution that the Northern countries did. For instance, Southern countries face important decisions about introducing infrastructures such as energy, transport, sewage, and communication systems, the introduction and maintenance of which in industrial countries have caused the earth's resources to dwindle. Today, many countries are still in a position to avoid this unsustainable course, opting without further delay for infrastructures which would allow them to embark on a low emission and resource-light trajectory. This is equally the case for transition countries, where it is often preferable to build new infrastructure systems rather than to upgrade aging ones. Investment in infrastructure such as light rail systems, decentralised energy production, public transport, grey-water sewage, locally adapted housing, regionalised food systems, and transport-light urban settings, could set a country on a road towards cleaner, less costly, and more equitable production and consumption patterns. Consider the following three examples.

Decentralised electricity generation. In industrial countries, electrical energy is overwhelmingly supplied direct from high-output power stations along high-voltage networks, to the centres of consumption. The power flow is thus essentially vertical. In a mainly decentralised supply system, by contrast, a considerable part of the current is generated in small, modular output units, whose priority is to supply a large number of small consumers. Power generation becomes a local economic activity, and energy consumers increasingly become energy producers. Indeed, from the point of view of an Indonesian farmer, it would be real leapfrogging to have an energy-efficient cooker, a solar pump or a biogas system: all these technologies make living easier and spare the natural environment, and their sources – sunshine and biomass – are accessible everywhere.

Mobility without car dependence. A country with a low degree of motorisation faces an alternative: either it can promote a system based on high motorisation for a minority, or it can opt for a moderate motorisation favouring as many people as possible. Many countries strive to reach Northern levels of car ownership, but these are unattainable because the ecological as well as the social and economic costs will prove too high. At some point things will get stuck: either the fuel imports will become unaffordable or the land for roads will run out or the weaker sections of society will not have sufficient purchasing power. A sustainable strategy will therefore opt for a

different structure of transport growth, concentrating on where it will bring the greatest advantage to society. This means, for example, extending roads to remote areas so that teachers and doctors can reach people, and farm produce can be supplied to local markets, instead of building motorways and ring roads demanded by the car-owning upper classes. First walk, then bike, then ride, this ought to be the order of priority for transport planning in developing countries – and elsewhere.

Regenerative agriculture. Industrial agriculture – in both North and South – has manoeuvred itself into an ecological and social dead end. It results in soil erosion and declining fertility, in the pollution of groundwater, lakes and seas, and in a decrease in agro-biodiversity that is only worsened by the introduction of genetically engineered plants and animals. Methods of regenerative agriculture involve the following essential principles: simultaneous growing of several crops alongside one another in a single field (e.g., mixed and intercropping), so as to offer a habitat for natural enemies of pests and to stimulate the biotic activity of the soil; crop rotation to regenerate the fertility of the soil and to break the life cycles of pests; mixed use of land for agriculture and forest; and, finally, the integration of agriculture, animal farming and, where possible, fishing, to obtain sufficient biomass and to return both organic and natural nutrients to the cycles of matter (Altieri 2004). Regenerative agriculture is therefore more cost-efficient than industrial agriculture, especially in lowwage regions: labour-intensive units operating on relatively small plots of land permit considerable savings in comparison with outside methods involving machinery, mineral fertilizer and pesticides. Since the ecosystem survives intact and species diversity is preserved, poor people in particular can continue to practise hunting and gathering as sources of food and income. Moreover, in a oil-short world, labour-intensive and energy-saving production would enable a reversal of the role played by agriculture in the economy. It could become a branch of the future, as a central source of energy supply. The countries of the South have a historic opportunity to become the spearhead of this development and to make their farmers the 'oil sheikhs' of the twenty-first century.

Decoupling justice from development

For a long time it has been a core political certainty that justice is created through growth, both nationally and internationally. After the Second World War, coupling the pursuit of justice to the idea of economic growth has became the conceptual cornerstone of the development age. In the last few decades, however, since the finite nature of the biosphere became evident, this cornerstone has been on shaky ground: in a limited environmental space, conventional growth can no longer create justice – except at the price of a ruined biosphere.

In the development age, justice was understood as a greater share for more and more people in a growing world economy. The social contract between North and South envisaged that growth and social policy would start a process whereby the disadvantaged countries and peoples would be able to 'catch up' with the rich nations. This was the tacit assumption behind the United Nations system and bilateral development cooperation. This assumption has acquired proverbial status in the metaphor of 'a rising tide' that will 'lift all boats' (not only luxury liners but also little sloops), a metaphor which presides over so many development efforts: the forces of growth will raise the income of rich and poor alike.

Comfortably enough, linking justice to growth allowed the developed world to evade the hard issue of distribution, delegating justice to future growth. Indeed, for decades development experts defined equity primarily as a problem of the poor. They highlighted the lack of income, the lack of technologies, and the lack of market access, and advocated remedies for raising the living standard of the poor. In short, they worked at lifting the threshold – rather than modifying or even lowering the ceiling. With the emergence of bio-physical constraints to economic growth, however, this approach has turned out to be definitely one-sided; it is not just the poor, but also the rich, and their economy as well that have to be called into question. At any rate, the quest for fairness in a finite world means changing the rich in the first place, not the poor. Poverty alleviation, in other words, cannot be separated from wealth alleviation.

It was in October 1926 that Mohandas Gandhi already sensed the impasse of development. In one of his columns for *Young India*, the mouthpiece of the Indian independence movement, he wrote: "God forbid that India should ever take to industrialisation after the manner of the West. The economic imperialism of a single tiny island kingdom (England) is today keeping the world in chains. If an entire nation of 300 million took to similar economic exploitation, it would strip the world bare like locusts." Nearly eighty years later this statement has lost none of its relevance. Indeed, its importance has increased, since today there are no longer 300 million but 1,000 million setting out to imitate Britain. Gandhi suspected that it would not be possible to restore India's dignity, and still less China's or Indonesia's, at the economic level of Britain. The bio-physical limits to the spread of industrial civilisation have impressively confirmed Gandhi's intuition.

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By now it is evident that the impacts of climate change have become a major threat to efforts to eradicate poverty and achieve the Millennium Development Goals. In order to lead to sustainable outcomes, all development actions must take this emerging factor into account. Moreover, it is important to try to look critically at the long-term vision behind development efforts and the strategies applied in building "a better world". New ways and means have to be found through which people in all countries can lead a life worthy of human dignity, in a way that is compatible with the constraints set by nature.

This book brings forward some challenges arising from the prevailing development paradigms in the context of climate change. What are the future prospects of reducing poverty by means of international trade? Can we develop the agricultural sector to deal with reducing crops in areas already suffering from hunger? Can we reconcile the increasing needs for energy with efforts at mitigating climate change? Could high levels of human development be reached at low levels of per capita emissions? What are the keys for choosing a certain development pathway? Can we shift the focus from growth to distribution and more equity in a global scale?

The authors, with background in academic institutions, UN organisations and NGOs, provide inputs both into the process leading to the Copenhagen Climate Conference, and for practical development work. For climate change negotiators and experts, the articles can help by setting policies in a wider context, with a view to finding practicable win-win-win solutions. For the benefit of the development community, they elaborate underlying interlinkages and present practical aspects for day-to-day work.

ELEMENTS for DISCUSSION

Development Communication
PO BOX 456
FI-00023 GOVERNMENT
FINLAND
Telephone: +358 9 1605 6370
Telefax: +358 9 1605 6375

internet: http://formin.finland.fi
E-mail:keoinfo@formin.fi

FORMIN.FINLAND.FI

MINISTRY FOR FOREIGN
AFFAIRS OF FINLAND