Adaptation to Climate Change

Setting the Agenda for Development Policy and Research

A Symposium hosted by the
Tyndall Centre for Climate Change Research and the
International Institute for Environment and Development

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Editors:
Neil Adger, Saleemul Huq and Simon Torok

Tyndall Centre Symposium Synopsis 2

Note: The conclusions of this workshop are discussed in the paper:
Adger, N. W., Huq, S., Brown, K., Conway, D. and Hulme, M. (2002). Adaptation to climate change in the developing world. *Progress in Development Studies* (accepted June 2002).

Introduction

Dr Neil Adger, Tyndall Centre and CSERGE, University of East Anglia

The Tyndall Centre for Climate Change Research is a national consortium for rtans-disciplinary climate change research, dedicated to the identification, evaluation and promotion of sustainable responses to the challenge of climate change. The Centre's headquarters are at the University of East Anglia's School of Environmental Sciences, with regional offices at UMIST, the University of Southampton and Southampton Oceanography Centre. Six other UK universities and research institutes complete the Tyndall Consortium. The Centre is funded by three Research Councils representing the natural environment (NERC), economic and social research (ESRC), and engineering and physical sciences (EPSRC), with additional support from the Department of Trade and Industry. The Tyndall Centre builds on the extensive experience of agenda-setting research by its founding members. This research has included the development and application of regional and national climate scenarios for vulnerability and adaptation assessments and development of appropriate policy-relevant indicators of adaptive capacity for development strategy purposes. The Tyndall Centre has a specific remit to understand adaptation to climate change focussing on enhancing the options for adaptation and promoting sustainable adaptive capacity. Much of this work is focussed in areas of the world apparently most vulnerable to the impacts of future climate change.

The International Institute for Environment and Development (IIED) was established as a charitable company in 1971 and has since been a major actor in developing the environment and development agenda globally. It played a significant role in the Brundtland Commission and later in the build up of the Earth Summit in 1992. It has major programmes in dry lands, urban environment, environmental economics, forestry, agriculture, water and, since 2001, climate change. The climate change programme at IIED, although newly established, has carried out significant activities including holding regional workshops in Africa and South Asia with partners in the region on adaptation to climate change and sustainable development for the most vulnerable countries in Africa and South Asia.

Together, the Tyndall Centre and the IIED are hosting this meeting to bring together practitioners and agencies from the development community. The aims are to explore the implications of the latest assessments of climate change impacts and potential for adaptation, and to facilitate engagement of the UK development community with the social and natural science community for agenda and priority setting in the area of climate change adaptation.

The broad questions the workshop aims to explore are:

- What is the potential for adaptation to climate change?
- What research needs to be done to support such adaptation?
- What does this mean for development policy, both internationally and locally?

Specifically, the workshop aims to answer research *and* policy questions for development strategies:

- Who is currently vulnerable to climate change?
- How can we enhance adaptive capacity, especially in developing countries and recognising that communities have always adapted to decadal climatic variability?

- How do we account for in-built resilience?
- How important is climate change compared to other manifestations of globalisation, such as large scale demographic changes?

These are key questions for relations between North and South, and for deciding how to respond to climate change.

The conclusions of the workshop are further discussed in the paper:
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Session 1: Emerging perspectives from the IPCC

Chair: Professor John Lawton, NERC

Climate change and extreme weather events: what do we know?

Dr Mike Hulme, Tyndall Centre for Climate Change Research

Climate change is likely to accelerate in the decades to come. All aspects of regional weather, climate and sea level will be altered by climate change. There are risks associated with these changes (a task for science to elaborate on) and there are strategies to minimise such risks (a task for policy to implement). These elements of the problem of climate change are neither accurately quantifiable (scientific uncertainty will remain) nor easily achievable (negotiations over policy will be complex).

Evidence for global warming over the past 100 years is now overwhelming. Instrumental climate data show a global warming at the surface of about 0.6 degrees Celsius since 1856, with six of the warmest years occurring in the last decade. Warming over the oceans has been somewhat less than this global average (though still significant) and tropical sea surface temperatures have risen over the past 50 years. In 1998 sea temperatures in the tropics reached record highs during an El Nino. Evidence for the most recent warming is seen not only in climate observations but also in physical and biological indicators, including rising sea level, retreating glaciers and, in mid-latitudes, longer growing seasons. There are also examples of changes being detected in the frequency and severity of extreme weather events. The science community and many policy makers are increasingly confident that many of the patterns associated with this warming reveal the fingerprint of human causation, among other climate controls such as fluctuations in the Sun's output.

Future average global warming in a carbon intensive world, i.e. one where we continue along our current path, is reported by the Intergovernmental Panel on Climate Change (IPCC) to be in the region of between approximately 3 and 6 degrees Celsius. This provides grounds for concern. With average global warming of this magnitude risks would be high to many unique and threatened species; there would be large increases in risk associated with extreme climate events; impacts of climate change would be negative for many regions; and there would be an emerging risk from future large-scale discontinuities.

These risks are reduced in a decarbonised world, where average global warming is confined to between approximately 1.5 and 2.5 degrees Celsius. The risks are further reduced if adaptation strategies are implemented. Past and future warming rates for selected countries for unmitigated and mitigated carbon emissions are shown in Figure 1.

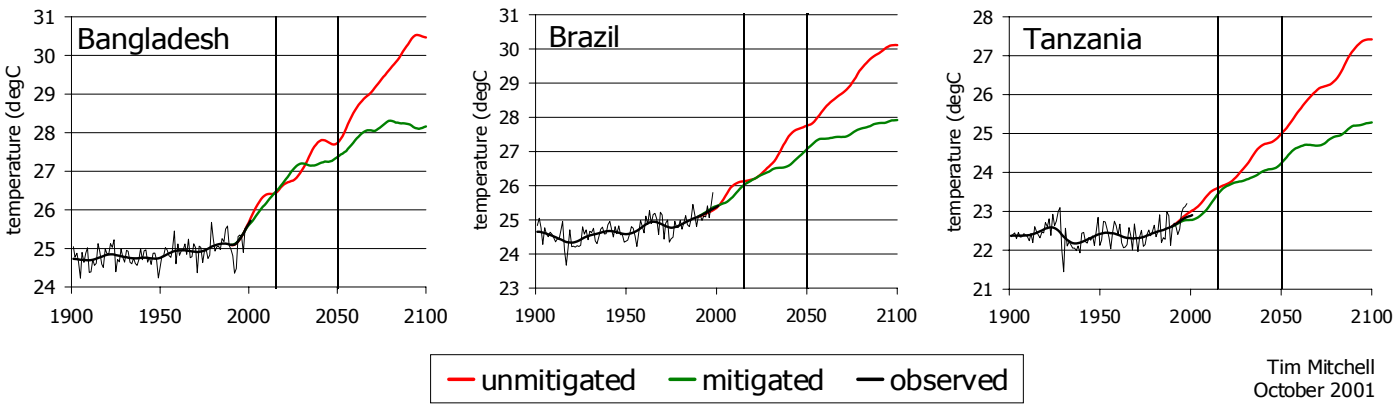


Figure 1. Past and future warming rates for selected countries

Already there is no such thing as a purely 'natural' weather event. Although it is difficult to quantify how much of the change to extreme weather events is artificial, it is true to say that historical statistics are no longer a guide to planning. Future change in climate will inevitably lead to altered frequencies and intensities of extreme weather. The IPCC concludes that it is very likely during the 21st century that there will be higher maximum temperatures and more hot days over nearly all land areas, higher minimum temperatures, fewer cold days and frost days over nearly all land areas, and more intense precipitation events. The IPCC also concludes that increased summer continental drying and drought are likely over most mid-latitude continental interiors.

Less conclusive work has been undertaken examining changes in more complex extreme weather phenomenon. For example, the IPCC conclude that tropical cyclone peak wind and mean and peak precipitation intensities are likely to increase. Overall, it is changes such as these that will likely have the greatest impact on the economy and welfare of nations. This is of importance for designing development policy and advising on development investment, just as it is for individual business sectors such as insurance, transport, finance, water, construction and health care. Health risks are sensitive to ENSO behaviour, hence improving predictability of El Nino events will help enhance adaptation in the short- and long-term.

Q. Could you expand on drought risk?
A. Scientists anticipate increased risk of drought, particularly in mid-continental regions, as climate warms.

Q. What is the definition of a 'carbon intensive' world?
A. This assumes a three- to four-fold increase of atmospheric concentrations of carbon dioxide, relative to pre-industrial levels. It does not assume Kyoto targets are

met. Kyoto is a step in the right direction, but it only reduces warming by a few tenths of a degree Celsius or delays warming by 4-7 years. But Kyoto does put in place the potential mechanisms for future reductions.

Q. What is the accuracy of the temperature scenarios in Figure 1?
A. These are relatively robust and depend on the global model. The figure would be subject to uncertainty of ± 0.5 - 1 degree Celsius at a country level, which is less than the 3 - 4 degree Celsius warming expected in these three regions.

Q. Who are the 'we' in you discussion of what we know about extremes?
A. This has been the essence of IPCC knowledge of extremes, so is the consensus view from the international climate science community. People's perceptions of changes in extremes can differ relative to long records of measurements.

Emerging perspectives on adaptation to climate change in developing countries

Dr Saleemul Huq, International Institute for Environment and Development

Our adaptation and mitigation response to climate change is not an either/or option. We need to mitigate, while assuming that some degree of climate change will occur and therefore consider ways to adapt.

The IPCC Third Assessment Report (TAR) launched a month prior to this workshop notes that the most vulnerable countries and groups are concentrated in the developing countries. The report also notes the need to treat climate change issues within the larger context of sustainable development in both developed and developing countries, and the need to understand the links between climate change and sustainable development. Adaptation was not a major topic in IPCC reports of the past, but is highlighted in the TAR's Chapter 18 of Working Group II (Adaptation, Sustainable Development and Equity). This chapter highlights the importance of adaptation and notes the need to develop adaptive capacity, i.e. the ability to cope with future change.

The UNFCCC Conference of Parties in Bonn in July 2001 reiterated the importance of developing adaptive capacity in the less developed countries, and set up a number of funds for this purpose, which focus on least developed countries (LDCs) and small island development states. The funds are to be disbursed by the Global Environment Facility and will take effect earlier than funds generated through Kyoto mechanisms. Adaptation funds will be finalised and capacity-building initiatives will be agreed in Marrakech.

Work in adaptation so far includes: national communications of emissions; vulnerability and adaptation studies in selected countries; Pilot Phase II adaptation studies (Caribbean, Bangladesh, Pacific); development of the framework for National Action Plans for Adaptation (NAPAs); and the work of UNEP/AIACC, UNDP, Canada/LDCs and DFID/IDTs.

However, many of the developing countries (in particular the LDCs) feel that the treatment of adaptation has been inadequate and needs to be done in much greater

detail. There is also a feeling among many of the developing countries that adaptation plans need to be better integrated into the national planing for sustainable development. There is a need to inform developing countries' policy-makers and agencies in, for example, the water sector about the importance of climate change and what can be done. Similarly, funding agencies need to understand their involvement in climate change issues, and development NGOs need to think how changes in the longer-term will affect their work.

There is an urgent need to improve the understanding of linkages between climate change and sustainable development (e.g. through looking at impacts on International Development Targets); to enhance the understanding of adaptive capacity; to enhance capacity in developing countries to understand and cope with climate change impacts; and for donors and NGOs to incorporate climate change into their activities.

Q. Are the risks of climate change increasing?
A. The problem of extreme events becoming worse focusses the attention of policy-makers, and necessitates better coping strategies.

Q. National plans don't look at implementation at the local level.
A. There needs to be a move away from top-down implementation. There needs to be more work on resilience at ground level.

Q. The international focus has been on mitigation; adaptation has only recently made it onto the agenda. Developing countries don't have the capacity to identify what they need for help. Adaptive capacity will be helped by increasing links with other conventions, e.g. biodiversity.
A. Yes, useful ways of using funds from the bottom up are required.

Q. Trade organisations need to be included
A. The paucity of qualitative research on adaptation could lead to the wastage of funds. The way forward is to put research into capacity building and improving knowledge on the ground and research collaborations between North and South.

Session 2: Implications of adaptation to climate change for development policy and research

Chair: Dr Katrina Brown, Tyndall Centre and School of Development Studies, University of East Anglia

Health impacts and adaptation

Professor Andrew Haines, London School of Hygiene and Tropical Medicine

Climate change is one of many (and a relatively new) areas of environmental change that impacts on health. Research into the health impacts of environmental change involve three tasks: examining the past and looking for analogues; detecting and attributing current health threats; and modelling and predicting future impacts.

The potential health impacts of global climate change include direct impacts through thermal stress and weather disasters (e.g. heatwaves, cold spells, floods, storms and

droughts); changes in physical and/or chemical hazards (e.g. photochemical air pollutants, pollens and fungal spores, threats to freshwater supplies); ecological changes (e.g. vector-borne infectious diseases such as malaria, dengue, etc., food-borne and water-borne diseases); and social and demographic disruption (e.g. due to sea level rise, agricultural disruption, refugees).

The relationship between temperature and mortality is V-shaped: deaths increase in cold and hot weather. For example, in the 1976 heatwave in London there were 520 deaths. An increase in temperature would see an increase in extreme high temperatures and a consequent increase in the expected number of deaths. In addition, diarrhoea is related to temperature: in Peru, there is an 8% increase in daily diarrhoea admissions for every 1 degree Celsius increase in temperature.

El Nino years lead to a higher number of people being affected by natural disasters, especially floods (see Figure 2), as well as increases in malaria and other vector-borne diseases. Such observations provide an example of the relationship of health to climate, but better data and surveys are required to be certain of long-term trends.

Flooding impacts immediately on health through deaths and injuries, followed by small impacts due to an increase in infectious diseases. There are also mental health effects due to the huge stress of losses of homes and livelihoods.

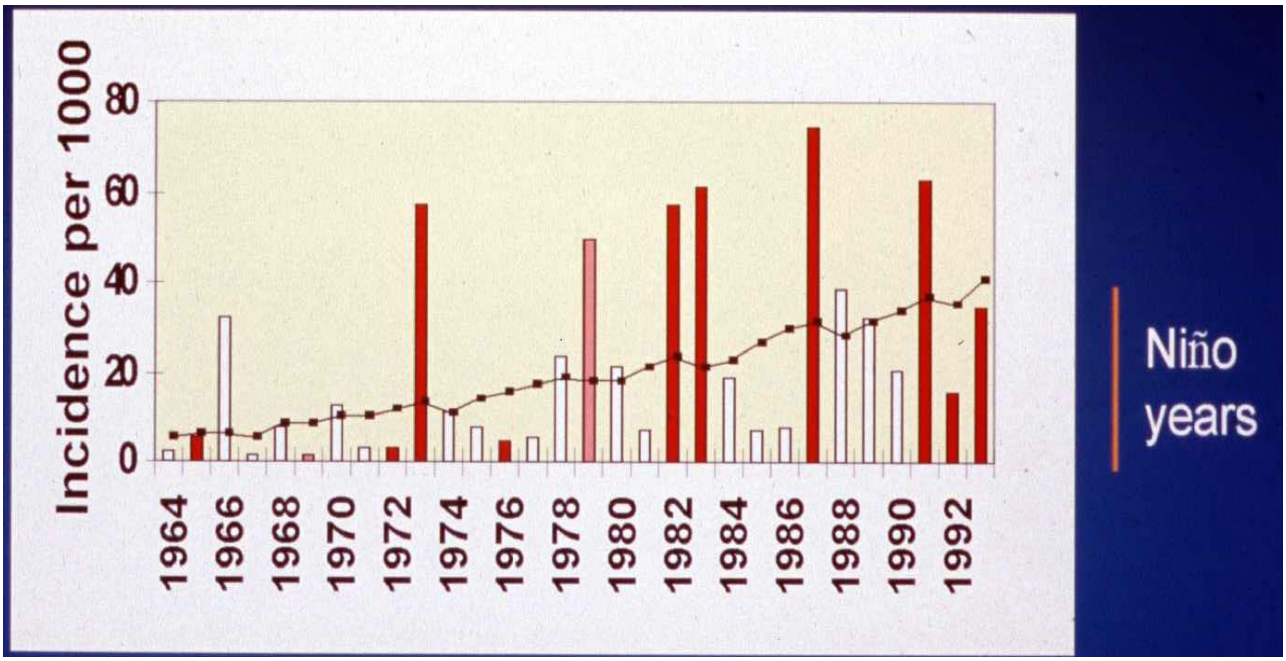


Figure 2. World population affected by natural disasters, highlighting the effect of ENSO.

The potential effects of climate change on water-related diseases include changes in vector (e.g. mosquito) breeding, increased pathogen survival (e.g. cholera), more water in air conditioning (leading to increases in Legionella), and algal blooms.

The process of comparative risk assessment (CRA) for climate change involves taking results from global climate models for various scenarios defined by the IPCC for use

in a health impact model, which generates comparative estimates of the regional impact of each climate scenario on specific health outcomes, and converts this to a measure of relative risk. CAR studies indicate that the poorest 20% in the world are 10 times more likely to die before they are aged 14 than the richest 20%. The least developed countries with 10% of the world's population account for 35% of under 5 deaths and 46% of maternal deaths. In the poorest 20% of the world's population, communicable diseases cause 59% of deaths. Tuberculosis is around four times higher among the poor.

Regions at high risk to climate change are those with persistently high infant mortality rates; areas with frequent extreme weather events; areas with low adaptive capacity; areas with rapid population growth; areas subject to political and social conflicts; areas with lack of access to infrastructure such as technology and water distribution; and areas where systems (e.g. health care systems) are in transition.

Adaptation strategies include disease surveillance; better weather warning systems to reduce impacts by evacuating or preparing those at risk; improving vaccines and other disease-control measures; improving flood prevention and other strategies outside the health system.

Q. Are there any opportunities?
A. Malaria could disappear in areas of increased aridity, but this does not imply a positive impact!

Q. How much adaptation can occur in the health sector?
A. It varies, but generally less can be done for extreme events as compared to diseases: for example, not much can be done for flooding health, but much can be done for reducing malaria.

Climate change and human rights
Dr Koy Thompson, Action Aid

Development agencies are unprepared when it comes to long-term climate change. Researchers need to convince organisations of the importance of climate change issues. Organisations take time to change. Climate change is recognised as an issue, but more so for extremes rather than disease. Disaster preparedness can be an add-on, as climate change is not seen as an immediate concern.

Vulnerability is dynamic, not static. It therefore requires ongoing observations and analysis. People are affected differently by the same emergencies. For example, poor people are especially vulnerable to disasters due to the causes of poverty. Aid agencies need to take this into account.

Adaptive capacity is linked to human rights. Policies need to be able to protect vulnerable populations.

Q. Are there research partnerships between developing and developed countries?
A. This is already being pursued, for example the advocacy agenda: people are interested in the reasons for vulnerability.

Q. Has the North's consumption been linked to the South's disaster mitigation?
A. This is being considered and work is being done to examine links.

Q. What is the difference between a vulnerable person and a poor person?
A. Poverty does not equal vulnerability. Vulnerability depends on assets, where assets are coming from, etc.

Q. If climate change brings increased temperature and rainfall, what impact will this have on Agencies?
A. Agencies need to be aware of the scenarios so they can face up to climate change. They need to see disasters as ongoing events, not one-offs.

Q. What can the climate science community offer?
A. Data, filling in information gaps in the areas in which agencies work. Highlight the issues that have an immediate impact, such as health. Bring issues to a local level to avoid disempowerment and ensure people are engaged. Find a way to communicate locally rather than providing global and national information. In the other direction, researchers need to be made aware of recovery times. Much can be learned by bringing researchers and aid agencies together.

Urban Settlement and adaptation

Dr David Satterthwaite, International Institute for Environment and Development

Urban areas are important to consider in relation to climate change due to many reasons: their concentration of population; the long-term trend towards increasing proportions of the population living in urban areas in virtually all low and middle income nations; a large and growing proportion of poverty concentrated in urban areas; cities having a key role in supporting prosperous economies; and large urban concentrations can mean far more people at risk from disasters and hazards such as floods, landslides and earthquakes.

Cities are expected to be able to adapt more easily to climate change. This is due to the large economies of scale for revenue raising, and proximity for delivery of services such as emergency response, etc. However, cities can only adapt with planning, and appropriate technical, institutional and political capacity. This leads to problems as most urban authorities lack capacity to investment in long-term planning. In addition, many of the most vulnerable cities are those with ineffective city governments. Even competent city governments will be reluctant to put in place the needed long-term steady investment in adaptation due to many other more pressing problems to address. Also, much of the urban population lacks the means to help adapt their homes to the direct and indirect effects of climate change.

Global warming can influence urban areas directly or indirectly. The direct effects include changes in temperature (e.g. heatwaves and the augmenting effect of the urban heat island), sea level rise (many of the world's largest cities are also sea ports), changes in the hydrological cycle (dryness affects water supplies and flooding affects health) and altered frequency and/or intensity of extreme weather events (e.g.

landslides, tropical cyclones). The indirect effects stem from ecological changes having serious effects on, for example, production of food.

There has been a shift in focus of the IPCC assessments towards better identification of urban vulnerability. The first IPCC Assessment identified the most vulnerable communities as poorer coastal and agrarian communities in arid areas. The second IPCC Assessment recognised the vulnerability of urban settlements with a predominance of low-income residents, most of them in illegal or informal settlements in and around urban areas built on hazardous sites. The third IPCC Assessment identified the kinds of urban settlements that would be most vulnerable: those that are dependent on resources at risk from climate change (agriculture, forestry, fishing, tourism); those situated in coastal, riverine or hillside locations; settlements in arid lands; and large population concentrations.

Local capacity is critical to successful environmental adaptation. Adaptation has to be consistent with economic development, environmentally and socially sustainable over time, and equitable. Acting now and over the long-term can cheapen costs and complement other goals: small changes in new buildings and infrastructure can introduce adaptation more cheaply than retrofit or prevention. Authorities should take advantage of replacement schedules to ensure infrastructure has more provision to cope with the likely impacts of climate change. City planning measures should anticipate floods using hard and soft responses, and ensure safe land sites are available to low-income households to build their own homes. All of this depends on better local governance.

Q. Should urban and rural areas be kept separate?
A. Poor people don't make a distinction between urban and rural areas: they live in both. The authorities need to have the capacity to deliver to both.

Vulnerability and adaptation in flood prone regions of Bangladesh and India

Dr Patricia Feeney, Oxfam UK and Ireland

Oxfam has reviewed its policy towards climate change. Its role is to alleviate poverty, suffering and distress; weigh up the need to meet immediate requirements with the need to implement longer-term adaptation efforts; and provide a voice for those most at risk who have the least information. Oxfam's policy is to adopt an incremental experience-based approach to climate change; examine the continuum between current disaster relief programmes and longer-term adaptation; reassess institutional response in light of new knowledge; and incorporate assessment of possible impact into strategic planning. External stimuli are now needed to move these aims further.

Wealthier countries have the infrastructure and predictive abilities to cope with climate change better than the rural poor. For example, in 1992 Hurricane Andrew killed 32 people in southeast USA, whereas a cyclone in Bangladesh killed 100 000. Poverty increases vulnerability due to overcrowded, temporary settlements being erected on unsuitable, hazard-prone land; precarious economic existence leading to no insurance against external shocks; and a lack of sanitation and access to water, poor diet and inadequate health care.

Bangladesh risks losing 18% of its land to the ocean by 2100. This would displace nearly one-fifth of the population. There has been progress since 1991 in disaster preparedness, e.g. early warnings for cyclones and an increase in the number of cyclone shelters.

Coping strategies include micro-credit to help cushion families in times of stress; training in disaster preparedness, rescue, disease prevention and hygiene; portable ovens, food storage materials and seed preservation containers; and the development of shelters that also serve as community halls and schools.

Q. The Government's willingness to work with NGOs and Aid agencies has prevented more deaths in Bangladeshi floods.
A. Yes, it is important to draw positive lessons from examples and not just focus on the tragedy.

Q. The IPCC reports different extremes in different areas. Agencies need to look at different types of hazards.
A. Agencies are getting there, for example looking at riverine flooding as opposed to coastal flooding.

Water resources and climate change: managing uncertainty

Dr Declan Conway, School of Development Studies, University of East Anglia, and Tyndall Centre

There is a 'cascade of uncertainty' from estimates of global greenhouse gas emissions to estimates of concentrations, to estimates of global temperature change, to estimates of regional change and finally to assessment of impacts. Changes in precipitation differ between scenarios and seasons, as seen in Figure 3. However, it is clear that temperature will increase in future, and therefore there will be an increase in evapotranspiration, which will affect water resources.

Climate change will increase the uncertainty of the water supply. Investigating the impacts can be done using scenarios and impacts models (which do not consider other impacts on water resources, such as adaptation strategies) or by using analogues (which involves intensive analysis and may not be representative of the future).

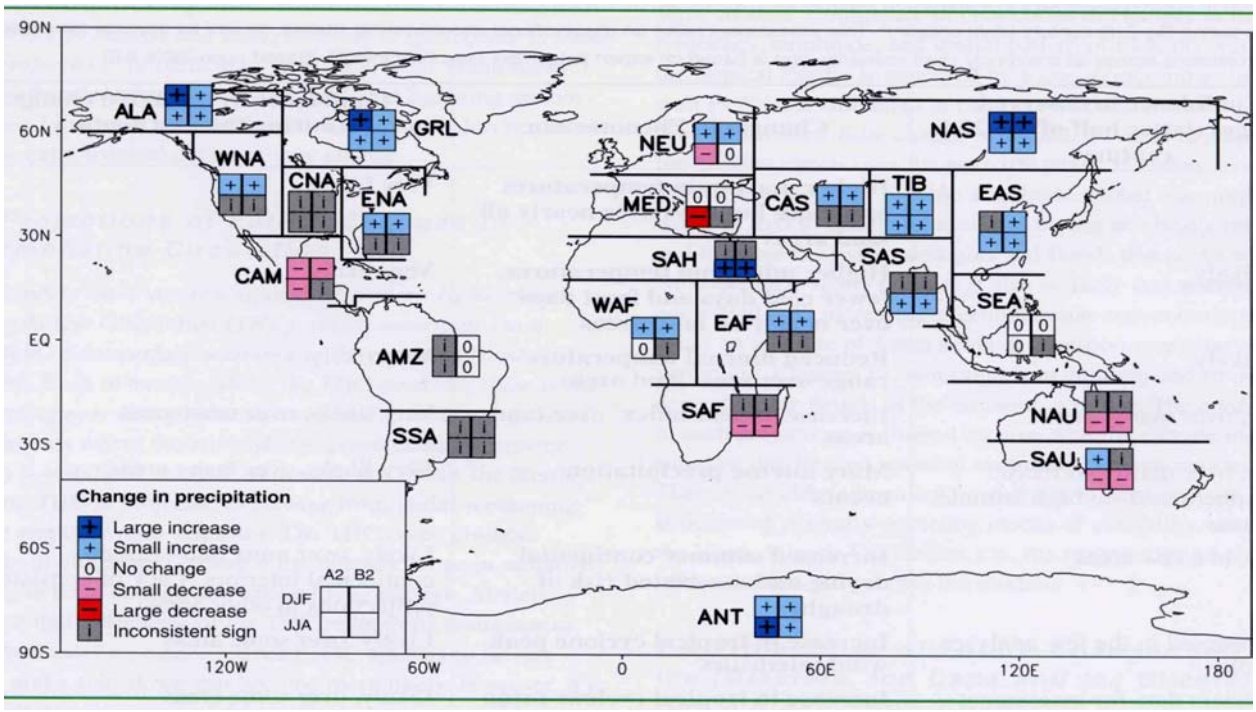


Figure 3. Seasonal changes in precipitation.

Water resources in Africa exhibit high natural variability, with prolonged changes in flow regimes in West Africa and the Sahel, and extreme events and trends in the Nile Basin. In the Niger, Sahel, a decrease in flow regime due to catchment changes is of an equivalent magnitude to global circulation model predictions, so offers a good example of the impacts of river flow decreases on society. Levels of Lake Victoria, East Africa, have increased by 2m, offering an analogue for impacts of increased flow and consequent impacts such as flooding. The Blue Nile, Ethiopoian Highlands, has experienced a decline in rainfall, leading to lower river flows and offering an analogue of future decreases.

Climate change uncertainty is incorporated into the current water management systems. However, some systems are already stressed and may not cope.

Q. Have there been impacts due to privatisation?
A. Consideration is now on the demand side more than supply. Private companies may be reluctant to increase supply.

Q. Huge numbers of people are at risk of having no water, so uncertainty is an issue.
A. Many millions of people already have no access to fresh water. The impact of climate change is to increase the reliance on irrigation as temperatures rise, but this is a small effect relative to millions of people going without water.

Water resources and food security: can poor people adapt to climate change?

Dr Michael Mortimore, Overseas Development Institute

According to the IPCC, Africa is the continent most vulnerable to climate change, on account of poverty. However, the Sahel population has adapted to past change in climate that have been greater than those estimated in future scenarios. The Sahel has experienced serious drought for many years (Figure 4). However, cereal production has been kept above the required production level of 200 kilograms per head (Figure 5). While the area planted has increased, this does not account for the stability of

cereal production. Yields have increased slightly overall and increased substantially against rainfall. Population density has increased, with the population living mainly off the land. In other words, despite decreasing rainfall and increasing population density, cereal production has been counter-intuitively stable in the longer term.

Figure 4. Rainfall variability in Maradi, 1932-1998

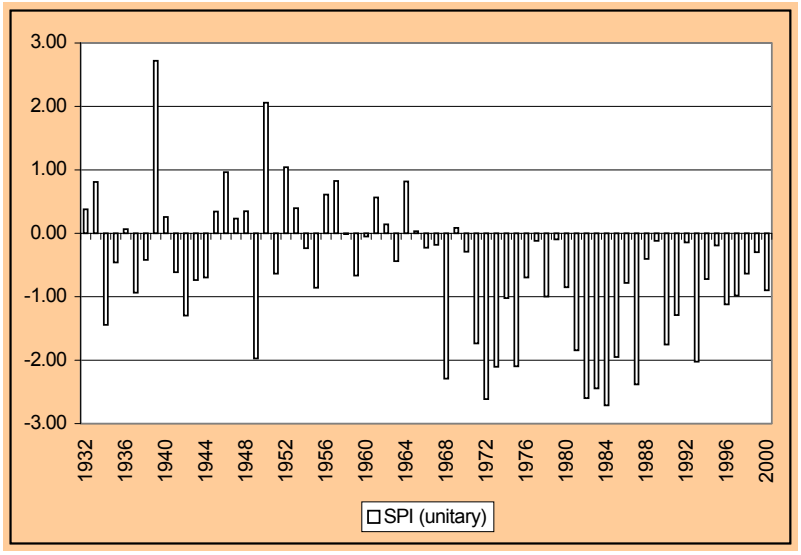
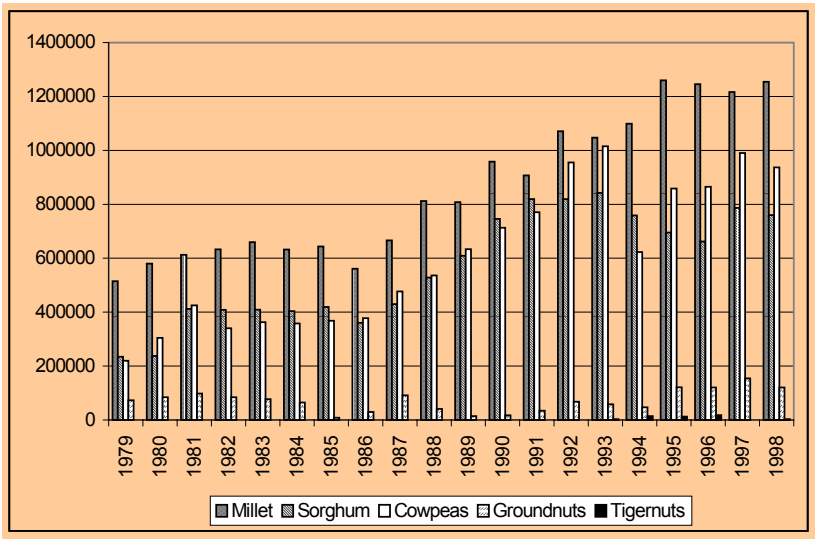


Figure 5. Cereal production (kg per capita), 1964-1998



Adaptation is autonomous at the household level, due to a diversification of capital (including natural resources, physical, financial and social resources), decisions on allocation of resources, flexible management and revision of resource allocation each year dependent on outcomes.

Adaptation to climate change is part of a network of important livelihood, market, production and policy variables. Climate change adaptation cannot be isolated from sustainable development objectives.
Adaptation is a way of life in the Sahel and this capacity should be recognised, particularly by the scientific community. Policies for development should offer

incentives for adaptation, and practitioners in development should resource adaptive capacity. Mitigation can also be accommodated: moving from 'deforestation' to 'on-farm forestry' could sequestrate and store much carbon. African smallholders should be seen as partners, not victims.

Q. What are the mechanisms behind adaptive learning?
A. This varies across countries. In Nigeria, World Bank funding did not have a high impact, so there was a return to old ways. New seed varieties are used, the society is very innovative. In Senegal, there was Government dependency in the 1970s; now the system is changing but there is a long way to go.

Q. Is there any role in adaptation played by Government?
A. Overall, the adaptive capacity is there. In general, the Government has acted as either a facilitator or blocker. When it is the latter, adaptation still rises to the surface. When it is the former, adaptation prospers.

Session 3: Panel discussion: Research Priorities and Directions

Chair: Dr Neil Adger, Tyndall Centre and CSERGE, University of East Anglia

Dr Andrew Bennett, Department for International Development
There is no doubt that climate change will happen. It will affect our lives and impact an increasing number of people. Outside this workshop there is still a denial that climate change is an issue. We need to make it less about models and outcomes and more about stability and economic impacts.

The community has a huge capacity for coping with climate change. Adaptive capacity at the moment relies on information and social capital. Those who have shown resilience need more access to information and the wider world.

Migration has not been a strategy discussed today. This is a coping mechanism and should be viewed as an option. We also did not hear about the technological side to adaptation. Connectivity through information technology allows lessons to be learned and shared.

We need to be water efficient. There is an assumption that biology can cope, but understanding tolerance will be important and genome research has a part to play in this. Large gaps in knowledge are yet to be filled.

Dr Camilla Toulmin, International Institute for Environment and Development
We need to look at how local communities adapt. How can this be supported? Governments should act as facilitators at national and local levels.

Communities in West Africa have adapted. People are aware of drought and have changed cropping patterns, they have diversified and varied the balance between livestock and crops, and they have migrated. While coping with climate change must be seen in a regional perspective, it needs to be considered globally. Land is becoming more scarce so migration will not be as easy an adaptation option.

Drought is forcing experimentation and a sharing of experience. Policies for the division of water will be required as rainfall, run-off and river flow decrease. We should look closely at West Africa as an analogue to future climate change, with the caveat that forces such as a scarcity of land may reduce the ability to use similar adaptation options.

Dr John Ashton, Foreign and Commonwealth Office, UK
Overall, countries most vulnerable to climate change are the most vulnerable to other perturbations.

We need direct, immediate ways of disseminating research to people whose lives are affected by the results. There needs to be a more ambitious system than the slow process of peer review.

All societies have thresholds. There needs to be a more solid understanding of these thresholds and what makes a community resilient to climate change.

All spatial scales must be examined, but there needs to be more focus on regional systems, for example watersheds.

We must also examine how to take account of risk in decision-making, especially with regards to low probability but high impact events.

There is a problem of a lack of trust in negotiations. People are talking past each other in country to country discussions. Partnerships are what deliver, focussed on specific issues and solutions.

Finally, we should not underestimate the consequences of the terrorist attacks in the United States in September. The World Summit for Sustainable Development in 2002 now has a focus: not the immediate challenge of war, but of how to win the peace and make sustainable development a reality.

Mrs Madeleen Helmer, Climate Centre, Netherlands Red Cross
The policy of the Red Cross is evolving. It is no longer only there when disaster strikes: the Red Cross is involved more in planning for and mitigating disasters.

Climate change currently involves mainly the science and policy community, and people on the ground are not interacting with them. This is true for the North as well as the South. If aid organisations and other agencies are involved, the decisions being made would be more real. Climate change should be brought out of the environmental corner and be made a disaster preparedness issue and a humanitarian concern.

We cannot expect climate change adaptation to become a big issue quickly, as there are many other problems, especially in Africa. But the issue of AIDS got out of hand due to action being 10 years too late. We do not want to see a similar delay happen with climate change.

Conclusions

Globalisation will require us to learn to cope with migration, a mix of cultures and values in one area. Negotiation and compromise will be needed. Similarly, migration to urban areas needs to be considered and planned for: there is a danger if links to rural communities are lost as there needs to be an ability to return to the land in economic downturns.

We can learn from experience in short-term disasters and long-term adaptation. There is good news in adaptation: resilience. But we need to consider how this will change due to climate change.

The Tyndall Centre has the remit of making connections. This workshop has achieved this, bringing together climate scientists, humanitarian relief and international development agencies. As a result, fresh ideas have come out that we must now pursue.