



Up in smoke?

Threats from, and responses to,
the impact of global warming
on human development

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Photo: Marcelo Alves

Contents

Foreword	1
Summary and recommendations	2
Up in smoke: human development and climate change	4
Warming up: threats from, and responses to, climate change	8
Food	8
Water	8
Health	13
Energy	13
Disasters	18
Environment	22
Livelihoods	25
Global issues	29
Why women suffer most from global warming	29
Trade and climate	29
The movement of people	30
Learning from history	32
Endnotes	35

Foreword

The need for informing the public on the gravity of the impacts of climate change on human existence across the globe has never been greater.

I am indeed happy to see a document of this nature being released to the public, given the enormous importance of climate change and its influence on all forms of life on this planet. The need for informing the public on the gravity of the impacts of climate change on human existence across the globe has never been greater. What is particularly noteworthy is the fact that this document is being released at an event that benefits from the presence and support of a large number of NGOs involved essentially in development activities. Climate change requires full understanding of its implications for development and, therefore, this document assumes great significance, since reading it would help to define how development policies and actions should and must reflect the reality of climate change today and the prospects of climate change in the future.

Most notable as a major issue of concern is the nexus between climate change and the widespread prevalence of poverty in the world. As the Third Assessment Report (TAR) of the IPCC clearly indicates, "The impacts of climate change will fall disproportionately upon developing countries and the poor persons within all countries, thereby exacerbate inequities in health status and access to adequate food, clean water and other resources." Take for instance the plight of poor farmers in the tropical and subtropical areas of the world. A large number of them are dependant on rainfed agriculture and are barely able to achieve a subsistence level of existence. Variations in precipitation levels, degradation of soil quality and increased frequency of extreme weather conditions could make the lot of poor peasants far more difficult than it is currently.

Climate change would also have a significant impact on the availability of water in several regions of the world. This would happen as a result of the melting of glaciers on the one hand and changed patterns of precipitation on the other. In those regions where agriculture is dependent entirely on rainfall, reduced levels of precipitation would only add to already increasing stresses in the availability of water for agriculture as well as human consumption. Decline in agricultural output in areas that depend on rainfed irrigation would lead to the problem of food

security becoming acute. Not only would the decline in yields affect human consumption and nutrition of the population dependent on such agriculture, but consequent reduction in income levels would also limit the ability of people to buy food from the market. The impacts of climate change on human health are also well documented, and the World Health Organization for instance has been looking at this problem in some depth in recent years. The Third Assessment Report of the IPCC has also highlighted the adverse effects of climate change on human health, and the Fourth Assessment Report would contain growing knowledge and evidence in this field available now.

All of these impacts of climate change have a direct impact on development, particularly for the poorest sections of human society. It is, therefore, encouraging that organizations involved in development activities are taking a comprehensive view of climate change and its relationship with development strategies. Given that the inertia of climate change would result in impacts continuing for centuries in the future, irrespective of the mitigation efforts that global society is able to mount in the near future, adaptation to climate change would have to become a part of development activities particularly amongst those who are the most vulnerable. We must, therefore, understand the enhanced challenge posed by the impacts of climate change to development planning. It is unlikely that development can by any means be made "climate proof". But integrating the impacts of climate change in the form of adaptation measures within development strategies can certainly minimize the cost of such impacts and ensure that those who are vulnerable are able to improve their livelihoods through the exercise of knowledge and foresight in this area.

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Summary and recommendations

This report represents an unprecedented coming together of leading environmental and development organisations with decades of experience working with poor communities across the world. We fear that global warming could threaten attainment of the Millennium Development Goals (MDGs) and even reverse human development achievements. This report is an expression of our common concern and a call for urgent action from governments.

Global warming is already happening. The impact of global warming is being felt most by the world's poorest people, as many of our case studies make clear. Food production, water supplies, public health, and people's livelihoods are all being damaged and undermined. Global warming threatens to reverse human progress, making the MDGs for poverty reduction unachievable.

To stop it running out of control – for example by global average temperatures rising beyond 2°C above pre-industrial levels – cuts in emissions of greenhouse gases by industrialised countries in the order of 60–80 per cent (relative to 1990 levels) by the middle of this century are essential, far beyond the targets of the Kyoto Protocol. A truly global solution to stop dangerous climate change is also unavoidable, one that will need to be fair and based on human equality.

As well as new resources needed to mobilise efforts to stop global warming, developing countries need much more money to adapt to the climate change that is already happening, and the warming that is already built into the earth's climate over the coming decades.

In the face of global warming, new models of development and nature conservation will be needed which are *climate proof* and *climate friendly*.¹ In 2002, the Red Cross's *World Disasters Report* called for a new development model in the face of the challenges of global warming, in which risks are proactively assessed, prioritised, and reduced. Every policy decision at every level must pass the test of whether it will increase or decrease vulnerability to the effects of climate change. From now on, planners must view all development decisions through the lens of risk reduction. Crucially, communities at risk must be at the centre of this planning process if it is to succeed.

As well as action from above, governments must also facilitate grassroots, community-based approaches to reducing harm from extreme weather events, like those described in this report. In our experience, these practical examples – including seed banks, water management, disaster relief, storm and flood

protection, and conservation of forests and other ecosystems – represent effective ways for threatened communities to adapt.

If they are replicated and scaled-up, small-scale renewable energy projects promoted by governments and community groups can help both to tackle poverty and reduce climate change. This will require political commitment and new funds from governments in all countries, and a major shift in priorities by the World Bank and other development bodies.

There must be substantial and genuine reductions in greenhouse gas emissions by the principal consumers of fossil fuels, led by the governments of the Organisation for Economic Co-operation and Development (OECD). The need and opportunity for new models of development must apply in developed countries as well as in less-developed countries.

Poverty causes insecurity and vulnerability and reduces people's ability to cope and to adapt. Today, humanity faces the intertwined challenges of obscene levels of poverty and a rapidly warming global climate. There is no either/or approach possible; the world must meet both its commitments to achieve the MDGs and tackle climate change. The two are inextricably linked.

The current and historical greenhouse gas emissions of rich, industrialised countries have far exceeded their per-capita share. Poor people and poor countries are least responsible for climate change and yet, due to their vulnerability, are affected most by the consequences. Rich countries have an obligation to take a lead in climate change mitigation and adaptation, and to bear an equitable burden of the associated costs.

The environmental and development community, like the rest of humanity, is faced with three overarching challenges:

- 1 How to stop and reverse further global warming.
- 2 How to live with the degree of global warming that cannot be stopped.
- 3 How to design a new model for human progress and development that is climate proof and climate friendly and gives everyone a fair share of the natural resources on which we all depend.



A cow in Zimbabwe dies from lack of food and water (Photo: ITDG/Zimbabwe)

We suggest that urgent priorities should include:

- A global risk assessment of the likely costs of adaptation to climate change in poor countries.
- Commensurate new funds and other resources made available by industrialised countries for poor country adaptation, bearing in mind that rich-country subsidies to their domestic, fossil-fuel industries stood at \$73 billion per year in the late 1990s.²
- Effective and efficient arrangements to respond to the increasing burden of climate-related disaster relief.
- Development models based on risk reduction and incorporating community-driven coping strategies in adaptation and disaster preparedness.

- Disaster awareness campaigns with materials produced at community level and made available in local languages.
- Co-ordinated plans, from local to international levels, for relocating threatened communities with appropriate political, legal, and financial resources.

In addition to these, as organisations striving to improve human well-being in the face of enormous challenges, we will:

- Work toward a collective understanding of the threat.
- Share the best of our knowledge about how to build human and ecosystem resilience and live with the degree of global warming that is now unstoppable.
- Do everything in our power to stop dangerous climate change and help bring about a global solution that is fair and rooted in human equality.

Up in smoke: human development and climate change

Global warming is happening. The impacts are already being felt most by the most vulnerable – the world's poorest people and countries. The organizations that have come together to produce this report fear that without the necessary urgent and radical action by governments, many of the gains of human development are now in jeopardy and may be reversed. Furthermore, the chances of attaining the MDGs by 2015 – the world's minimum commitment to ending the worst of global poverty, hunger, ill health, and disease – will be seriously reduced.

According to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), the global average surface temperature has increased over the 20th century by about 0.6°C. The panel says that *“There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.”* It also concludes that the combustion of fossil fuels is mostly to blame. The IPCC climate models project that global average surface temperature will increase by 1.4°C to 5.8°C by 2100, depending largely on the scale of fossil-fuel burning. The projected rate or speed of change is probably without precedent during at least the last 10,000 years.

But things could be getting worse. Work done by the UK's Hadley Centre, incorporating so-called environmental feedback mechanisms such as forests dying, suggests that *“The rise in global mean surface land temperature between 2000 and 2100 is around 3°C greater... compared to the previous model estimates.”* More than 180 nations, including the United States, Australia, and Russia signed up to, and ratified, the 1992 United Nations Framework Convention on Climate Change (UNFCCC). Under Article 2 of the Convention they are committed to *“Achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”* It said that *“such levels should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally... to ensure that food production is not threatened...”* On current projections this objective is unlikely to be met.

Past and current emissions mean that an increase in temperature of 1°C to 1.5°C is inevitable. Yet the increase of 0.6°C that has already occurred is having a severe impact on global ecosystems and especially on poor people. To avoid the most serious impact of global warming and climate change, we need to ensure that global mean temperature is limited to a 2°C increase above pre-industrial levels, as agreed by the UK Government at the European Council conclusions of May 2003.

Temperature rises beyond 2°C are, according to the IPCC, likely to result in reduced crop yields in most tropical, sub-tropical, and mid-latitude regions and

“Some ecosystems will be irreversibly damaged or lost.” It will certainly result in much more flooding in low-lying areas, declines in food production, an increase in disease, and the extinction of plants, animals, and entire ecosystems. There are also fears that temperature rises beyond 2°C may trigger runaway global warming and that temperature rises on this scale already compromise the precautionary principle.³ But there is a danger that without radical short-term action to shift onto a low-carbon path, the option of even limiting the temperature increase to 2°C will disappear well within the next two decades.

Making development climate proof and climate friendly

While the internationally agreed precautionary principle and sheer common sense demand that the concentration of greenhouse gases in the atmosphere needs to be held at a level below that which will lead to a 2°C rise, global warming is already having disastrous effects on people and ecosystems around the globe.

The need to tackle global warming has to be addressed now – not the day after tomorrow. Whether our expertise is environment, development, or social and economic affairs, we recognise that global warming presents a challenge much bigger than any or all of us. The poor people we work with, and the ecosystems in which they live and on which they depend, will bear the brunt of its impacts.

The kind of devastation caused by Hurricane Mitch that hit Central America in 1998 or the 2004 floods in Bangladesh and India shows that an acute danger now exists for many of the slow, hard-won gains in human development of the last few decades: in places, these could be swept away in a matter of hours. The frontline experience of many of us working in international development indicates that, already, many of the communities we work with have to combat more extreme weather conditions – droughts, floods, typhoons. These people have to adapt now. Likewise, species, habitats, and systems that have evolved over geological time are at risk of extinction or severe disruption this century.

The organisations that have come together to produce this report all believe it is feasible and achievable to improve human well-being in ways that are environmentally sustainable. Together we have practical expertise applied in partnership with local organisations around the world, ranging from growing food, to piping clean water and improving sanitation, to building and running schools and health centres, and making sure that homes have light and power. In addition to our call for action, *Up In Smoke?* builds on our experience in the struggle for human development and allows us to deliver a range of insights into what is at threat, and what we might be able to do about it.

It is clear to all of us that from now on, a critical test for all development projects and policies should be: Are they increasing or decreasing human vulnerability in the face of global warming? But this test is not just a concern for groups directly engaged in environmental and development work. It must also apply to governments, financial institutions, the private sector, and individuals everywhere. Increasingly, what all of us do will have to be both climate proof and climate friendly.

The new vulnerability

Globally, several environmental, economic, and political trends are coinciding and contributing to rising instability that exposes people and biodiversity to greater risks and vulnerability than ever before. Without a new agenda explicitly focused to reduce vulnerability, we could face a major reversal of human progress.

In the global market place, the incremental removal of controls on the movement of finance and goods has introduced a new era of economic volatility. Low, unstable prices destroy earnings and the ability of poor, commodity-dependent countries – already constrained by the burden of debt and structural adjustment policies – to invest in development. Financial volatility wrecks the livelihoods of millions. But of all the new threats, it is the many dimensions of global warming that are least analysed for their impact on efforts to improve human well-being.

Global warming, and its predominant cause – the rate at which humanity is burning fossil fuels – is making us look anew at how the world works. It asks fundamental questions about whether, and how, we will achieve human development; about how the global economy can run within the environmental limits of the planet's life support system; and about the obligations between rich and poor people, within and between countries.

The IPCC says that as a result of human activities, atmospheric concentrations of greenhouse gases are rising and with them, global temperatures. In addition to increases in temperature, global warming results in more extreme weather patterns: more rain, longer dry spells, stronger and more violent storms, more fires, and the spread of tropical diseases.⁴ None of these impacts respect national boundaries. Taken together, their effect is to create more instability in atmospheric processes. Ironically, while the developed nations of the world produce the majority of greenhouse gases, the burden of impact will be more severe on developing countries whose populations are poorer and therefore more vulnerable and less equipped to deal with extreme weather events.

So-called hydro-meteorological disasters driven by global warming – floods, storms, and droughts – present the most widespread direct risk to human settlements. Flooding and landslides pushed by heavier rainfall and, in coastal areas, sea-level rise, will become increasingly common. With sea levels set to rise by up to nearly one metre in the coming century, heavily populated areas of low-lying land, such as Southern Bangladesh, the Nile delta, parts of Eastern China

and many atoll islands of the South Pacific and Indian Oceans face a bleak future. So too do the long stretches of low-lying coasts in Western Africa from Senegal to Angola, in South America from Venezuela to Recife in Brazil, almost the entire US seaboard, and much of the coastlines of Indonesia and Pakistan. Particularly vulnerable parts of the world, like the South Pacific, have seen a 65-fold increase in the number of people affected by disasters in the last 30 years.⁵

Storms, floods, drought, heat waves, and atmospheric pollution due to forest fires now have acquired regional dimensions. During the 1990s and early 21st century many of these effects have filled our television screens. In Central America, Hurricane Mitch destroyed much of the infrastructure of Honduras and devastated parts of Nicaragua, Guatemala, Belize, and El Salvador.

In Asia, serious floods affected Nepal, India, China, Vietnam, Cambodia, and Bangladesh. In summer 2004, two-thirds of Bangladesh, along with much of Assam and Bihar in India, was under water, with over 50 million people affected and tens of thousands suffering from diarrhoea as sewage mingled with the flood waters. A similar devastating flood occurred only six years ago, in 1998. The main monsoon rice crop has been severely damaged and some 20 million people are likely to need food assistance for at least part of the next 12 months.

Drought has been more damaging to households in Southern and Western Afghanistan than the protracted conflicts there.⁶ In 2001, the Tigris and Euphrates rivers in Iraq also dropped to about 20 per cent of their average flow.⁷ Drought and erratic rainfall provoked food crises in most countries in Southern Africa and in Ethiopia and Eritrea. Economic injustice – for example, the historically low world prices for coffee – has combined with drought to produce a crisis for small farmers, farm workers, and their families.

The rate of climate change and the impact of increased sea level and other associated changes are difficult to quantify. What is clear is that unless we act now to effectively combat climate change, in a best-case scenario things will get gradually worse for many poor countries. Some wealthier countries might even experience short-term benefits, though soon outweighed by medium-term costs. But there are also serious catastrophe scenarios in which sudden changes occur, feeding off each other, resulting in a runaway change to the climate.

Even though the ultimate consequences on human lives and livelihoods cannot be precisely quantified, they will impose a far greater burden on the poor than on the rich.⁸ The Financial Initiative of the United Nations Environment Programme (UNEP) recently calculated that the economic costs of global warming are doubling every decade. The cumulative number of people affected by disasters rose to two billion in the 1990s, up from 740 million in the 1970s. Virtually all are concentrated in poorer countries.

Regions that are already least secure in their food production, like Sub-Saharan Africa, stand to be worst affected by global warming, as wet areas become wetter and dry areas become drier.

Halving the proportion of hungry people by 2015 – one of the key MDGs – could become a mirage unless the temperature rise can be capped, and unless resources are provided by the prime causes of man-made climate change to enable the societies which will suffer most to adapt.

The other MDGs are equally threatened. Ambitious reductions in child and maternal mortality will be hampered by the unpredictable spread of diseases, destruction of property, and contamination of water supplies that go hand in hand with a warming and volatile atmosphere. Achieving universal primary education will be undermined. Time spent finding and fetching (often unsafe) water is already a major reason why girls in particular fail to go to school. The pressures of poverty that keep children away from the classroom will be reinforced by global warming, the number of environmental refugees and displaced people will grow, and infrastructure like schools be damaged by weather extremes.⁹

Impacts on the natural biological systems upon which so many poorer people depend are also potentially catastrophic. As the IPCC's latest assessment report says *"Ecosystems and species are vulnerable to climate change and other stresses ... some will be irreversibly damaged or lost."*¹⁰ Based on studies of plants and animals in Australia, Brazil, South Africa, Europe, and Mexico, covering about 20 per cent of the world's land area, a recent paper in *Nature* concluded *"We predict that 15 to 37% of species in our sample of regions and taxa will be "committed to extinction" as a result of mid-range climate warming scenarios for 2050."*¹¹

Not only do many people depend on biological systems for their day-to-day existence, they can be a source of significant income. Many poorer countries depend heavily for foreign currency on their national parks and reserves. Other consequences are intangible; for example, the national flower of South Africa, the King Protea, is likely to become extinct in the wild.

As climate change pushes the world towards more extreme weather, more and more people will be exposed to recurrent disasters during their lives. Investment in development is frustrated if it is destroyed by extreme weather events. Development plans and investment must be conceived in the light of increasingly unnatural hazards – and the challenge of the new vulnerability. From now on 'development' will only be worthy of its name if it succeeds in being both climate proof and climate friendly.

Heads of State and Government, gathered at the UN in September 2000, declared: *"We will spare no effort to free our fellow men, woman and children from the abject and dehumanising conditions of extreme poverty."* The MDGs are the minimum goals that the world community committed itself to achieving by 2015. The MDGs are:

- 1 Eradicate extreme poverty and hunger.
 - Reduce by half the proportion of people who live on less than a dollar a day.
 - Reduce by half the proportion of people who suffer from hunger.
- 2 Achieve universal primary education.
 - Ensure that all boys and girls complete a full course of primary schooling.
- 3 Promote gender equality and empower women.
 - Eliminate gender disparity in primary and secondary education, preferably by 2005, and at all levels by 2015.
- 4 Reduce child mortality.
 - Reduce by two thirds the mortality rate among children under five.
- 5 Improve maternal mortality.
 - Reduce by three quarters the maternal mortality rate.
- 6 Combat HIV/AIDS, malaria and other diseases.
 - Halt and begin to reverse the spread of HIV/AIDS and halt and begin to reverse the incidence of malaria and other diseases.
- 7 Ensure environmental sustainability.
 - Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources.
 - Reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation.
 - Achieve significant improvement in the lives of at least 100 million slum dwellers, by 2020.
- 8 Develop a global partnership for development.
 - A range of commitments by northern countries to address trade imbalances, debt, aid and development financing, and intellectual property rights.

(Sources: www.un.org/millenniumgoals/ or www.developmentgoals.org)

Climate change and Africa: drought in Northwest Kenya¹²

Africa already has a highly variable and unpredictable climate. Global warming is making that worse. In the Sahel, there has been on average a 25 per cent decrease in annual rainfall over the past 30 years – consistent with climate change models. This is nowhere more apparent than in the Turkana region of Northwest Kenya – 2,000 miles of some of the most inhospitable territory known to humankind.

Nevertheless, the Turkana tribe who live there are nomadic pastoralists whose way of life is well suited to the harshness of this land. They are skilful and adept at seizing every opportunity. By being constantly on the move they search out the few watering holes and available pasture on which to graze their cattle, camels, donkeys, sheep, or goats during the long dust-dry nine months between one wet season and the next. The wet season, or *akiporo*, may arrive any time between March and June.

But it has been many years since the *akiporo* has been sufficient to allow the full regeneration of pasture and to refill the watering holes. Anna Nangolol (pictured) lives on the banks of what was once a large river (from which she derives her name – *nangolol* means born at a river) but which, she says, has not seen water since around April 2003. She sees the current drought as being the same one as when the name was given back in 1999: *Kichutanak*, meaning 'It has swept everything, even wild animals'.

"This drought has been very bad," explains Anna. "Past droughts have been short and rains have come. This one seems never to finish and our goats and cattle are not multiplying. Even if the rains do finally come now, it will take a long, long time for us to get back all of our animals."

Anna Nangolol's impression of the severity of the current drought is backed up by statistics. More prolonged droughts are occurring at a higher frequency. Over the past 40 years there have been five major droughts in Turkana. Rains were sporadic and inconsistent in 1960 – the year called *Namotor*, meaning 'bones exposed/emaciated'. 1970 was *Kimududu*, meaning 'the plague that killed humans and livestock'. Again this lasted only until the following rainy season. Nine years later the drought of 1979-80 spread across two years. It was named *Lopiar*, or 'sweeping/cleaning everything away'. There was then a gap of 12 years before the prolonged four-year drought of 1992-95, called *Longuensil*, meaning 'when the man with no legs from Oxfam came', a reference to an



Photo: Gary Iveson, Oxfam

Oxfam member of staff with a disability. It was then just four years before the current drought, *Kichutanak*, began in 1999 – and continues to this day.

The Turkana nomadic lifestyle has evolved over centuries and is sufficiently flexible for people to survive a poor rainy season, using up some of their livestock bank in the expectation that the following year's rains will replenish their stock. But this superbly balanced and well-adapted way of life is under terrible stress. By late 1999, international aid agencies were supplying 1.7 million people in 21 districts of Kenya with emergency food. By the summer of 2004 that had expanded to 2.2 million people, with the warning that 3.3 million people will need food if the short rains due from October–December 2004 are as disastrous as the previous rains have been.

The nomads of Turkana are paying with their lives and their way of life for the profligate consumption of fossil fuels by others. Everything must be done to cut emissions to stop global temperatures rising even further – and the North also has a responsibility to provide the funds needed for immediate, ongoing, and sufficient relief aid so that when the rains do eventually come, there will still be a Turkana people to greet them.

(Source: Oxfam)

Warming up: threats from, and responses to, climate change

This section shows the pervasive impacts of global warming on vulnerable people around the world. It highlights the challenge of making human development both *climate proof* and *climate friendly*.

Cases of human vulnerability to global warming are balanced with examples of best practice from different organisations that show how we can begin to combat the effects of climate change. Some case studies could be examples of either threats or responses to more than one issue, such as health or growing food. But they appear under only one heading to avoid replication. All development issues tend to cross the boundaries between different disciplines.

Food

There are now at least 815 million chronically malnourished people in the world; 95 per cent of them in developing countries. Inequitable access to food is a major factor in fuelling world hunger, but global warming is also undermining food security. Africa's hungry are especially threatened by weather-related disasters.

During the Mozambique floods in 2000 (the worst for 150 years), the lowlands of the Limpopo river were inundated for up to three months. While short-term flooding can benefit some crops like rice, the 2000 floods lasted so long that, according to the United Nations Food and Agriculture Organization (UNFAO), they led to a wipeout of the plant resources that local people relied on. Stored food, seed reserves, and all field crops were destroyed, forcing farmers to find fresh seed from far away.

The region's people and its economies are highly vulnerable to both flood and drought. Records since 1900 show that Africa's annual rainfall has been decreasing since 1968, "*possibly as a result of global warming due to man-made emissions*" says the UN Environment Programme.¹³ For every 1°C rise in night-time temperatures there is at least a 10 per cent fall in rice production according to the International Rice Research Institute, based in the Philippines.¹⁴

Agriculture in Sub-Saharan Africa – of which up to 90 per cent is rainfed – accounts for 70 per cent of the region's employment and 35 per cent of its gross national product (GNP). While many farmers have successfully adapted to slow changes in the region's climate, the level of unpredictability which global warming introduces may overwhelm their capacities to cope. Crop yields in Sub-Saharan Africa are projected to fall by 20 per cent under global warming. Tropical and subtropical areas will be hardest hit – precisely those countries already suffering from food insecurity.¹⁵

Water

The world is already facing a serious water crisis which global warming is making far, far worse. Already 1.2 billion people lack access to safe water and 2.4 billion lack access to basic sanitation. In the 100 years between 1900 and 2000, global consumption rose six-fold, or twice the rate of population growth. The Stockholm Environment Institute has estimated that by 2025 the proportion of the world's population living in countries of significant water stress will increase from approximately 34 per cent (1995) to 63 per cent – some six billion people, the same number of people as are currently living on Earth. And that figure is based upon only a moderate projection of climate change.¹⁶

Global warming is exacerbating water stress by changing rainfall patterns, river flows, lake levels, and groundwater recharge. In some places water sources are becoming more depleted; other areas are being hit by floods. Globally, river basins and wetlands – where most of the world's populations live – are becoming damaged and less able to provide the conditions and processes that provide a water supply of adequate quality and quantity to ensure sustainable development and maintain vital ecosystems. Fisheries are becoming depleted and degraded. Food security is eroded as it becomes increasingly difficult to obtain good harvests.¹⁷

It has been estimated that a 2°C to 3.5°C increase in temperature in India could result in a decline in farm revenues of 9 to 25 per cent.¹⁸ Both drought and floods, in different ways, favour the spread of water-borne diarrhoeal diseases, as well as diseases such as malaria and dengue.

Lo-tech answers to farms hit by floods and droughts

We are all dependent on agriculture to meet one of our most basic needs: food. Many of the world's poorest people living in rural areas are directly reliant on agriculture for both their food and their livelihoods. But agriculture is particularly vulnerable to the vagaries of the weather. It is not only that hay must be made while the sun shines, but seeds must be planted when the rains come – so the rain must come. Whether it brings increasing floods and storms or worse drought, climate change will create havoc for poor farmers, jeopardising their livelihoods and threatening their food security.

For this reason it's essential to promote the knowledge and methods which enhance the resilience of small-farmer agriculture and food production.

Many techniques for *sustainable agricultural* relate directly to difficult climatic conditions. They deal with both water scarcity and over-abundance, typical of tropical countries with seasonal, often unreliable, rainfall patterns:

- *Contour bunding* involves constructing low mounds, embankments or 'bunds' of earth or stones along the contour of a field to catch the rain when it falls so that it has time to soak into the ground rather than run off and be lost. The bunds may be planted with vegetation to help fix them, as well as to help delay the rainwater. A number of bunds may be spaced at intervals across the field or, if the field is small, only along the lowest edge. The bunds can also help prevent valuable soil being washed away.
- *Gully plugging* – the placing of piles of stones across a gully – can prevent gullies caused by heavy tropical rains getting worse and even help 'cure' them as soil builds up behind the 'plug'.

- *Check dams* are small, stone or concrete dams usually constructed across watercourses and also designed to delay the flow of rainwater so it has time to soak into the earth and replenish the groundwater table while keeping adjacent land moist.
- *Tanks* – in India and elsewhere larger dams or bunds were traditionally built to create ponds or 'tanks' to store water. Water seeps from these ponds into fields of crops and every so often the pond is de-silted and the silt used as a fertiliser. Although there has been a decline in these ponds, there are some places where they are being revived.
- *Compost* from animal manure and rotting vegetation can be churned into soil, adding nutrients but, equally importantly, helping to hold moisture, benefiting crops for longer.
- *Pit planting* – as compost is usually scarce, rather than spreading it across the whole field farmers may choose pit planting which involves digging a pit for each plant – usually fruit trees or bushes – and adding the compost to the soil as it is dug in.

Support and organisation is as vital to sustainable agriculture as more appropriate techniques and practices:

- *Agricultural research* at a local level through formal institutions and local development organisations which work directly with farmers is essential to develop crop varieties and improve farming practice.
- *Demonstration, training, and extension services* to promote these new crops and techniques to farmers are another part of the equation.
- *Microcredit* – as farmers need access to credit for tools, seeds, and transport and as mainstream banks have usually proved inaccessible, local community finance organisations are now widespread.
- Combining credit with *grain banks* – the community storage of food grains – helps avoid poor farmers having to sell their produce quickly and cheaply, enabling them to sell later when prices may be higher. Such grain banks can also serve to enhance community food security. *Seed banks* meanwhile are set up as a way of saving seeds for next year's planting.

(Source: Christian Aid)

Strengthening community resilience by conserving local seeds

Long periods of drought are becoming more common in much of Sub-Saharan Africa, and are predicted to become more widespread as a result of global climate change. The Tharaka District lies in the arid and semi-arid area of North-central Kenya. Soils are acidic, of low fertility, and rainfall is unreliable and below 600mm. The main crops are sorghum, millet, cowpeas, green grams for food, and cotton as a cash crop. Farmers have sustained their livelihoods by selecting seed from varieties that yield best under difficult conditions to plant the following season. Poor farmers do not have the cash to buy new seed from merchants, and the commercial varieties are often less suitable for drier conditions.

In the past, communities could rely on a few farmers who would produce seed and save enough to supply others when their crops failed due to drought or because they had been forced to eat their precious seed stock. But recurrent drought undermined these traditional seed-storing and sharing practices and led Intermediate Technology Development Group (ITDG) East Africa to run a programme to improve seed security in Tharaka from 1994 until 2000. The programme focused on conserving local plant genetic resources through seed bulking, seed banking, and seed shows.

To establish a **seed bank**, seed must first of all be 'bulked' – produced in sufficient quantity for enough to be available for storage. Training on the managing of plots for seed bulking took place before training on managing seed banks in which to store the bulked seed. Each member of a seed bank group is required to deposit two portions of at least 1kg of seed of each variety they grow: one portion for their own use, one for the group. At planting season, members withdraw part of their own deposit; the group uses its portion for income generation or for issuing to members wanting to try different varieties. A committee ensures that all seed entering the bank is of top quality: clean, dry, pest free and mould free. By ensuring access to seeds at the right time, the seed banks have enhanced food security and



Wendo Wa Musyi Self-help Group, Kathekani. The 16 group members agree criteria for selecting seed for the community-run seed bank. They check on maturity (early maturing preferred), growth vigour, whether they are pest and disease free and true to type. Seeds are then extracted, sorted in terms of size and quality, and stored. At planting time, group members can withdraw a portion of the seed they've banked in their group store. Showing members of the farming group harvesting grass seed.

conservation of local plant diversity. Since forming in 1997, one group has expanded its collection from 57 to 140 varieties of local crops.

Seed shows enable farmers to sell or exchange surplus seeds, to obtain new seed varieties, and to exchange and share information on the best crops for local conditions. ITDG first developed seed shows

in Zimbabwe and decided to introduce the idea into the Tharaka District where locals now run them. Each year the number of exhibitors, crops and varieties of seeds displayed increases; an important benefit is the renewed belief in the values of traditional crop varieties, especially by younger farmers.



Maragwa Seed Show 1998. A woman farmer exhibiting the many different seed varieties that she uses.

Despite these examples of local progress, the importance of farmer-led conservation of agricultural biodiversity is not appreciated in many countries. Many agricultural departments still view the cultivation of traditional varieties as backward and unproductive while policy-makers need to be influenced so that governments also support seed banks.

(Source: ITDG)

What hope for coping strategies? The Tuareg in the Sahel

Since 1990, local organisation JEMED has been working with the semi-nomadic Tuareg people in Niger to reduce their vulnerability to drought. The Tuareg are well adapted to surviving in the Sahel's dry, marginal land – if pastures fail in one area they move on, taking everything with them. However, the great droughts of 1973 and 1984 decimated herds, and subsequent droughts in 1993–4 and 1997–8 have thwarted recovery, and climate change means that already dry areas are likely to get drier. The combination of droughts and the need to graze herds has had a devastating effect on the land, causing famine and poor health.

Women bear the brunt of the famine. While men are forced to leave their communities to search for new pasture for their animals, women are left behind to try and feed their families, foraging for fruit, borrowing from neighbours, and also going to find work. When the food runs out, the Tuareg are forced to sell more of their animals – which represent their only wealth and long-term security.

The Tuareg people reasoned that it was better to make some changes and adjustments now, and lose only some of their traditions, than do nothing and lose their whole way of life. At their request, JEMED has been helping communities establish 'fixation points' to enable them to survive the changes that desertification and increased population have brought. These do not settle people permanently, but build on a tradition that the Tuareg would spend part of each year camped in a particular place.

The fixation point helps the community better manage and use the resources of the surrounding area and protect them from encroachment by farmers. Fixation points also enable communities to develop a social infrastructure and education, training, health, and agricultural projects, while keeping hold of many of their traditional pastoral

ways. Each fixation point has a management committee made up of, and elected by, members of the local community.

The first step is to build wells. In 2002, JEMED assisted three communities to dig a 95-metre-deep well at three points, providing water for all human and animal needs in each community. This directly benefits 390 families, accounting for about 2,000 people. Another 750 more people who pass through also benefit. At each point, cows are loaned to the neediest families to help them re-establish their herds. This results in an increased milk supply, which improves health. The produce from the herds can be sold to provide a small income.

JEMED has also helped communities conserve scarce rainwater by forming a low dike of stones across valley contours. When the rains come, the stones slow the flowing streams, causing water to sink deeper into the soil. Behind the dykes, the Tuareg have been able to plant wild wheat. In Intikikitan, an established dyke has increased moisture levels to the extent that plant species not seen for half a century have returned.

These measures mean thousands of Tuareg families are more prepared to face and survive drought, and

to build up their assets in good years. Their recent experience shows remarkable human endurance and adaptability, but a future of progressive global warming may well push them beyond their abilities to adapt and cope.

(Source: Tearfund)

Climate change and the water crisis in central Asia

Global warming could tip the former Soviet states of central Asia into conflict with each other over access to water. Meanwhile, for ordinary people, it is already worsening their many difficulties.

In the summer of 2004, Tajikistan was hit by serious floods and landslides. Half the capital, Dushanbe, was without safe water, and the only road between Dushanbe and Khujand, the second city, was cut along 25km, with many bridges also swept away. Economic damage was severe. In 2000/2001, in response to the worst drought in 74 years, Oxfam began working in Tajikistan, the poorest of the five new nations. In the most affected area, 200 hand pumps were installed to alleviate water shortages for some 9,000 people. The background to the drought is a general increase in average annual temperatures of between 0.7°C and 1.2°C; partly because of this increasing aridity, Oxfam is extending its development programme, including introducing farmers to new drought-resistant and less water-thirsty plants. Yet paradoxically, because Tajikistan has a complex, mountainous landscape, floods and landslides have also become more frequent and more severe in other areas. In 1998, such a flood swept away a pumping station on the Qizil Soo (Red) river, depriving some 7,000 people in six villages of clean water. Oxfam engineers are helping local people to renovate the pumping station, and are strengthening the riverbanks to guard against another flood.

Global warming is by no means the main cause of the region's water problems, which are man-made in another way. In theory, there should be plenty of water for all. The central Asian countries are locked into an unsustainable spiral of expanding water-intensive cotton farming, and have inherited what were already hopelessly inefficient and wasteful irrigation systems. Now that Soviet subsidies have dried up, there is no longer the money to maintain

what was an already dilapidated infrastructure. Deforestation adds to flooding problems, and Tajikistan suffered a civil war, which further damaged infrastructure. Now, nearly a quarter of the population uses irrigation channels – contaminated by farm chemicals – as its main source of drinking water. Meanwhile, far downstream, the Aral Sea continues to shrink, exposing the fertiliser and pesticide dust washed into it from Soviet cotton fields and creating a toxic wasteland for people living on its shores.

But global warming could be what precipitates a crisis, tipping people over the edge just as it threatens to in other places around the world. In particular, melting glaciers are causing grave concern. Tajikistan generates 55 per cent of all the water in the Aral Sea Basin – which it shares with four other countries; much of that water comes from glaciers. Neighbouring Kyrgystan contributes another 25 per cent, yet the country's glaciers have shrunk by 35 per cent in the last 50 years. Kazakhstan's capital, Almaty, depends on water from the fast-shrinking Tien Shan mountain glaciers.

In mountain valleys, melting increases the risk of floods and landslides as glacial lakes burst. Downstream, it is likely to increase competition for water. Many experts have pointed out how the regional water-sharing systems, once closely woven together by Soviet design and management, have unravelling, and must be managed by five fractious and poverty-stricken new countries (and also Afghanistan) that have shown relatively little willingness to co-operate, each wanting more water for national development.



Shibanai village, Tajikistan, after 24 hours of heavy rain. The drainage canal has silted up. When it rains, blockages increase the danger of burst banks and flash floods. Water is slowly seeping up the walls of the houses. Mosquitoes are attracted to the stagnant puddles. Oxfam has paid for a mechanical digger to clear the canal.

Oxfam has encouraged local civil society to begin to debate how Tajikistan can manage its water resources fairly and efficiently and move away from cotton-dependency, so that ordinary people obtain the safe water they are entitled to and the country develops equitably and sustainably. At the same time, dialogue will need to encompass Tajikistan's neighbours so that water becomes a source of peace and not of conflict.¹⁹

(Source: Oxfam)

Health

As global warming increases, it becomes clearer that it will lead to serious impacts on human health around the world. These effects will be direct and indirect. Indirect effects will happen because of the close relationship between climatic conditions and insects and rodent populations. This in turn will affect diseases such as asthma, as well as increase the range of vector-borne parasitic diseases like malaria and leishmaniasis. Food-borne diseases are likely to increase as a result of warmer temperatures. Water-borne diseases may also increase because of extra demands on diminished water supplies, which will in turn increase the risk of contaminated supplies reaching the public.

According to the World Health Organisation (WHO), UNEP, and the World Meteorological Program, at least 150,000 people die unnecessarily each year as a direct result of global warming.²⁰ Warmer and wetter conditions could trigger unprecedented levels of disease outbreaks in both humans and the natural world, and undermine the MDGs to reduce child mortality; improve maternal health; and combat HIV/AIDS, malaria and other diseases. Every year, nearly 11 million young children die from mainly preventable illnesses.²¹ The impact of climate change on water supplies is likely to increase cases of diarrhoea, which claims the lives of nearly two million children every year.²² Malaria, which is already the second leading cause of death in the world for 5–14-year-olds, is expected to reach unprecedented levels because of climate change.²³ It has been estimated that 260 to 320 million people are likely to find themselves living in areas with potential malaria infestation by the year 2080. This will lead to increased expenditure for poor countries. Climate-change-related disasters can also drain public resources for health care.

Variations in extreme weather typically associated with the *El Niño* cycle are likely to become more common and more intense. *El Niño*, a natural phenomenon, is associated with warming sea surface temperatures across the central and eastern equatorial Pacific Ocean. The last strong cycle of *El Niño* was in mid-1997 and continued through 1998; it had a major global impact. Estimates of global loss range from US\$32 billion upwards.²⁴ Across the Pacific, climate change may create more permanent *El Niño*-type conditions. Spending on health care in Bolivia, Chile, Ecuador, and Peru fell by 10 per cent, due to the fall in GNP after the *El Niño* cycle in 1982–83. *El Niño* also has a dominant, but poorly understood, influence on climate patterns in Africa.²⁵

Direct effects will include heat stress, with associated cardio-vascular effects, as well as the physical and psychological impact of storms, floods and other extreme weather events. Even in wealthy France, there were thousands more deaths above the seasonal average during the summer of 2003 following a particularly powerful heatwave. These effects will be especially powerful in the developing world, with

its less-developed and poorly funded healthcare infrastructure. But there is another social cost connected to the current energy system that drives global warming: It results directly from the burning of fossil fuels.

Strong evidence comes from large US studies and points to global implications. According to researchers at Harvard University's School of Public Health,²⁶ air pollution from combustion processes that produce ultra-fine particles from cars, lorries, and power plants, is killing roughly 60,000 Americans each year. This represents about three per cent of all US deaths every year. Every combustion source is contributing to the death toll; none is benign, including incinerators; cement kilns; soil burners; flares and afterburners; industrial and residential heaters and boilers; cars; buses; trucks; and power plants.

Such direct impacts increase or decrease in proportion to our use of fossil fuels. The Working Group on Public Health and Fossil Fuel Combustion compared the health impact of two carbon emission scenarios, a 'business-as-usual' scenario based on trends in energy consumption forecast by the IPCC, and a 'climate-policy' scenario where developed and developing countries undertake significant reductions in carbon emissions.²⁷

Adoption of the climate-policy scenario was estimated to avoid 700,000 premature deaths each year as a result of reduced particulate pollution with the greatest effect in developing countries. These benefits are cumulative, so that over a 20-year period, adoption of climate policies could avoid a total of eight million deaths, globally including 6.3 million in developing countries. A subsequent World Bank study modelled particulate health impacts for China. Under a business-as-usual scenario, it predicted 600,000 premature deaths, more than five billion restricted activity days, 20 million cases of respiratory disease, and an annual health cost of \$98 billion by 2020.

Energy²⁸

For years, the superpower politics of the Cold War blocked efforts to end global poverty. Today the hot war of energy economics and global warming presents an enormous obstacle.

We know that climate change already affects the poorest people in the poorest countries. We also know that from Nigeria to the Middle East and Latin America, the extractive industries leave behind them a wake of corruption and conflict.

But now there is another big problem. A considerable body of evidence indicates that we are living on the cusp of the so-called 'Hubbert Peak' of oil production. If so, it means that the \$40-per-barrel and more oil price spikes of 2004 will be just the first tremor of an impending earthquake in the economic Richter scale. The

point at which global oil production peaks and begins its decline coincides with endlessly rising demand. The result depends on whether that decline is long and slow – or short and rapid; if the latter, then the chances of global economic chaos are high.

Some mistakenly think that declining oil reserves means that climate change will solve itself: the problematic fossil fuels will simply run out, so end of problem. Unfortunately there are more than enough fossil fuels left – especially coal – to trigger catastrophic warming.

Following the 1979 oil price shock, rich countries' fear of inflation created a triple blow for their poorer relations: falling demand, export price collapses, and sky-high real interest rates which laid the foundations of a massive debt crisis. Bad as it was, there were ways out then that, today, due to climate change and the Hubbert Peak, will no longer be available.

Fossil fuels collectively account for about four-fifths of the global primary energy supply. Oil makes up over 40 per cent of our energy consumption. Without intervention, the International Energy Agency (IEA) predicts “*A future in which energy use continues to grow inexorably (and) fossil fuels continue to dominate the energy mix.*” But the dominance of dirty energy is not a natural state or a rational economic choice. It's largely the consequence of massive, perverse subsidies poured into coal, oil, and gas, and the failure to internalise the cost of their environmental damages. Good estimates put the global scale of subsidies, including the OECD at a minimum of \$235 billion per year. The share of energy research money going into renewables stood at just over eight per cent after the 1970s oil shocks yet, as awareness of climate change grew through the 1990s, it fell to just over seven per cent. As recently as 2003, fossil fuel projects represented 86 per cent of the World Bank's spending on energy, and renewables represented just 14 per cent.

The situation is absurd because renewable energy is super-abundant. It provides a triple win for human development and an exit strategy from the multiple problems of fossil fuel addiction. Globally, renewables account for about 13 per cent of energy supply, although some of the cleanest forms, including solar, wind, geothermal, and tidal currently account for less than a quarter of that. They have the potential, however, to meet all human energy needs. Small- and medium-scale applications are particularly well-placed to improve the lives of the 1.6 billion people globally who have no access to electricity, four-fifths of whom live in rural areas often remote from ailing national grids. The *theoretical* potential of the main clean renewable sources is over two million times greater than current use. Even the more limited *technical* potential means that, according to research for the Bonn 2004 International Conference on Renewable Energy, we could increase uptake by a factor of 120.

But renewable energy technologies are much more than mere potential as a set of awards for best practice, run by the Ashden Trust, show. From saving the sight and lungs of urban street traders and home cooks by using solar lanterns and eco-stoves, to solar powering communication systems for flying doctors in the rainforest and getting electricity to remote mountain and island communities – renewables are already delivering human well-being in some of the most difficult human circumstances. They also inoculate against the economic, environmental and political shocks linked to fossil fuels.

One major obstacle remains, however, to the mainstream uptake of renewable energy in the developing world where they attract only one to three per cent of energy investment. Highly polluting fuels, like brown coal, are plentiful and cheap. A global framework with major incentives is needed to encourage the shift, and forego growing dependence on oil and coal.

For this revolution to happen there has to be a managed withdrawal from fossil fuels towards the uptake of cleaner low-carbon technologies – one that gives developing countries their equitable per-capita shares of the remaining carbon cake that it is still safe to burn. The type of framework which will best do this is a matter of debate. For example, there is the ‘contraction and convergence’ scheme proposed by the Global Commons Institute. It works in stages: agreeing a precautionary concentration target for greenhouse gases; setting an emissions budget to reach it, assuming that everyone in the world has an equal entitlement to pollute; and then politically negotiating both the period of time and rate with which the target is met and equal entitlements are achieved. In the process of shrinking and sharing greenhouse gas emissions, spare entitlements can be traded to generate income for ‘under-polluting’ countries.

Another approach is the Climate Action Network (CAN) framework. It promotes a multi-track approach for mitigation and adaptation. Based on the Kyoto framework, it calls for industrialised countries to act first in meeting their obligations to reduce emissions, to help fund development of clean technologies in developing countries as well as the adaptation needs for the more vulnerable countries. It is based on a combination of factors for equity and fairness – including per-capita emissions, ability of a country to pay, and historical responsibility in allocating emissions targets and choosing approaches to mitigation.²⁹

Any framework that builds on the current Kyoto Protocol will have to deal with the sense of historical injustice about rich countries' ecological debts, or the dawn of renewables will be derailed.

Extracting the World Bank from fossil fuels

International Financial Institutions (IFIs), such as the World Bank, have long been criticised for their failure to deliver on poverty alleviation, development, and environmental protection. Controversies surrounding these institutions' involvement in the oil, mining, and gas sectors led the president of the World Bank, James Wolfensohn, to commission an independent review. Questions were being asked about whether investments in oil, mining, and gas met the World Bank's overarching stated objective of poverty alleviation. This resulted in the World Bank Extractive Industries Review (EIR).

Taking three years, the EIR concluded in December 2003 following consultations with multinational corporations, national governments, affected communities, and civil society representatives. The task was to assess the poverty alleviation potential and consistency with sustainable development principles of World Bank investments.

Such a spotlight exposed many problems. On average, 80 per cent of the energy produced by World-Bank-financed extractive-industry projects are exported to the rich industrialised countries. The financial revenues obtained by the host country are minimal and project benefits very rarely reach those on the ground. According to Archbishop Desmond Tutu, the consequences of these projects, particularly for indigenous peoples and local communities are too often *"war, poverty, climate change, greed, corruption, and ongoing violations of human rights"*.³⁰

The EIR concluded, that in the vast majority of cases, World Bank extractive-industry investments had not alleviated poverty and had failed to promote sustainable development. The review, and a parallel report of the World Bank's own evaluations department, concluded that in countries with weak governance, extractive-industry lending is not a suitable use of World Bank funds, failing the Bank's stated mission. The EIR also concluded that free,

prior, and informed consent of affected communities, respect for human rights, and the protection of internationally established no-go zones in areas of armed conflict and sites of high spiritual or scientific value, must be pre-requisites.

The EIR recognises climate change as an issue that will affect the world's poor the most. Using public money to subsidise projects managed by multinational fossil fuel energy giants, where the vast majority of energy is exported, is a fatally flawed strategy for poverty alleviation, more often leading to conflict and corruption. The EIR therefore recommended that the World Bank should stop financing oil and coal projects by 2008.

IFIs often provide the essential economic guarantee and public legitimacy that allow extractive-industry projects to go ahead. So when the World Bank announced in August 2004 that it was not going to implement the EIR in full, it was a huge blow to sustainable development.

(Source: Friends of the Earth)

Community hydropower in Kenya changes energy policy

Two community hydropower schemes in remote areas of Mount Kenya, Kathama and Thima, between them serve over 200 households. The projects provide lighting, radio and telecommunications for the households, income generation from chicken farming – electric lighting provides warmth, increasing productivity – and a means to charge batteries. By replacing kerosene wick lamps, cutting the need for 18 tonnes of kerosene each year, the equivalent of 42 tonnes of carbon is saved.

ITDG East Africa, in collaboration with Nottingham Trent University and the Kenyan Government, installed the schemes in association with local communities. The communities provided building materials, land for the turbine house, and labour and financing towards the scheme. They also manage, operate and maintain the projects on their own. They pay monthly charges for power supply, and share their experiences with other communities across the country. The schemes have proven cost effective, as households now pay less for a better quality of lighting, and the project has been financially self-sustaining for the past three years.

From practice to policy – developing appropriate technology

These small-scale projects help develop an appreciation of the practical problems associated with decentralised energy schemes and highlight the policies needed to support them. In brief:

- The schemes have demonstrated that despite being small scale they are operationally and technically viable.
- They can contribute to developing national standards and codes of practice for low-cost, off-grid, small hydropower schemes.
- There is a need to build more local-manufacturing capacity so that the turbines and their components are readily available.

The aim of the project was to demonstrate the viability of small-scale community-managed hydropower in Kenya, where less than four per cent of the population have access to the electricity grid. By directly involving the Kenyan Ministry of Energy from the start, the successful implementation of the project has influenced national policy and contributed to the reform of Kenya's new energy policy and Electric Power Act.

Usually, the key constraint to replicating and expanding such projects is a monopoly structure in the power sector, prohibiting independent private power producers. The project has demonstrated the viability of micro hydropower in reaching communities far from the national grid, and the Government has now drafted policies recognising the approach. The current project has been operating with special permission from the Government, but other schemes are expected to follow once the revised policy becomes operational. ITDG has received expressions of interest for new small hydro schemes from over 60 communities. Estimates show that Kenya has about 3000MW potential power from micro hydro.

(Source: ITDG)



Ndundu village, Thima, Kirinyaga district, is one such site. 160 households are able to light their homes from this scheme. View of power house and community members. Kinyua, trained in how to maintain and manage the system says, "We did not believe it was possible to make electricity from such a small stream but Ndundu Village had its best Christmas ever."

Seeing the cook for the smoke: climate, biomass cooking, and health³¹

More than a third of humanity, 2.4 billion people, burn biomass – wood, crop residues, charcoal, and dung – for cooking and heating.³² Biomass energy accounts for approximately 80 per cent of the current global renewable energy supply. About half of the population in developing countries relies on biomass energy; in Africa, this rises to 73 per cent.

Traditional biomass fuels have significant drawbacks. Burnt on open fires and rudimentary stoves, the smoke produced from these fuels is the fourth greatest risk factor for death and disease in the world's poorest countries. It is linked to 1.6 million deaths per year.³³ The smoke makes lungs vulnerable to illnesses like pneumonia and chronic obstructive pulmonary disease. In addition, rural women and children spend a significant portion of their time gathering and collecting biomass fuel for cooking and space heating. What can be done?

Billions of people would lead a healthier life if their exposure to high levels of smoke was reduced. Public awareness of the health risks of smoke is a crucial first step. The most effective way to reduce smoke in the home is to switch to a cleaner fuel, such as liquid petroleum gas (LPG), kerosene, or modern biofuels, such as biogas. However, the vast majority of people at risk are too poor to change to a cleaner fuel, or have no access to modern fuels. In these homes, the answer will be to reduce exposure, by using cleaner, more efficient, and better-ventilated stoves.

Cleaner fuel and climate change

Traditional biomass fuels have a complex relationship with climate change. Using solid biomass fuel usually produces higher greenhouse gas emissions per meal than fossil fuels, kerosene and LPG, even where the biomass fuel is harvested sustainably.³⁴ This is due to inefficient combustion of the biomass fuel releasing products of incomplete combustion – such

as methane – which have a greater greenhouse potential than carbon dioxide. However, biomass energy can be a clean, affordable and environmentally friendly source of energy if it is used in an efficient and effective manner. A combination of solutions will be required to meet the differing needs of diverse communities while minimising the environmental impact, as demonstrated below.

Experience in Sudan, Kenya, and Nepal

Working with communities to select solutions that suit their own needs, ITDG is collaborating with partners in three different locations to help beat indoor air pollution. In each place the choice of technology was influenced by culture, cost, geography, access to fuel, and climate.

In the displaced person's settlement in Kassala, Sudan, the community identified LPG as an appropriate solution once microfinance was made available to cover the initial cost of the stove. The scheme is popular, and already others outside the project are using the 'revolving-fund' credit system to buy stoves. Fuel costs are much lower for LPG than for charcoal and wood in Kassala, so repayments can be offset by reduced fuel costs.

In the communities around Kisumu town in Kenya, wood fuel is much cheaper than LPG and is often free, so most households have elected to continue using biomass. Smoke hoods and eaves spaces with fuel-efficient stoves are proving effective.



Reducing indoor smoke with a combination of an improved stove, smoke hood and eaves space in West Kenya (photo: Nigel Bruce/ITDG).

In the cold, mountain village of Gatlang in Nepal, solutions have been more difficult to identify, as energy is needed to heat the house as well as to cook the food. It is remote, making LPG or kerosene unavailable. Home insulation has been chosen for retaining room heat whilst reducing the need to burn fuel wood for space heating. Smoke hoods are currently being developed, along with improvements to the traditional stove to reduce fuel use.

(Source: ITDG)

The Solar Island

Six kilometres off the mainland in West Bengal, India lies sacred Sagar Island. Although home to just under 200,000 people spread over 43 villages, each year in January more than one million visit on pilgrimage for the Gangasagar Mela festival. But Sagar Island is now becoming the focus for a new kind of pilgrimage, one where people are travelling to see how medium-scale solar power is meeting the needs of thousands of people who, like millions of others, are unable to access energy from national grid.

Beginning in 1996, the West Bengal Renewable Energy Development Agency now operates nine stand-alone solar photovoltaic power plants that provide grid-quality electricity. The Agency works in co-operation with rural energy development co-operatives formed by the beneficiaries of the power supply, an original feature of initiative. Over 1,600 families also benefit from solar powered home lighting systems and 58 shops and businesses are getting stable power supplies. Before solar power, arrived the island depended on expensive and inadequate diesel generators. More recently a wind/diesel hybrid power plant has been added to the energy mix.

The solar ambitions of Sagar Island are bold. Importantly, the initiative to set up the power plants comes from the local village government Gram Panchayet level. Apart from bringing electricity to homes the mini-grids also aim to power schools and health services. The project also integrates power with water supply systems bringing drinking water to the island's homes. Jobs have been created directly and the local economy has benefited as new lighting and power allows local businesses, markets and home workers to work more cleanly, efficiently and safely outside daylight hours.

Gon Chaudhuri, the award-winning, dynamic director of the Agency,³⁵ emphasises that local people fully understand and promote the radical environmental improvements that solar brings, "Sagar Island has its unique ecosystem. It falls under the Sunderbans delta. Diesel power generation is responsible for environmental degradation not only in Sagar Island but in the entire delta zone. Solar energy is totally eco-friendly. There are no emissions and no sound pollution from solar PV. Local people are now very conscious about the protection of the environment of 'Solar' Island." Chaudhuri is unlikely to stop until everyone on the island has access to a solar mini-grid.

(Source: *The Price of Power*, nef)

Disasters

After a decade of UN conferences designed to end poverty and save the global environment, disasters – driven or exacerbated by global warming – could spell out the end of human development for the poor majority, and perilous political and economic insecurity for the rest of the world.

The number of people affected by disasters – a definition that includes being physically injured or made homeless – has grown enormously. According to the *World Disasters Report*, published by the International Federation of Red Cross and Red Crescent Societies, it is up from 740 million in the 1970s to over two billion in the last decade. The figure includes a kind of double counting as some people are repeatedly affected, but this merely emphasises how increasingly difficult it is for people and communities to recover. Reported economic losses have increased five-fold from \$131 billion in the 1970s to \$629 billion in the 1990s. And the number of reported disasters rose three times from 1,110 to 2,742 in the same period. The South Pacific has seen a 65-fold increase in the number of people affected by disasters in the last 30 years.

Massive disruption to the earth's hydrological cycle means that millions will become trapped between the extremes of floods and droughts. Global average rainfall is projected to increase during the 21st century and sea levels are expected to rise by up to one metre.³⁶ As a result, the IPCC predicts that there will be a "widespread increase in the risk of flooding for many human settlements".³⁷ Indeed, according to the IPCC, flooding and landslides pose "the most widespread direct risk to human settlements from climate change".³⁸ It's estimated that by 2025 over half of all people living in developing countries will be highly vulnerable to floods and storms.³⁹

But the IPCC also predicts that as a result of global warming, there will be increased droughts during the 21st century. Most mid-latitude continental interiors will be hit by droughts occurring with *El Niño*-type events.⁴⁰ It also predicts that climate change will lead to "decreased water availability for populations in many water-scarce regions, particularly in the sub-tropic".⁴¹ Not only will water become scarcer, but the quality of available water will deteriorate.

Food chains are increasingly likely to be disrupted in sudden and unexpected ways. For example, climate change has led to the warming of the North Sea and a change in its plankton – microscopic plants and animals upon which all higher sea life depends, directly or indirectly. Apparently, as a result of these changes, populations of small fish known as sand eels – the prey for both larger fish and birds – have collapsed, as have seabird populations off Northern Scotland. This type of event is likely to occur more frequently affecting both people and wildlife.

More disasters related to global warming seem inevitable. How the international community responds to them will be vital. And following on from immediate response, intelligent recovery from disaster is an important strategy to reduce vulnerability the next time a flood or drought strikes.

The ecology of disaster recovery⁴²

Recovery for whom, or of what, is the question that hangs over any effort towards post-disaster reconstruction. What is the end in mind when designing an economic reconstruction plan? Is it targeted towards creating maximum resilience and sustainable livelihoods in the disaster-affected area? Or is its prime aim re-gearing economic infrastructure to meet more abstract economic targets? Being clear about objectives makes it more likely that appropriate strategies will be found.

Post-disaster economic reconstruction will only work if it takes an integrated approach respecting the subtle dynamics of communities' economic, political, and cultural lives, and how these interact with the natural environment. It is more important to ask people what they need to recover their daily lives, than to rush in foreign contractors to rebuild risks in the familiar shape of major engineering works. Resilient, inclusive, and democratic local economies are the best inoculation against the multiple risks wrought by disasters.

A recipe for post-disaster economic recovery could include initiatives to:

- Plan for climate change: Low-carbon development strategies are needed everywhere to minimise the increasingly hostile greenhouse effect. Risk reduction strategies must be built into disaster recovery plans.
- Forge sustainable livelihoods through rebuilding diverse local economies to meet local needs as the foundation for human recovery. Maximise contributions to the micro/small business sector, and minimise environmental impact.
- Create employment, not just wage labour, to maximise long-term secure work, self-help and self-employment. Ensure that the particular employment needs of women are addressed, such as day care for children.
- Set local procurement targets in disaster response to maximise local economic recovery. Use grants and microcredit schemes to increase support to micro/small businesses and co-operative enterprises. Ensure reconstruction prioritises secure local employment as an immediate need.
- Measure the effectiveness of reconstruction with a Local Multiplier Effect ratio.⁴³ This would be a new measuring tool to indicate real contributions of aid and investment to the affected area and could help plug the economic leaks. Aid interventions must not undermine incentives for local production or distort markets by undercutting local producers.

- Improve access to resources for the poorest, such as microcredit, land, livestock, and farm inputs. This will not necessarily be solved by more foreign direct investment, which – because of higher-than-usual demands for returns – can drain resources from poor, high-risk economies.
- Strengthen democracy to improve recovery planning and efficiency, through: stakeholder councils, citizens' juries, and local micro/small business alliances for participatory planning from the pre-disaster phase through to relief and reconstruction.
- Focus on community disaster resilience as the primary economic goal of reconstruction rather than export-oriented production. Beware of the economic and environmental vulnerability linked to dependence on a few cash crops. Focusing only on export crops can displace local, community-serving activities.
- Create new resource-raising mechanisms: more grant finance, not tied aid, from rich countries; deeper debt relief; and legal compensation for the effects of climate change are needed to compensate low, fossil-fuel-consuming countries for the ecological debt of industrialised nations.
- Safeguard natural resources that buffer the elements. Prioritise conservation efforts to protect natural buffers against climate-related disasters, for example, mangroves, forests, coral reefs, natural river deltas, etc.

Lifting people out of poverty is the best way to reduce the number who have to be lifted out of mud, floodwaters or drought when disasters strike. Investment in local-level economic recovery is better at creating disaster-resilient communities than investment which depends on dams, dykes, and concrete.

Living with disasters in Bangladesh

In Bangladesh, extreme weather events have always been a fact of life; floods, typhoons, and river erosion endanger human lives and affect livelihoods annually. Increasingly, the impact of these disasters is being exacerbated by global environmental change. Scientists have warned that, through sea-level rise, 20 per cent of the land of Bangladesh may eventually be under water. Already, typhoons and floods show increased severity.

ITDG has been working with flood-affected communities to increase their resilience to these environmental shocks using a process called Participatory Technology Development. It involves communities identifying technological options, farmers and communities experimenting, followed by self-assessment and reflection.

In communities severely affected by floods, the technologies developed cover livestock, and crop and fish production. Where livestock is concerned, help with managing feed and disease control during flood periods, and homestead rearing of poultry in pens has improved the survival of household livestock.

Growing vegetables at home is helped by digging pits and enriching the sandy soil with manure for crops like chillies and gourds. Sticks mark pits during flooding. Training in how to grow trees and crops during flood periods enables people to be ready for planting-out when floodwaters recede. Another initiative is developing water-resistant fruit trees by grafting onto different flood-tolerant root stocks.

One technology with great potential is the management of small seasonal ponds for native fish breeding alongside the rearing of stocked carp.



A natural channel of the river is shown which has been modified by earth embankments for use as a closed resource and catchment area for fish culture. The fish including carp will be available nine months of the year. This process involved consensus building over access to the water for the poor. This is a pilot project that ITDG is helping to develop and, if successful, other physical barriers can be more simply erected using netting.

Using cages suspended in floodwaters for fish breeding enables the poorest people to benefit from natural resources. The production of cultivated species rose by 50 per cent in one year. Wild fish production increased three-fold as a result of new

conservation and stocking initiatives. In one community, 48 people are managing a water area that extends up to 24 hectares during the rainy season. Poor people have limited access to, and control over, natural water basins, but it is easier to negotiate access to this type of small-scale or medium-size water resource.

New research is being carried out on how to manage native fish with fish culture of larger edible species, and on the interaction between wild and stocked species in semi-closed aquatic systems.

Long-term sustainability of this approach is ensured by training local people who provide technical support and farming inputs to their fellow villagers and are paid by them for their services. So far, over 100 rural community-based workers are now selling their services to the community.

(Source: ITDG)

Shelter from the storm: cyclone protection in Bangladesh

In May 1997, a ferocious cyclone hit the Cox's Bazar region in Southeast Bangladesh. It was the sort of extreme weather event likely to become more common under global warming. The cyclone brought winds of 150 miles an hour and lasted for over 10 hours, leaving a million and a half homeless, but only 100 died. It was more ferocious than the one in 1991 when 140,000 were killed, yet the death toll was small by comparison. This was due partly to the fact that the cyclone struck during daylight and at low-tide. However, new cyclone shelters and people trained to alert their community of the impending dangers were also key factors in saving lives.

The Christian Commission for Bangladesh (CCDB), Gonoshasthaya Kendra and other NGOs supported by Christian Aid had built a number of cyclone shelters, mostly on stilts. Used as community centres or schools in normal times, when the cyclone struck they provided refuge to the whole community. The low-lying island of Moheshkhali was one of the areas worst hit by the cyclone. Most villagers were left homeless but because of the cyclone shelter all survived.

Other programmes to protect against cyclones and flooding include building embankments and homestead and community land raising. Local organisations are supporting villagers with 'cash-for-work' programmes where earth is moved to build up platforms of earth, to rebuild homes, school playgrounds or other communal areas at a higher level, or so that large groups of people can take refuge. The people living around the Bay of Bengal are used to cyclones, but climate change is likely to increase both the frequency and the intensity of cyclones in the region.

(Source: Christian Aid)



Flood damage in Bangladesh (Photo: ITDG/Janet Boston)

Environment

Global warming is itself a defining environmental phenomenon for our time. But due to its complex nature, it has enormous implications for ecosystems the world over. The first extinction due to climate change has probably already occurred: the golden toad of Costa Rica.⁴⁴ Many believe that domino-like environmental effects triggered by existing levels of climate change are already underway. For example, as glaciers and ice shelves shrink, less heat is reflected back from the earth's surface. In some areas, warming also leads to forest die-back releasing more carbon into the atmosphere.

Vitality, the web of life upon which our food chain depends – our biodiversity – is under attack, from climate change, the pressures linked to the expansion of human settlements and the current paradigm of intensive agriculture using only a few crop varieties. Often, the ecosystems that are under threat are also ones essential for people's livelihoods, or important defences against the hostile elements. The science journal *Nature* reported threats of extinction for up to over one third of land-based plant and animal species by 2050 as a result of climate change.⁴⁵ Threats to coral reefs, with their high sensitivity to changes in sea temperature, and their direct link to human livelihoods, provide one of the clearest examples, but there are many more.

A forest of loss

Forests play four major roles in relation to the climate.

- They currently contribute about one-fifth of global carbon emissions when cleared.
- They react sensitively to a changing climate when managed sustainably.
- They produce wood fuels as a benign alternative to fossil fuels.
- They have the potential to absorb about one-tenth of projected global carbon emissions into their biomass, soils and products, and store them, in principle, in perpetuity.

While the UNFCCC mentions forestry only briefly, the Kyoto Protocol deals with it explicitly. Article 2 mentions that industrialised countries shall “*implement and/or further elaborate policies and measures... such as... promotion of sustainable forest management practices, afforestation and reforestation*” in helping to limit and reduce their greenhouse gas emissions.

About 350 million of the world's rural poor and forest-dwelling indigenous peoples depend on forests for their home, livelihoods, and energy supply. Forests contain literally millions of types of flora and fauna, as much as 90 per cent of the

world's land-based species. But industrial logging has resulted in the lands of indigenous peoples being overrun, forests being destroyed, and cultural traditions threatened.

Worldwide, 80 per cent of original forest cover has been cleared, fragmented, or otherwise degraded. Forests have virtually disappeared in 25 countries; 18 have lost more than 95 per cent of their forests; and another 11 have lost 90 per cent. Both temperate and tropical forests are being cleared at the rate of 23 ha per minute. The World Conservation Union recently calculated that about 12.5 per cent of the world's 270,000 species of plants, and about 75 per cent of the world's mammals are threatened by forest decline.

Large-scale industrial investments in timber extraction and plantation forestry do not have a known track record of contributing to sustainable development. To date there is little scientific evidence that large-scale commercial logging can be conducted in primary forest in an environmentally sustainable manner and deliver development benefits to local people. The IPCC showed that plantations can damage biodiversity if they replace trees with grassland, wetland, heathland, or shrubland habitats. But plantations of non-native or native trees can be designed to enhance biodiversity by encouraging the protection or restoration of natural forests.⁴⁶

In 2001, Governments at the 7th Conference of the Parties to the Climate Change Convention (COP7) put the final touch to the decision that allows forests to be used as a 'carbon store' to help countries reduce their net emissions. These projects are eligible for credits under the Kyoto Protocol's Clean Development Mechanism.

Friends of the Earth and others have campaigned to oppose the inclusion of 'carbon sinks' into the Protocol. There are huge uncertainties and accounting problems involved. Furthermore, the faster a tree grows the more credits can be gained. This is an incentive for large-scale industrial tree plantations which can generate poverty and inequity, damage food security, deplete water and soil resources and slash biological diversity. Planting trees rather than reducing emissions from fossil fuels will not save the global climate and will do little to protect biodiversity.



Raised well in Northern India (Photo: Tearfund/Caroline Indy)

The Plantar forestry company in the state of Minas Gerais in Brazil has large monoculture eucalyptus plantations covering 23,100 hectares, to be used to create charcoal to supply the pig iron and steel industry. The plantations were established at the expense of the existing mixed forestry and evicting local people. The company's social, environmental, economic, and cultural impacts were widely documented in recent research work carried out by the World Rainforest Movement which highlighted impacts such as appropriation of land and eviction of inhabitants, depletion and contamination of water and soils, deforestation, destruction of biodiversity, net loss of jobs, bad working conditions, loss of livelihoods, and risks to health, among others.⁴⁷

Burkina Faso's unplanned use of forests led to the deterioration of all forest areas around Ouagadougou, prompting a government decision to develop new management techniques. The project aims to develop a national programme for the sustainable and integrated production of wood and non-wood forest products, particularly fuel wood and charcoal. In an area 150km around Ouagadougou, 80,000 ha are being managed with the active participation of local people using simple techniques for silviculture. Supported by the UN Development Programme and the FAO, the Government of Burkina Faso has introduced a planned and more rational approach to forest resources. This has resulted in resource conservation and protection, as well as a 50 per cent income increase for local people, who are now able to fulfil urban demand for fuelwood and charcoal. Plans are underway for the management of a further 570,000 ha in Burkina Faso. Other Sahelian countries have expressed interest in adopting similar programmes.⁴⁸

The case for a 'Climate Impact Relief Fund'

The principal agenda of Northern, industrialised countries at international climate change negotiations has been to argue that all countries should have responsibilities to reduce greenhouse gases. Acknowledging that these mitigation responsibilities should take into account the different circumstances that countries find themselves in, as enshrined in the so-called 'principle of common but differentiated responsibilities' of the UN Framework Convention on Climate Change.

Developing countries, in contrast, are generally more concerned with the gap in historical responsibility for climate change between rich and poor countries and the unfair burden of climate change impacts, which fall heavier on the poor.

To bridge the divide, Benito Muller of the Oxford Institute for Energy Studies proposes a multi-lateral Climate Impact Relief Fund (CIRF). Too few funds are available to help poor countries deal with crises, and when climate-related disasters strike, the few funds that are available are often inequitably distributed and arrive too late on the scene. The CIRF would collect contributions from governments and other donors before rather than after disasters occur.

Although many questions and more detailed operational practicalities about this particular proposal remain outstanding, it is clear that the burden of climate-related disasters is increasing and that the international community's response needs to become more efficient and equitable. The proposed CIRF merits further exploration because:

- It would be a concrete, achievable, short-term goal.
- It could bring immediate benefits and reduce suffering for many people directly affected by climate change through more timely and efficient delivery of relief aid.
- It could add to and/or complement the drive to provide funds for adaptation to global warming, and prevention and preparedness.
- It builds on the existing specialist knowledge and expertise of emergency and humanitarian agencies.
- It helps to promote global climate justice and equity with a tacit recognition of the disproportionate burden of climate impacts on least developed countries.

Coral reefs cooked by warming climate

Coral reefs are vital to island and coastal communities that rely on them to support the fishing that provides their livelihoods. They are also complex and have the highest biodiversity of any marine ecosystem. They provide important services and direct economic benefits to the large and growing human populations in low-latitude coastal zones. The natural habitat of coral reefs near the meeting between land, sea, and air can be a stressful environment. Reef organisms have evolved ways to adapt and recover from such stresses over hundreds of millions of years.

However, recent global increases in reef degradation and die-back suggest that both the rate and nature of recent environmental changes are exceeding the capacity of coral reefs to adapt. This can lead to reefs being displaced by seaweeds and other non-reef systems. Such ecosystem shifts are already well advanced in the Caribbean region, where two of the major reef-building coral species have been devastated by disease. In the Indo-Pacific region, repeated episodes of lethal 'bleaching' suggest that reefs cannot recover sufficiently between such events.

This crisis is almost certainly the result of interactions between pressure from local human populations and global climatic stresses. The former includes direct destruction, coastal habitat modification, contamination, over-harvesting, and increased nutrient and sediment build-ups. The latter includes rising ocean temperatures implicated in chronic stress and disease epidemics, as well as mass coral-bleaching episodes and reduction in necessary calcium levels, which provides the building blocks of coral reefs. Increasing atmospheric CO₂ levels can also inhibit calcification. These stresses may interact with each other and exacerbate other stresses like disease and predation. As with many ecosystems, it is difficult to separate the effects of global climate and local, non-climate impacts.

Predicting the future of reefs is difficult because current environmental changes are causing a combination of surface ocean chemistry and temperature conditions that have almost certainly never occurred in the evolutionary history of modern coral reef systems. Key uncertainties include the extent to which human activities will continue to alter the environment; how climate variability such as the frequency and intensity of *El Niño* Southern Oscillation (ENSO) events will change relative to global temperature; and the biological and ecological responses of coral reef communities to unprecedented future conditions. Although climate change has the potential to yield some benefits for certain coral species in specific regions, most of the effects of climate change are stressful rather than beneficial. Continued climate change will almost certainly cause further degradation of coral reefs, which will be even more devastating in combination with the continuing non-climate stresses that will almost certainly increase in magnitude and frequency. Reef systems that are at the crossroads of global climatic and local human stresses will be the most vulnerable.

Research into adaptation and recovery mechanisms and enhanced monitoring of coral reef environments will help us to learn from and influence the course of events rather than simply observe the decline. A

significant step would be an international network of marine-protected areas to provide refuges for future generations of coral reef organisms. Yet, even with such efforts, recent degradation of coral ecosystems combined with future climate change will pose a significant challenge to the global sustainability of coral reefs.⁴⁹

(Source: IIED)

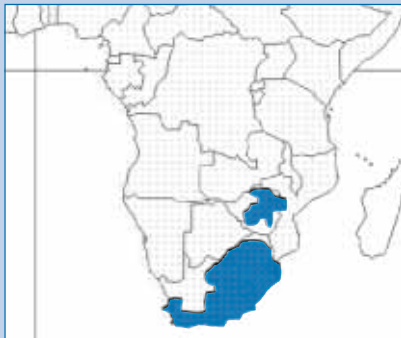
Nature conservation in Southern Africa

Sub-Saharan Africa arguably has the most spectacular wildlife in the world. Not only is the myriad of species important in its own right but the parks and nature reserves provide employment and are one of the main sources of tourism and hence foreign currency in many African countries. Yet climate-induced changes in species' ranges pose challenges for so-called site-based nature conservation. Entire species or ecosystems may move away from protected areas.

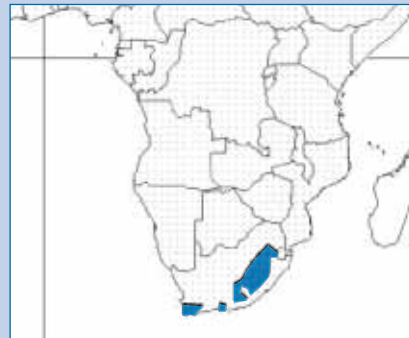
BirdLife International, a worldwide partnership of more than a hundred national conservation organisations, is working with the UNEP World Conservation Monitoring Centre and the Universities of Copenhagen and Durham to provide practical ideas that will help to maintain the function of BirdLife's Important Bird Area (IBA) network in Sub-Saharan Africa as the climate changes.

The project ascertains the ranges of threatened species through local networks of observers. Species likely to be strongly affected by climate change include Iringa Akalat of the Tanzania–Malawi montane forest and Short-legged Ground-roller of the East Malagasy wet forests. Models of future climate change are then used to predict where species' habitable areas will be in 2100, and hence where each bird species range might move to. Next, the physical and human geography of the region is examined to assess whether each species will be able to reach its new range, and whether there will be suitable habitat within the new range. Finally, the new species' ranges are superimposed on the existing IBA network, and the impact of climate change on the function of the network determined.

Early results suggest that African species may undergo major range shifts following climate change, as is shown below for the Cape Longclaw.



The current 'climate envelope' of Cape longclaw



The predicted range of Cape longclaw in 2070, based on climate modelling

(Source: RSPB)

Livelihoods

It is in the area of livelihoods that many of the threats from, and responses to, global warming come together. Without stopping global warming it is clear that the viability of millions of people's livelihoods will be undermined; without significant new resources, millions of others won't be able to adapt to changes that are *already* happening.

Food, health, water, energy, and more, are all elements of livelihoods. How they are affected by global warming and how people adapt, will determine the future for human progress. Threats range from the loss of a home in a flood or storm, to the loss of the land on which it is built through sea-level rise. Health too is under threat: Areas that were once free of malaria may suddenly become susceptible as local climates change and safe drinking water may become harder to get.

Similarly, livelihoods built for generations on particular patterns of farming may become quickly unviable. But, somehow, communities will have to cope as best they can. Whilst runaway climate change will pose a threat to human civilisation matched only perhaps by that of nuclear war, for the immediate future, taking the right approach can prevent a crisis becoming an irretrievable disaster.



Cycling along the bank of the swollen Surhob (Red) River, Tajikistan, after heavy rain. Climate change, glacier melt and deforestation are likely to increase the power of rivers like this during the winter, but reduce flow at other times. (Photo: Oxfam)

The real value of mangroves: ‘no-regrets’ adaptation in Fiji

Fiji is already vulnerable to extreme climatic events such as cyclones, floods, and droughts. The costs of storm surges can account for a noticeable share of annual GDP. Coastal resources are the highest priority in terms of certainty, urgency, and severity of impact, as well as importance.

Fiji receives around US\$30 million in aid annually. Between 23–36 per cent of development assistance by aid amount and or 19–23 per cent of donor projects by number are in sectors potentially affected by climate-change risks. Several donors have been actively involved in efforts to assess Fiji’s vulnerability to climate change. However, aside from climate-specific projects, donors and the Government have failed to make climate risks a central consideration in their development work.

Coastal mangroves highlight the problem. Mangroves protect against coastal erosion and storm damages, but are themselves vulnerable to sea-level rise and would need to migrate shoreward with the rising inter-tidal zone as sea level rises. Pressures on these land areas from competing land uses, such as agriculture, tourism, and housing, militate against their conservation, which benefits fishing communities and the environment.

Conservation of mangroves is a ‘no-regrets’ adaptation given the wide range of other benefits they provide to local communities. These include their role in fisheries, reef protection, stabilisation of coastlines, timber supply, and medicinal uses. However, mangrove cover is being lost in Fiji. One reason for this is the significant undervaluation of mangroves, which encourages their clearing for development. The method typically used by the

Department of Lands gives only a fraction of the value to mangroves, as low as one-twentieth, compared to the values assessed by other groups using methods that take into account a range of services provided by the mangroves. Another reason for the continued loss is the mismatch between the mangrove ecosystem and the property-rights regime. In Fiji, a traditional clan, or *mataqali*, has communal claim over the physical resources and the environment, including mangroves. However, the Government has limited the amount of compensation paid for loss of mangroves for reclamation purposes.

‘No-regrets’ adaptation in Fiji, will therefore require greater policy coherence between climate change and development policies – appropriate value attached to mangroves would be one such example. There is also a need for a coastal management plan that prioritises mangrove conservation, requiring development to be set back from the high water line to allow mangroves to move and spread. To be successful, local communities need to be involved in these processes.⁵⁰

(Source: IIED)

Preparing for the flood: reducing damage in North India

Since 2002, Tearfund local partner organisation Discipleship Centre (DC) has been working with five villages in Bihar, North India, to reduce their vulnerability to flooding. The villages are poor and geographically isolated. Government aid programmes do not reach them. For three months of every year, they are subject to monsoon floods which destroy lives, livestock, houses, and property.

Before DC's programme began, the people had no safe route out of the five villages to escape rising flood waters. With no unity within or between villages, everyone looked after themselves, rescuing possessions, livestock, and people in a haphazard, disorganised manner. Boats for rescue purposes had to be hired from local landlords, or banana stems were floated on the water as makeshift rafts. The flood waters submerged and clogged hand pumps so that the villagers had no safe water and were forced to drink from the river. Flood-related diseases were common.

The people wanted to improve their situation so DC mobilised each village to form a Village Development Committee (VDC) and four teams of volunteers which were trained in flood preparedness. The committees oversee the teams, which are responsible for early warning and evacuation, management of boats, resource mobilisation, and care of the vulnerable. The teams have a recognised uniform and meet on a regular basis to learn first aid and practice evacuation procedures.

DC mobilised the village communities to build raised embankments to connect the villages to each other and to the main road, providing an escape route during the flood season. Culverts were built to reduce water pressure, and tube wells with raised hand pumps were constructed to guarantee

safe drinking water when flood levels rise.

These measures have proved effective in saving lives and property. The monsoon floods in 2003 were severe but no lives were lost to drowning or flood-related illness, and very few livestock perished. The villagers frequently comment on the difference the measures have made to their lives:

"In the past we all used to dread the flooding season... because we did not know if we would survive. Now we have peace because all the people know they can save themselves."

The project has had other unexpected benefits. The rescue boats are generating income through being hired out for other purposes, and the raised embankment is providing a valuable connection to the main road for trading. The villagers have learnt the value of community co-operation, and developed confidence and leadership skills. They are more aware of their needs and their potential to meet these needs, and as a result are now collecting money for a school.



Trained volunteers in Bihar (Photo: Tearfund/Caroline Irby)

There is a strong emphasis on community mobilisation and use of local knowledge in the flood programmes. With a small amount of outside assistance, the villagers are better able to cope with the floods they have lived with all their lives. As one villager commented *"We could have done this 50 years ago but no-one showed us how."*

(Source: Tearfund)

Living with climate change in South Africa and Mozambique

Climate data for Africa for the last 30–40 years shows global warming has taken a firm hold. If current trends continue, climate models predict that by 2050 Sub-Saharan Africa will be warmer by 0.5°C to 2°C and drier, with 10 per cent less rainfall in the interior and with water loss exacerbated by higher evaporation rates. There will be more extreme events such as drought and floods, and the seasonal patterns will shift.

What is important is that these changes are happening right now, and already people are having to learn to live with the consequences across the whole of the Sahel, the Horn of Africa, and Southern Africa. Food security may become increasingly difficult to achieve and humanitarian crises may be exacerbated.

With support from Oxfam and Save the Children, ADAPTIVE researchers at Sheffield University, funded by the Tyndall Centre for Climate Change, are co-ordinating a major research programme to find out just what strategies people are using to cope with changing environments. They are taking an in-depth look at life in three districts in the Republic of South Africa and one in neighbouring Mozambique.

Following statistical analysis of climate data trends by the Climate System Analysis Group at the University of Cape Town, the first phase of research has involved working in areas that have already experienced significant changes in climate over the last 30 years, within many people's lifetimes. In Lehurutshe, people are seeing an increase in regular periodic droughts; in Dzanani, farmers are experiencing a more general, significant drying trend with more pervasive drought; in Uthukela, rural households have experienced increasing intensity and variability in rainfall and seasonality; and in Manjacaze, Mozambique, extreme weather patterns with floods and droughts are having a severe impact

on people's lives. The research is now in its second phase and will be completed next year.

Professor David Thomas said, *"What we're seeing is that people's responses are complex and dynamic – they are not helpless in the face of these major changes. It looks as though the communities that are most able to cope are those which are most co-operative and with the strongest social institutions. They are able to innovate and experiment in the face of change, as well as drawing on traditional knowledge and networks."* Dr Chasca Twyman added *"but other communities are doing much less well, and even with those that are more successful, we don't know whether they will continue to be able to cope with such serious stresses."*

The aim of the research is to help local and regional governments, policy-makers, and non-governmental organisations like Oxfam and Save the Children, understand how communities adapt, and what kinds of assistance will be most effective in the face of current and predicted climate changes.⁵¹

(Source: Oxfam)

Why women suffer most from global warming⁵²

Despite their minimal, per-person contributions to greenhouse gas emissions, the impacts of climate change will disproportionately affect people living in poverty in developing countries. It's here where the damage will be highest and where people have the lowest capacities to cope. About 70 per cent of the 1.3 billion people in the developing world living below the poverty threshold are women, yet gender issues receive little attention in the climate change debate.

Vulnerability to the hazards of climate change depends on things like wealth, technology, education, information, skills, infrastructure, and management capability. Women often have less access to these resources than men, increasing their sensitivity and exposure to climate shocks and limiting their ability to cope and recover from shocks when they arrive. Gender-related inequalities are particularly pervasive in the developing world.

Women who have to find food for their families will find it more difficult if climate change lowers rainfall and increases drought in their home area. If fish populations are subsequently affected by salinity in freshwater systems, one of the primary sources of protein relied on by women will be at risk. Changing weather patterns could also affect farming activities such as paddy cultivation in Asia, and cash crops such as cotton and tea, the cultivation of which employs many women. Following extreme events such as storms and floods, the burden of devastation falls primarily on women who must keep the family together.

Ensuring greater gender equality will benefit society as a whole and help promote sustainable development. However, getting gender issues into debates on climate change and sustainable development is happening piecemeal, extremely slowly, and often as an afterthought. This is in part due to the lack of participation by women in decision-making at all levels. This must change, because climate-change policies will be unsuccessful if women have no opportunity to influence decision-making, build their capacity, lower their vulnerability, and diversify their income sources.

The international response to the implications of climate change has largely focused on mitigation (reducing greenhouse gases), and given less attention to adaptation (dealing with the adverse impacts of climate change) and the social implications of climate change. Neither the UN Framework Convention on Climate Change nor the Kyoto Protocol mentions the words 'poverty' or 'deprivation', let alone 'gender' or 'women'. In addition, there has been an absence of discourse on

areas where gender is likely to be an important factor. Opportunities to direct climate funds towards women's real needs have not yet been taken up.

The Global Environment Facility and the Clean Development Mechanism of the Kyoto Protocol could play a role in promoting sustainable development in a way that does not disadvantage women. Special attention also needs to be paid to the opportunities arising from investment in adaptation, which to a large extent involves land-use solutions in rural areas. This is a key sector as women account for almost 80 per cent of the agricultural sector in Africa. The dependence of women on biomass energy means that they should also be involved in projects promoting the diversification of energy resources. Further still, women's knowledge on local adaptation is a resource well worth documenting and building on.

A better understanding of how poverty in general, and women in particular, are affected by climate change is needed to influence all efforts to adapt to climate change. Much more human capacity is needed to ensure that those entrusted with policy development and project work incorporate gender issues. We must continue to listen to the voices of these people over the roar of wealthier countries driving the debate in order that the consequences of climate change should not lead already marginalized and vulnerable sections of society into further deprivation.⁵³

Trade and climate⁵⁴

Fossil-fuel-dependent global transport networks have grown in tandem with the trade they help facilitate. And whilst the benefits to poor countries from trade liberalisation remain the subject of intense academic debate, the economic costs of climate change continue to rise inexorably. International trade is linked to ever-rising greenhouse gas emissions. Between 1950 and the mid-1990s, while total world output grew by a factor of five, exports went up by over 14 times. Global trade in goods and services grew twice as fast as GDP during the 1990s, and, according to the World Bank, the faster rate of growth is a trend likely to continue.

The significant dynamic of this process has been the globalisation of production and distribution inside multinational businesses. Globalised production within the subsidiary networks of transnational corporations saw components and parts making up one third of all trade in manufactured goods by the early 1990s, to a value of \$800 billion. But much international trade lives in a bubble. International aviation and marine fuels are immune from any kind of taxation that would internalize the real environmental cost of freight and shipping. Greenhouse gas emissions from international freight are also exempt from the emissions

reduction targets set for rich countries to meet under the Kyoto Protocol of the UN climate change convention. The transport networks underpinning the movement of goods are hugely subsidised and their contribution to global warming escapes international agreements to control greenhouse gases. As well as the free ride for international marine and aviation bunker fuels, most of the increased demand for freight transport in developing and transition economies is for high-polluting road transport, and it is growing at up to double the rate of GDP.

The impact of climate change will have disproportionately negative impacts on developing countries. A dramatic picture of the impact of greenhouse gas emissions and climate change comes from projecting forward the trend of the last few decades of rising economic costs linked to 'natural' disasters. Using historical data from reinsurance giant Munich Re and assuming that current trends were to continue, by shortly after the middle of this century – in 2065 – the economic costs of natural disasters and an increasingly volatile climate would exceed total world output.

Economic considerations about which patterns of trade bring real benefits to different trading partners, coupled with the carbon constraints suggested by global warming, both point to the need for new models of trade. The specific circumstances for a poverty and climate 'win-win' scenario need to be worked out. Trade will always be an important part of the global economy. But the picture of who trades what with whom, and how, will have to change if the poorest countries are to benefit and the climate is to be protected

There is still enormous pressure on poor countries to liberalise their trade regimes but for poor countries who depend heavily on selling primary commodities, increased supply and availability to the rest of the world has meant a long-term downward trend in the prices they receive for their goods. Several other factors reinforce this trend including corporate consolidation of the marketing chains – for example in coffee – and macro-economic policies pushed by international finance capitalists leading to widespread deflation in rural economies.

There are other problems to do with international trade that receive less attention. In the international trading system poor countries have to run faster to stay still, whilst at the same time putting greater pressure on their natural-resource base and the global ecosystem. A study of the more immediate environmental impacts of trade liberalisation in developing and transitioning economies by the UNEP concluded that there were "*serious negative environmental, and related social, impacts of expanded trade activity*".⁵⁵ These included:

- Land degradation
- Water pollution
- Biodiversity loss

- Displacement of local, community-serving economic activity
- Loss of common property rights in the shift to export led activity
- Social instability resulting from structural economic changes
- The failure and obstruction of policies designed to mitigate:
 - Environmental impact
 - Land use conflicts
 - Deforestation, and
 - Perverse incentives for resource depletion

The movement of people: environmental refugees – the case for recognition⁵⁶

Hysteria often walks in the footsteps of refugees and immigrants. In Europe, barely a day passes without scare stories of crime, fraud, and intolerable burdens placed on public services. It seems irrelevant that the well-documented reality is that immigrants always have made, and continue to make, a vital contribution to Europe's economy.

But amidst the irrational fear is a deeper irony. It is now the case that numbers of refugees could be about to increase dramatically over coming years as a direct result of the way that the rich global elite lead their lives.

Global warming, more than war or political upheaval, stands to displace many millions of people. And climate change is being driven by the fossil-fuel-intensive lifestyles that we enjoy so much.

Environmental refugees are already with us. They are people who have been forced to flee their homes and even cross borders primarily because of environmental factors such as extreme weather events, drought, and desertification.

There are probably more of them already than their 'political' counterpart – 25 million environmental refugees in the mid-1990s, according to Oxford academic Norman Myers, compared to around 22 million conventional refugees at the same time. By 2050, mostly due to the likely effects of global warming, there could be over 150 million.⁵⁷

The effects of this scale of population movements will be highly destabilising to the global community unless they are carefully managed. Without action, the countries least responsible for creating the problem – poor developing nations who already are the major recipients of refugee flows – stand to carry the largest share of additional costs associated with environmental refugees. As a consequence of global warming, Bangladesh, one of the poorest countries in the world, expects to have around 20 million such environmental refugees in the coming years.

Although they do not confer any legal status, the UN's Guiding Principles on Internal Displacement are a widely used tool that consolidates existing principles of human rights and international humanitarian and refugee law. It then applies these principles to the needs of people forced to leave their homes but remaining within their countries of origin – including as a result of natural or human-made disasters such as climate change.⁵⁸ But, in certain circumstances, however, the suggestion that the solution must lie purely at the national level could be absurd, since the national level may be under water. According to one study, at least five small island states are at risk of ceasing to exist. There are several serious unanswered questions. What will happen to the exclusive economic zones of such countries and what status and identity will their populations have? Where whole nations become uninhabitable, should they have new sovereign lands carved out for them in other states? Without proper environmental refugee status, will the world have to create lots of new little Israel's for the environmentally displaced? Or would they become the first true, World Citizens? If there is no state left, how can the state protect its citizens?

Sea-level rise in the range expected by the IPCC would devastate the Maldives. Without real international legal protection, their people could become potentially resented minorities in Sri Lanka, itself threatened, or India, with enormous problems of its own. On the small South Pacific island of Tuvalu people already have an *ad hoc* agreement with New Zealand to allow phased relocation. Up to 10 million could be displaced in the Philippines, millions more in Cambodia, Thailand, Egypt, China, across Latin America, and the list goes on.

Creating new legal obligations for states to accept environmental refugees would be one way to ensure that industrialised countries accept the unintended consequences of their fossil fuel intensive lifestyle choices. Just as the 1951 Geneva Refugee Convention provides protection for people fleeing persecution, a new international treaty could address the current gap in the international legal system by conferring special status and rights on environmental refugees, forced to flee their country of origin either because it no longer exists or cannot meet their needs due to the scale of climate change impacts.

Numerous poor countries already cannot afford to meet the basic needs of their people. Without status, environmental refugees could be condemned by a global problem to a national economic and geographical lottery, and to the patchwork availability of resources and the application of immigration policies. There is a wide acceptance that current national policies would not be remotely capable of handling the scale of the problem. Environmental refugees need recognising, and the problem needs managing before it manages us.

The Churches and climate change

"Here on the small island atoll of Kiribati, the impacts of human-induced climate change are already visible. The sea level is rising. People's homes are vulnerable to the increasingly high tides and storm surges. Shores are eroding and the coral reefs are becoming bleached. The water supplies and soil fertility are being threatened by the intrusion of salt water. Weather patterns are less predictable, posing risks to fisher-folk and farmers."

These words introduced the Otin Taai declaration, produced by the Pacific Churches' Consultation on Climate Change which met on the small island state of Kiribati during March 2004. The consultation involved 50 representatives of the Pacific Conference of Churches from Kiribati, Nauru, French Polynesia, Niue, Marshall Islands, Solomon Islands, Fiji, Tuvalu, Vanuatu, Tonga, Samoa, American Samoa, New Caledonia, Papua New Guinea, and the Cook Islands. *Otin taai*, pronounced *osin tai*, means sunrise, a symbol of hope in the Kiribati language.

Kiribati is not alone in its plight, according to the declaration. Many other island nations in the Pacific are experiencing similar impacts of human-induced climate change, affecting about seven million people. The signatories promised to dedicate themselves to engaging Christian Churches internationally in education and action on the issue. Church-related specialised ministries for emergency-response, development, and advocacy were called upon to integrate climate change and adaptation projects into their policy development, education, and advocacy. Churches were also asked to encourage companies that are major producers or consumers of fossil fuels to support a transition towards less carbon-intensive economies, reduced energy usage, and the development of cleaner, renewable energy sources.

Over the past few years Dr David Hallman, of the World Council of Churches' Climate Change Programme, has challenged inaction by the US Government over the issue. In the US itself, the Catholic Bishops' Conference issued a statement in 2001, *Global Climate Change: A Plea for Dialogue, Prudence, and the Common Good*, in which they stated that the level of scientific consensus on global warming obligated taking action to avert potential dangers. *"Since our country's involvement is key to any resolution of these concerns," it said, "we call on our people and government to recognise the seriousness of the global warming threat and to develop effective policies that will diminish the possible consequences of global climate change."* The Bush Administration was urged to undertake initiatives for energy conservation and the development of renewable energy. US citizens were asked to reflect on their lifestyles as 'voracious consumers' and consider living more simply. In the UK, Christian Ecology Link's Operation Noah has asked congregations to sign a Climate Covenant petitioning the Government to respond. On 5 July 2004, the Archbishop of Canterbury, Dr Rowan Williams, endorsed remarks made by Sir David King, the government's chief scientist, describing climate change as *"a weapon of mass destruction"*.

(Source: Columban Faith and Justice)

Learning from history

"History teaches nothing, but only punishes for not learning its lessons"
Vladimir Kluchevsky, Russian medievalist

History shows that the right kind of resilient economy is the ultimate disaster preparedness tool, and that the wrong kind of economic structure significantly exposes people in poverty to unstable climatic conditions.

In *Late Victorian Holocausts: El Niño Famines and the making of the Third World* author Mike Davis looks at the experience of 19th century India, China, and Brazil as a parallel for contemporary development dilemmas.

According to Davis the *"forcible incorporation of smallholder production into commodity and financial circuits controlled from overseas"* fundamentally undermined food security, and left millions of people exposed to famine during *El Niño* cycles.

Indian peasants in general had three practical safeguards against famine conditions provoked by climate instability: domestic grain hoards; family (silver) ornaments; and credit with the village money lender and grain dealer. Toward the end of the 19th century all were lost under the changing balance of power in the rural economy and the trade imperatives of the British Raj.

Davis maintains that under the British, *"Between 1875 and 1900, years that included the worst famines in Indian history, annual grain exports increased from 3 million to 10 million tons – an amount equivalent to the annual nutrition of 25 million people."*

Today, poverty, planning errors, and an increasingly unstable climate are all increasing the vulnerability of marginalised people to so-called 'natural' disasters. But, again, history shows that the impact of climate-related disasters can be drastically reduced under different regimes.

Before the British took control of much of India, local Mogul rulers used a range of policies to prevent famine taking hold. They relied on embargoes on food exports, anti-speculative price regulation, tax relief, distribution of free food without a forced labour counterpart; and 'zealous' policing of the grain trade in the public interest.

Although hard to visualise now, Davis speculates that prior to colonial re-engineering of the majority world economies, *"It is very likely that, in the middle of the eighteenth century, the average standard of living in Europe was a little bit lower than that of the rest of the world."*

Today, the danger is that the imperatives of trade liberalisation are once again being put before food security and the need to build disaster-resilient economies. As peasants and farm labourers became more exposed to natural disasters from 1850 onwards – a period when their local economies were violently incorporated into world markets – there were dramatic consequences.

Thirty one serious famines happened in 120 years of British rule of India. Only 17 famines were recorded in the previous 2,000 years. For Davis the experience represents *"a baseline for understanding the origins of modern global inequality...how tropical humanity lost so much economic ground to western Europeans after 1850... (and) goes a long way to explaining why famine was able to reap such hecatombs in El Niño years."*

Similar patterns repeating themselves today around the world suggest that history is punishing us for not learning its lessons.

Canaries in the coal mine: small island states

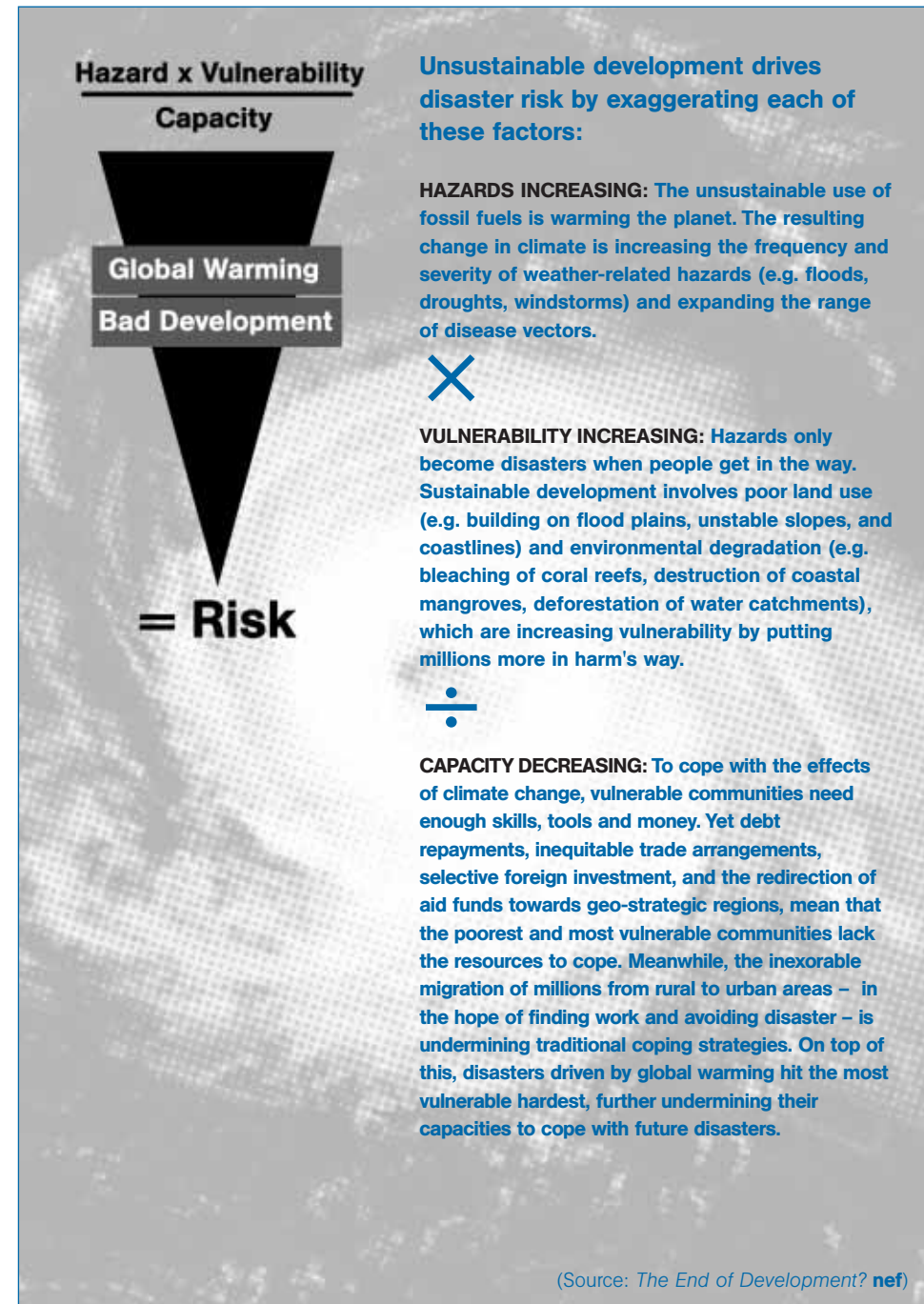
The threats posed to Pacific islands by climate change are varied and far-reaching. But they have common vulnerabilities which hamper the ability to mitigate and adapt to the negative effects of climate change. These are problems that show in microcosm what is faced by many other countries. Unprecedented changes in temperatures, sea levels, and weather patterns bring incalculable risks not only to the Pacific's natural environment, but to economic development, health, food security, and public safety. Conventional development is too often 'disaster blind' – it risks exacerbating the vulnerability of island nations and coastal communities to the volatility of world weather systems.

The island nations of the Pacific are diverse in many ways, but they share certain problems in the age of climate change:

- Small physical size and (often) low elevation.
- Wide geographic distribution and remoteness.
- Proneness to 'natural' disasters.
- Rapid urbanisation and dense, growing populations.
- Increasing degradation of fragile environments.
- Limited natural, human and financial resources.
- Loss of traditional coping mechanisms.
- Export-dependent, open economies.

Small island states cannot solve many of these problems alone. Political and financial commitment from developed nations is needed. The IPCC points out that *"small island states account for less than one per cent of global greenhouse gas emissions, but are among the most vulnerable of all locations to the potential adverse effects of climate change and sea-level rise."* What is happening today to low-lying communities is a warning to countless other regions around the globe. A stronger, realistic commitment from the world's richest, industrialised nations to reduce the risks posed by climate change will prove in their best interests. It is long overdue.

The Risk Equation





Women in Zimbabwe picking leaves, the only food available (Photo: ITDG/Keith Machel)

Endnotes

- 1 'Climate proof' does not mean to suggest that communities can be completely immunised against the impacts of climate change and variability; instead it refers to the need for increased resilience and reduced vulnerability to be at the heart of development work.
- 2 Simms, A *et al* (2004) *The price of power: poverty, climate change, the coming energy crisis, and the renewable revolution*, (nef, London).
- 3 The precautionary principle suggests that when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically. One of the most important expressions of the precautionary principle internationally is the Rio Declaration from the 1992 United Nations Conference on Environment and Development, also known as Agenda 21. The declaration states:

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

4 McMichael *et al* (2003) *Climate Change and Human Health – Risk and Responses*, (WHO, UNEP, WMO, Geneva).
5. International Federation of Red Cross and Red Crescent Societies (2002) *World Disasters Report 2002* (IFRC, Geneva).
6. Lautze, S *et al* (2002) *Qaht -E-Pool - "a cash famine" Food insecurity in Afghanistan 1999–2002* (ODI, London).
- 7 <http://www.worldwaterday.org/2001/thematic/floods.html>
8. *Human Development Report 1998* (UNDP, New York); World Bank 2002.
9. International Federation of Red Cross and Red Crescent Societies (2002) *World Disasters Report 2002* (IFRC, Geneva); Simms, A and M Conisbee (2003) *Environmental refugees: the case for recognition* (nef, London).
10. Watson, R *et al* (2001) *Climate Change 2001: Synthesis report, summary for policymakers* (Cambridge University Press).
11. Thomas, C *et al* (2004) "Extinction risk from climate change" in *Nature*, 8 January 2004.
- 12 Source: Oxfam report by Gary Iveson and Climate Change and Poverty, Dfid, June 2004.
13. *Africa Environmental Outlook 2004* (UNEP, Nairobi).
14. *The Guardian*, 1 July 2004.
- 15 This passage is based on *The End of Development* (2002) nef & BCAS.
- 16 Cited in Dfid (2001) *Addressing the Water Crisis*.
- 17 Submission to CSD-12 from eight UK NGOs (BirdLife International, Care, Freshwater Action Network, Green Cross, Oxfam, TearFund, WaterAid and WWF).
- 18 Cited in Dfid (2004) *Climate Change and Poverty*.
- 19 *Tapping the Potential, improving water management in Tajikistan*, UNDP National Human Development Report 2003, and *Central Asia: Water and Conflict*, 30 May 2002, ICG Asia Report 34, International Crisis Group, www.crisisweb.org.
- 20 McMichael *et al*, *op. cit.*
- 21 *Human Development Report 2003* (UNDP, New York).
- 22 McMichael *et al*, *op. cit.*
- 23 UNEP, Environmental Threats to Children.
- 24 Estimates from UNEP, Munich Re & Swiss Re.
- 25 Environment and Societal Impacts Group (ESIG) at the National Centre for Atmospheric Research (NCAR); Centre for Ocean Atmospheric Prediction Studies.
- 26 Dockery, DW *et al* (1993) Harvard University School of Health
- 27 Working Group on Public Health and Fossil Fuel Combustion, *The Lancet* 1997
- 28 Simms, A *et al* (2004) *The price of power: poverty, climate change, the coming energy crisis, and the renewable revolution* (nef, London).
- 29 CAN International (2003). *A Viable Global Framework for Preventing Dangerous Climate Change (2003) – Discussion Paper*. www.climate-network.org
- 30 Letter from Desmond Tutu and other Nobel Laureates to President Wolfensohn, www.eireview.org, 9 February 2004.
- 31 Warwick, H and A Doig (2004) *Smoke the killer in the kitchen: indoor air pollution in developing countries* (ITDG Publishing).
- 32 *The World Energy Outlook 2002* (International Energy Agency, Paris).
- 33 *World Health Report 2002* (WHO, Geneva).
- 34 UNDP (2000) *World Energy Assessment: energy and the challenge of sustainability* (UNDP, New York).
- 35 Gon Chauduri won the Ashden Award for Sustainable Energy in 2003.
- 36 IPCC (2001), *Summary for Policymakers (A Report of Working Group 1 of the Intergovernmental Panel on Climate Change)* online at www.ipcc.ch
- 37 IPCC (2001), *Summary for Policymakers Climate Change 2001: Impacts, Adaptation, and Vulnerability* online at www.ipcc.ch
- 38 International Red Cross and Red Crescent Movement, *Global Warming* (2001) magazine issue 2.
- 39 International Federation of Red Cross and Red Crescent Societies (2002) *World Disasters Report 2002* (IFRC, Geneva); p 134.
- 40 IPCC (2001), *Summary for Policymakers (A Report of Working Group 1 of the Intergovernmental Panel on Climate Change)* online at www.ipcc.ch
- 41 IPCC (2001), *Summary for Policymakers Climate Change 2001: Impacts, Adaptation, and Vulnerability* online at www.ipcc.ch

- 42 International Federation of Red Cross and Red Crescent Societies (2001) *World Disasters Report 2001* (IFRC, Geneva).
- 43 Sacks, J (2002) *The Money Trail: Measuring your impact on the local economy using LM3* (nef, London).
- 44 Pounds, J *et al* (1999) 'Biological response to climate change on a tropical mountain' *Nature*, 398 pp 611-615.
- 45 *Nature*, January 2004, 'Feeling the heat'.
- 46 IPCC (2002) Technical Paper V, Climate Change and Biodiversity.
- 47 WRM (2003) *Certifying the uncertifiable: FSC certification of tree plantations in Thailand and Brazil* (World Rainforest Movement, Uruguay).
- 48 UNFAO.
- 49 Buddemeir, R *et al* (2004) *Coral Reefs and Global Climate Change. Potential Contributions of Climate Change to Stresses on Coral Reef Ecosystems*. (Pew Center on Global Climate Change, Virginia).
- 50 Agrawala, S *et al* (2003). *Development and climate in Fiji: focus on coastal mangroves* (OECD, Paris).
- 51 The project understands 'adaptation' to mean the continuous adjustment of a system to moderate impacts and the use of new opportunities to cope with the consequences. Adaptive capacity is the ability of the society, household or individual to take advantage of new opportunities, thus reducing their vulnerability to the harmful impacts of disturbance and change.
See: <http://www.shef.ac.uk/adaptive>
- 52 IIED.
- 53 Rachel Masika (ed.). *Gender and Development*. Oxfam. Vol. 10, No. 2. July 2002; Fatma Denton. Point de vue. *Bulletin Africain Bioressources* no 14, October 2001.
- 54 Simms, A (2000) *Collision Course: free trade's free ride on the global climate* (nef, London).
- 55 UNEP (1999) *Trade Liberalisation and the Environment – lessons learned from Bangladesh, Chile, India, Phillipines, Romania and Uganda: A synthesis report*, Geneva
- 56 Simms, A and M Conisbee (2003) *Environmental refugees: the case for recognition* (nef, London).
- 57 Today the gap would be even greater as global warming drives greater displacement and official refugee numbers go down. There are 17 million "people of concern" to UNHCR, including 10 million "refugees" (down from 13 million in 2000). Ref: UNHCR 2003.
- 58 See: http://www.reliefweb.int/ocha_ol/pub/idp_gp/idp.html



Rano Boymirzeova and Oimkol Amonova (front, with bucket) collect water from the river. Many communities in Tajikistan get their water from rivers or from drainage canals, often heavily polluted with agricultural chemicals. Oxfam is rehabilitating a pumping station which will ensure clean water to five villages. (Photo: Oxfam)

Supporting organisations (The Working Group on Climate Change and Development)



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