



WAITING FOR THE WATER TO COME?

Poverty reduction in times of global climate change



Center for Development Research
University of Bonn



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Poverty reduction in times of global climate change

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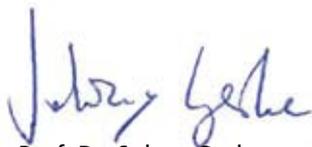
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Climate change is a global risk for humanity, as Ulrich Beck, well-known German sociologist and globalization expert, has said; it will determine our present and future on a scale not yet foreseen. It is primarily caused by the countries of the North, yet the countries of the South are more severely impacted by some of the consequences. This disproportionate effect is partly due to the fact that large numbers of people in developing countries are highly dependent on the natural environment. As a result, the populations who bear the brunt of particular risks are those who have neither caused climate change, nor benefited from the achievements which contribute to it. Poor populations in developing countries are forced to react to environmental problems such as droughts and flooding, water shortages and changing rainy seasons: problems which they can hardly predict and which are causing an increasing sense of uncertainty. All this leads to a growing need for interdisciplinary and transdisciplinary research, whose findings can provide a basis for planning.

The Center for Development Research (ZEF) at the University of Bonn carries out interdisciplinary research, aiming to contribute to poverty reduction and sustainable development. The ZEF's goal is to find local solutions to problems caused globally and to combine current research findings with the experience of local people. This paper focuses on precisely this integration of interdisciplinary research in a development context (ZEF) and practical, poverty-oriented cooperative development (CARE). It effectively presents the current state of research on climate change and poverty reduction and combines this with the local knowledge and innovations developed by the people of East Indonesia.

CARE and ZEF aim to point the way for future research in collaboration with organisations which tackle poverty. Only if practical and scientific, local and cross-border knowledge can be brought together will the inevitable adaptations to climate change impacts have a chance of success.



Prof. Dr. Solvay Gerke

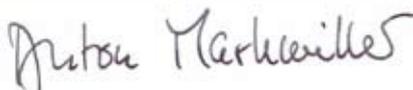
Director ZEF, Department of Political and Cultural Change

Climate change is taking place worldwide; its impacts are direct and severe – especially for the poorest, who are least responsible for the causes. Climate change accelerated by human activity is altering the rhythm of natural weather events such as droughts, floods and hurricanes. It is generally assumed that climate change is exacerbating poverty, but what is the evidence for this assumption? How exactly are these phenomena related and what does that mean for an organisation like CARE, which combats poverty worldwide?

This paper aims to provide an overview of the state of the debate on poverty reduction in the face of climate change. The authors have investigated the links between poverty and climate change in practice and examined the issues in the light of a case study in Indonesia. They have deliberately selected a country which is both particularly affected by climate change and also one of those causing global warming. The findings are clear: climate change does make tackling poverty more difficult. And it seems that more and more people are in danger of slipping into poverty due to changing environmental conditions.

The central theme of this paper is the humanitarian task of securing people's livelihoods, since individuals and their immediate environment are the lowest common denominator of global climate change and its consequences. All over the world, in Asia, Africa or Latin America, the poorest of the poor are affected by climate change and are forced to adapt to the consequences. Their success will depend partly on their knowledge, their capital and on the assistance they receive. For an organisation such as CARE, the challenge of sustainable poverty reduction in the era of climate change will demand all our strength.

CARE supports millions around the world who are suffering the effects of climate change. For them, it is a question of survival. This daily experience should remind us that climate change has a human face.



Dr. Anton Markmiller

National Director, CARE Deutschland-Luxemburg

It is the poor who suffer most under the impact of climate change. They are often directly dependent on the natural environment and have few options to escape the consequences of change such as poor harvests, water shortages and illness. Their survival strategies and livelihoods are endangered, in some cases acutely.

Climate change makes poverty reduction more difficult. First, it is harder to help people out of poverty when conditions are increasingly uncertain: but climate projections are often uncertain, making it difficult to assess the effectiveness of adaptation measures. Second, there is the danger that climate change will reduce more people to poverty, increasing the numbers of those who need assistance while the resources of those tackling poverty are limited.

This paper presents the consequences of climate change, the ways climate change is anticipated to develop in future and aspects which make the poor particularly vulnerable. The focus is on the measures people themselves can take to maintain and adapt their livelihood strategies to the changing climate conditions.

We show how poverty reduction is linked to climate change, the fundamental goals and criteria of poverty alleviation and concrete examples of how it can include adaptation to climate change impacts. Various case studies from Tanzania, India and Indonesia illustrate in detail how both people's own adaptation strategies and the work of organisations like CARE can constitute successful reactions to the consequences of climate change. Finally, conclusions are drawn in the form of recommendations for organisations like CARE.

RECOMMENDATIONS FOR ORGANISATIONS ON POVERTY REDUCTION

1. Poverty reduction should prioritize adaptation to changing climatic conditions (not merely coping with them) and be based on existing local strategies.
2. Local knowledge of relations between climate change events and local adaptation options should be systematically included; local populations should also be encouraged to develop their knowledge.
3. However, existing practices as well as new strategies should be critically examined applying five criteria (effectiveness, flexibility, fairness, efficiency and sustainability).
4. Tackling poverty should promote awareness of and independent local adaptation to those climate change impacts which have so far attracted less attention.
5. The actual impacts of climate change are extremely hard to predict. This fact should not be ignored and current projections taken as "certain" when planning adaptation measures.
6. The urgency of adaptation to climate change should not be used to justify measures (such as forced resettlement) without the agreement of the local population.
7. Poverty reduction measures should be realistic and organizations should concentrate their energies, aiming to preserve the poorest people's general resilience and capacity to act.
8. Profound, broad-based and critical analysis of the extent of climate change impacts and adaptation measures is essential. Common recommendations such as diversifying income have sometimes proved unproductive or counterproductive in tackling poverty.

I. Climate change and poverty reduction are inseparable

THE POOR ARE PARTICULARLY AFFECTED BY CLIMATE CHANGE AND VULNERABLE TO ITS IMPACTS

The poor are both particularly exposed to the effects of climate change and have few resources to combat it. This is a frequent topic in the climate change discourse. But what exactly does it mean? And how does this fact affect the work of organisations which tackle poverty? These thoughts were the starting point for this paper. The authors assume the following hypotheses:

How far climate change and its consequences actually affect individual lives depends on how vulnerable they are to its impacts. Several factors influence this:

1. Global climate change impacts vary according to locality. The impact on people depends on local climatic effects such as rising temperatures or changing precipitation patterns. Local climatic changes such as heatwaves can have an immediate, direct impact on the population.
2. Local ecological and social systems are not equally sensitive to local climatic changes. Alterations to the environment affect people directly: if the ground dries out because of rising temperatures, agricultural production is more difficult. The robustness of the local infrastructure is also a significant factor – for example, whether roads can withstand heavy rainfall. These effects can reinforce each other and create a vicious circle.
3. The extent to which individuals are actually harmed by these effects depends on how exposed they are to the consequences (e.g. how dependent they are on agricul-

ture) and how they resist, cope with or adapt to them. These coping or adaptation capacities may include factors such as whether the local population has access to the technology required to maintain agriculture, whether they have sufficient cash to import food instead or whether they can utilize other sources of income.

To sum up, the greater the scale of local climate change effects for the population and the less they are able to adapt to the impacts, the greater the damage that can be wrought by climate change on their lives. The poor often live in particularly vulnerable areas (regions with extreme climates, coastal areas, regions affected by regular river flooding). The likelihood of being affected by a climate disaster is around eighty times higher in developing countries than in member countries of the OECD (HDR 2008: 20/21). In addition, it is the rural poor whose livelihoods are directly dependent on natural resources and who are most affected by climate change.

Climate change is not the sole cause of poverty, but it works with other factors to intensify the vicious circle which traps people in poverty. This makes it harder to help people out of the downward poverty spiral. It is also likely that more people will fall into poverty if climate change undermines their current livelihood strategy. The Stern report (Stern 2006) states that 145 to 220 million people in Africa and South Asia could become poor by 2100. “Climate change is undermining international efforts to reduce poverty“ (HDR 2008:10).

These two factors, the increase in numbers of the poor due to climate change and the increased difficulty of assisting them, reinforce each other; this is why climate change has a signifi-

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Climate change could cause up to 220 million people to fall into poverty

cant influence on aid organisations' work. This paper defines climate change more precisely, traces its physical and socio-economic effects on poverty and examines what this means for efforts to tackle poverty. We show how climate change influences people's opportunities and livelihood strategies, so indicating how aid organisations can react to alterations caused by climate change. This is illustrated by examples of how people have attempted to adapt to climate change. The case study of the village Toineke shows very practical strategies and individual cases and reveals how aid and development organisations can contribute to the reduction of poverty. This provides a basis for recommendations for successful poverty reduction in the more difficult conditions caused by climate change.

An outline paper cannot cover all aspects of the topic. Migration and conflict over natural resources have been discussed in detail e.g. in the German Government's Advisory Council on Global Change's report (WBGU 2007) and therefore are not dealt with here. Technological advances such as early warning systems are mentioned but not described in detail. The case studies were selected in view of the focus on livelihood strategies and people's adaptation measures, especially those of the poor.

II. Climate change

CONSEQUENCES AND PROJECTIONS OF CLIMATE CHANGE

First of all, the term climate change refers to the rising atmospheric and ocean temperatures observed in recent decades. The global climate has always been subject to change, but today the emission of greenhouse gases caused by human activity – in particular carbon dioxide, but also methane and nitrous oxide - reinforces the natural greenhouse effect and so cause global warming. In 2004, 31% of these emissions were caused by agriculture and forestry, 40% by industry, transport and buildings and 26% by energy supply (IPCC 2007c: 29). The natural greenhouse effect produces an air temperature at ground level of approx. 15° C, thus enabling life as we know it to exist. The additional anthropogenic greenhouse effect is causing a dangerous increase in this temperature. This occurs because as the concentration of greenhouse gases in the atmosphere increases, they are heated by the earth's infra-red radiation and thus produce more radiation themselves. This "atmospheric radiation" is reflected down to reach the earth's surface in addition to the sun's energy, so heating the earth additionally (Philipona et al. 2004).



Reduced rainfall is anticipated in many regions, causing the land to dry out

II.1. CLIMATIC EFFECTS OF GLOBAL WARMING

The initial impact of climate change is therefore global warming. This is linked to processes whereby climate change affects the natural environment and the human population, particularly in causing alterations to weather patterns. Climate, in the sense of the "average weather" in a region, comprises first of all temperature, precipitation and wind conditions.

Not only are average air temperatures rising; temperature extremes may also become more frequent. There are more extremely hot days, heat waves occur more often and extremely cold periods will probably occur less frequently. Rising temperatures are already affecting people directly, for example those with coronary or blood pressure problems. The poor in hot countries are particularly affected and vulnerable; they usually have no access to preventive technology such as air conditioning. They are often malnourished or undernourished and cannot cope with the heat.

The indirect consequences of rising temperatures can take various forms. The rhythm of the seasons alters, so the warmer seasons start earlier and last longer. In many regions, this is coupled with changes in precipitation patterns, resulting in longer dry periods and leading to more water shortages, curtailment of growing seasons and reduced harvests. The people of Toineke, West Timor, are confronted with these effects, as the case study shows. Geographically, climate zones and thus vegetation zones are shifting; for example, previously tropical areas are now threatened with entirely new regional climates. The actual advantages and disadvantages this may bring to the local population are often impossible to estimate. However, it is already clear that the replacement of forest by savannah and savannah by desert will cause particular problems for people whose livelihood is directly dependent on natural resources. This can be seen in the arid zones of southern Africa (Scholz/Bauer 2006).

Climate change also leads to changing precipitation patterns.



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Increased rainfall can quickly result in flooding

In a warmer climate, global precipitation quantities increase, as rising temperatures cause more evaporation of water, which then falls as rain. If the rain does not fall as quickly as near the equator, clouds carry the water into higher latitudes. This effect has reduced rainfall in the Sahel region, around the Mediterranean, in southern Africa and in parts of south Asia (IPCC 2007a). This is leading to a shift in areas of rainfall, so subtropical regions are becoming drier and higher latitudes wetter. Rainfall will increasingly tend to be less frequent but more intensive. There will be fewer days with rainfall, but heavy rainfall will be more common and dry periods longer. This can lead to extreme weather conditions such as flooding

or high river levels due to heavy rainfall, or on the other hand to droughts.

These effects are very different in different locations. The likelihood of drought is increasing in the Mediterranean, in southern Africa and in the Brazilian Amazon region in particular. However, in areas where rainfall is increasing, the amount of surface water available to the population will also decrease – because of high levels of evaporation. Increasing rainfall also tends to occur in the rainy season, which does not improve water availability in dry periods (Arnell 2004). The poor are most affected: they are the first to lose access to reduced water supplies, are less able to treat contaminated water and are thus more vulnerable to disease.

These changing weather patterns literally deprive people of their economic base. Firstly, the dried-out ground is more subject to erosion; heavier rainfall also contributes to this effect. Deforestation and overgrazing make the land even more vulnerable. Secondly, soil degradation will increase, for example through salination, in areas where irrigation is overused to compensate for more rapid evaporation (WBGU 2007: 74). Agricultural production will fall as a result. People who depend on subsistence farming will be particularly affected, but the urban poor will also face rising food prices when the amount of agricultural land is reduced.

Changing precipitation patterns are very hard to predict. This is typical for the central problem climate change causes for poverty reduction: on the one hand, future developments are predetermined because processes have been irrevocably set in motion and people must cope with them. On the other hand, the future is dangerously uncertain, since previous knowledge, for example about water availability, is no longer applicable to the future. Knowledge of the new situation is still being gathered and is not certain; the people affected often lack awareness of the global processes involved. This reduces their capacity for action. Previously, variations occurred on a limited scale and could be coped with by measures such as

THE POOR ARE PARTICULARLY AFFECTED BY CLIMATE CHANGE AND VULNERABLE TO ITS IMPACTS

water management. However, climate change has changed the scale to such an extent that these coping mechanisms are no longer sufficient (Milly et al. 2008). The combination of inevitability and unpredictability make it more difficult to plan for the future. The people of Toineke, Indonesia, for example, do not know whether the flooding will recur in future, so they choose cheaper provisional measures rather than long-term adaptations. Instead of raising their houses on stilts as a long term solution, they simply raise sleeping and cooking accommodation and animal quarters; however, this still leaves them vulnerable to flooding. The core of the problem is therefore the “deterioration of the planning base in the natural environment” (WBGU 2007: 70) – both for the people’s own livelihood strategies and for the organizations working to reduce poverty.

Discussions about wind focus above all on the increasing frequency and intensity of tropical hurricanes caused by rising sea temperatures. However, it is difficult to establish a clear relationship between climate change and increasing numbers of storms (WMO 2006). Future temperature increases are likely to boost the rise in numbers of storms (WBGU 2007), but some studies dispute even this point (Knutson et al. 2008). The populations of endangered coastal areas are increasing, so the storms will have increasing societal impacts.

II.2 PHYSICAL EFFECTS BEYOND CLIMATE CHANGE

Rising temperatures affect not only the climate but also other systems, such as the oceans. The best-known effect is the rise in sea levels, caused by two factors:

the expansion of the water as it heats up and the increasing quantity of water as glaciers and inland ice sheets melt. This process endangers low-lying islands, coastal regions and river deltas in particular. Floods erode the coastline, damage infrastructure and alter groundwater and drinking water, sometimes also causing disease through water contamination. This will inevitably affect large numbers of people, because approx. 70 % of the world’s population live in these areas. The poor will feel the effects even more, because they tend to live in less sheltered areas in inadequate housing and are dependent on natural resources which are destroyed by flooding. Even if they are able to move away from the affected areas, they lose their livelihoods and do not always succeed in finding new livelihoods even in cities (IISD 2003: 14). An annual sea level rise of only 40 centimeters would flood the regions which are home to 95 million people, a fifth of whom live in south-east Asia (Wassmann et al. 2004).

Rising ocean temperatures enable the seas to absorb some of the excess carbon dioxide in the atmosphere; they act as carbon sinks, thus counteracting climate change. However, as the CO₂ is absorbed by the water, the oceans become more acidic, endangering the coral reefs which at present shelter a rich variety of marine life and the minute sea creatures at the bottom of the ocean food chains (WBGU 2006).

Ocean currents are also changing. Up to now there have been fears that the constant circulation provided by the North Atlantic Drift might be weakened or even interrupted by climate change. This would cause a massive drop in temperature in western and northern Europe. However, it is also possible that ocean currents will become stronger (Toggweiler/Russel 2008). Both acidification and changing currents affect fish-

ery, another area where the poor are the first to suffer, as their small boats do not allow them to follow the remaining fish reserves. In the end, climate change will affect all ecosystems. A huge loss of biodiversity is likely, though this effect will also vary from place to place. In polar regions, warming could increase biodiversity (Weller 2007: 1017). The increased speed of change in biodiversity, especially extinctions, can unbalance ecosystems. This affects not only nature lovers, but the whole of humanity, since we are all dependent on these systems.

BOX 1: CASCADE EFFECTS: A DAM BURST SCENARIO

A paper by the Feinstein International Center (2008) illustrates the cascade effect with a disaster scenario in which global warming causes the Tibetan glaciers to melt. The water combines with extreme rainfall to fill the Three Gorges Dam so that the water triggers seismic activity. The earthquakes and water pressure break the dam, flooding cities down river with 2.5 million inhabitants. Political unrest follows; investors withdraw; the result is an economic crisis etc. At the end of the cascade, 1 million people are dead, 4 million displaced and the economic cost runs into hundreds of billions of US dollars.

Climate change also lies behind less dramatic chains of events which also have disastrous effects, e.g. failed harvests, leading to migration of workers, increasing population pressure in the cities and depopulation of rural areas. This may cause more pressure on urban infrastructure and the collapse of the rural economy.



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The risk of failed harvests is increasing worldwide

II.3 CONSEQUENCES AND EXTREME EFFECTS OF CLIMATE CHANGE: FEEDBACK AND TIPPING ELEMENTS

Rising temperatures due to climate change not only cause direct alterations in the weather or the oceans. Feedback effects also occur, where climate change impacts themselves affect the climate, often reinforcing the effects.

For example, the melting of the Arctic icecap means that less solar energy is reflected back into space, so increasing atmospheric temperature. The ice becomes sea water, which is darker, absorbs more solar energy, becomes warmer and causes the ice to melt faster – negative feedback, in fact. And if the huge methane reserves locked as gas hydrates in the Siberian permafrost or deep in the ocean should be released by climate change, they will give the greenhouse effect a massive boost.

The consequences affect not just the global climate but also have societal effects. A change in the weather can trigger an uncontrollable cascade of economic and societal effects (see box 1). One of the difficulties with cascade effects is that it is often unclear what will happen next. Simultaneous effects, where several events occur at one time, are another problem. If a heatwave and flooding occur simultaneously, a society may not be able to cope with the subsequent double disruption of water reserves.

Climate change impacts are not all gradual: they can also trigger developments which alter the global system abruptly and drastically. The climate system has tipping points where events achieve an uncontrollable momentum; for example, the Amazon rain forest will dry out irreversibly once it has reached a certain threshold; the North Atlantic Drift may weaken; the Greenland ice sheet will melt irreversibly once certain temperatures have been reached (WBGU 2007: 77ff).

Other consequences which affect poorer countries in particular are the reduction of monsoon rainfall in India and West Africa or the increasing frequency and severity of the El Niño phenomenon, which causes various effects including extremely heavy rainfall in the countries on the eastern Pacific rim (Lenton et al. 2008).



If temperatures rise beyond a certain point, irreversible melting of large icesheets will take place

II.4 ECONOMIC AND HEALTH IMPACTS

The climate change effects described impact the poor in particular. Around 60 – 70 % of the poor worldwide live in rural areas, mainly from agriculture. This is the economic sector most affected (see Fig. 1, from: HDR 2008: 23). Subsistence farmers are most endangered if they have no alternative income sources.

It is impossible to say at present how far other economic sectors will be affected (WBGU 2007: 75). It is foreseeable that long-term energy demands will increase as rising temperatures lead to increased cooling requirements, which will not be entirely compensated for by reduced heating demands. An upsurge in energy prices will have a corresponding effect on efforts to reduce poverty. Extreme weather events will also affect the insurance industry, with consequences for attempts to give the poor access to microinsurances, to help them safeguard themselves against losses due to the weather (see also the case study on India, page 29). Tourism may also be affected with knock-on effects on the poor; it is predicted that tourism, and thus a source of income, will shift from developing countries to more northern latitudes.

Apart from these trends, it is unclear to what extent individual sectors will be affected. Discussion is focussing increasingly on climate change's overall effects on national economies. The best-known calculation is probably that presented in the Stern report (Stern 2006), where an inevitable loss of 5 %, possibly up to 20 %, of global gross domestic product (GDP) is predicted if climate change is not slowed down. These are controversial figures. According to the IPCC, however, most calculations agree that a rise of a few degrees celsius in global temperatures would cause global GDP losses of several per cent. This effect, too, will hit some countries disproportionately hard, especially those in lower latitudes. Reductions of up to 30 % in some small national economies are already

being predicted for a global temperature rise of 2° C (WBGU 2007:76). The poor are not only geographically more vulnerable to negative growth; another effect will be that shrinking tax incomes will leave states with even less funding for social and development policy (Cord et al. 2008).

Increases in rainfall, flooding and drought are also accompanied by a higher incidence of water-borne diseases, in particular diarrhoea, cholera and typhus. According to the people of Toineke, diarrhoeal illnesses spread within weeks. The incidence of these diseases is predicted to rise especially in East, South and Southeast Asia, due to a combination of lack of clean water, pollution of existing water sources, general living conditions and levels of hygiene. Changes in the local water situation can also lead to mosquito-borne diseases; the insects breed wherever (contaminated) surface water collects, e.g. through increased rainfall or the wider use of irrigation systems. The regions and periods affected by these illnesses will expand. Southern Africa, the Horn of Africa (Cord et al.

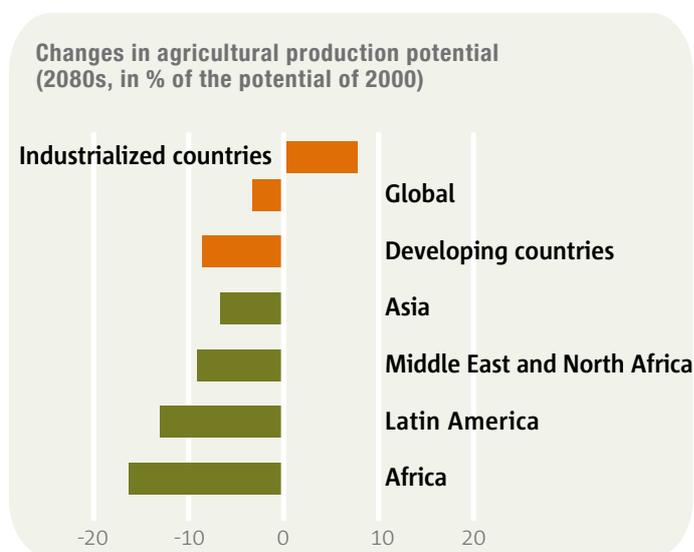


Fig. 1. Source: Human Development Report (HDR 2008, S. 23)

INCREASES IN RAINFALL, FLOODING AND DROUGHT ARE ALSO ACCOMPANIED BY A HIGHER INCIDENCE OF WATER-BORNE DISEASES

2008) and Central Asia (IPCC 2007b: 408) are threatened by the spread of malaria. The incidence of dengue fever will increase in urban areas where the lack of waste water disposal systems provides mosquitoes with breeding grounds. Most of the victims will be the urban poor, subsistence farmers, groups with weaker immune systems (the elderly, children) and coastal dwellers (WBGU 2007: 77).

Fig. 2 (after Cord et al. 2008) summarises some effects of climate change and their diverse, complex interaction. It also illustrates the particular vulnerability of the poor to these impacts.

III. What climate change impacts are anticipated in future?

At present it is hardly possible to predict how the climate change effects described above will actually play out in individual regions. This is mainly due to two factors (C. Müller 2009: 9ff). First, the global climate is so complex that all models of it are very simplified, i.e. only partial and/or approximate. Retrospective modelling of global temperatures in the twentieth century are relatively good; however, precipitation patterns and regional details are inaccurately represented. Temperature rises shown in half the models for Africa were lower than were actually observed. Rainfall was 30 % under- or 79 % overestimated in the models compared to actual

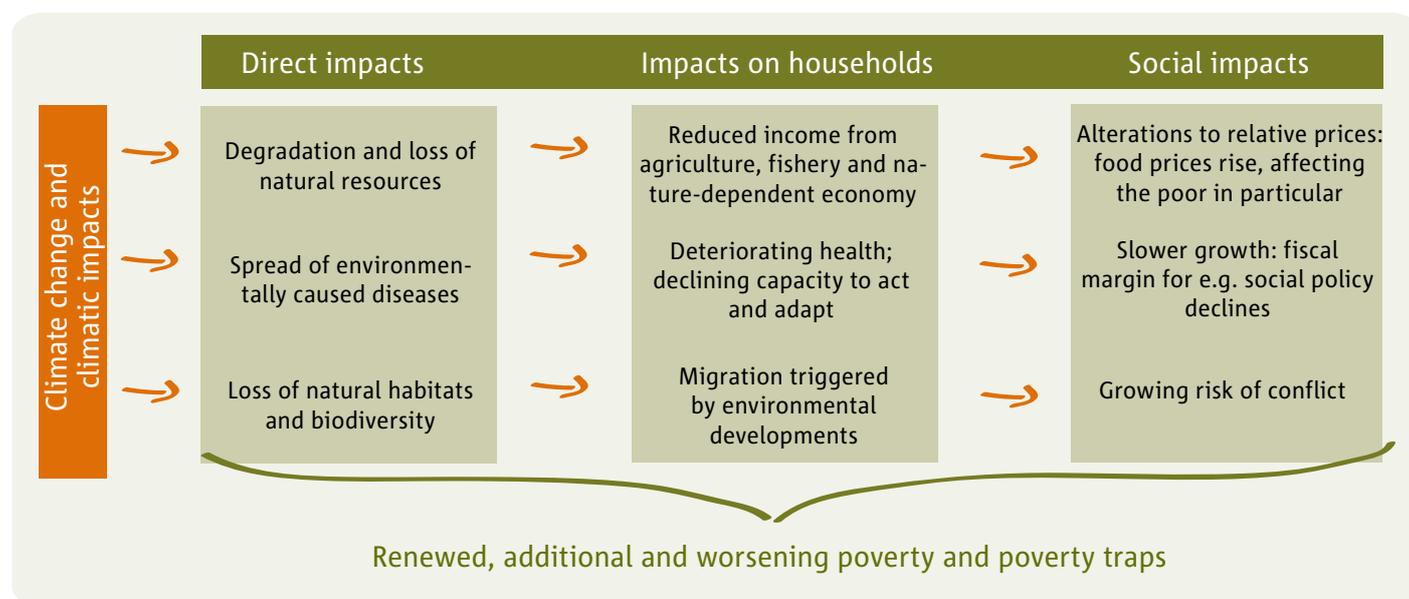


Fig. 2: Effects of climate change Source: Cord et al. 2008

amounts (ibid., p. 17). Projections based on these models are correspondingly unreliable.

Second, the drivers of climate change, above all greenhouse gas emissions, vary depending on human decisions – which are unpredictable. This is why scenarios are used to describe alternative emissions processes. Another important function of the scenarios is that they also indicate what alternative courses of action are necessary to avoid climate change reaching dangerous proportions. The IPCC’s scenarios show

projected future situations with variations in population growth, technological change, energy use, energy sources and land use (Nakicenovic/Swart 2000), factors which significantly affect the scale of emissions and of climate change.

The Carbon Budget 2007 report published in September 2008 (The Global Carbon Project 2008) shows how CO₂ emissions have increased in recent years, rising four times faster since 2000 than before. The following diagram from the Human Development Report 2007/2008 (HDR 2008: 20) shows the projected development of total CO₂ emissions in the atmosphere during the 21st century according to each of six IPCC scenarios.

It also illustrates the maximum total emissions and the climate-friendly CO₂ budget required for this century if disastrous climate change is to be avoided. The conclusion is that dangerous levels of climate change can only be prevented if future emissions are halved by 2050 compared to 1990 levels and subsequently reduced even further.

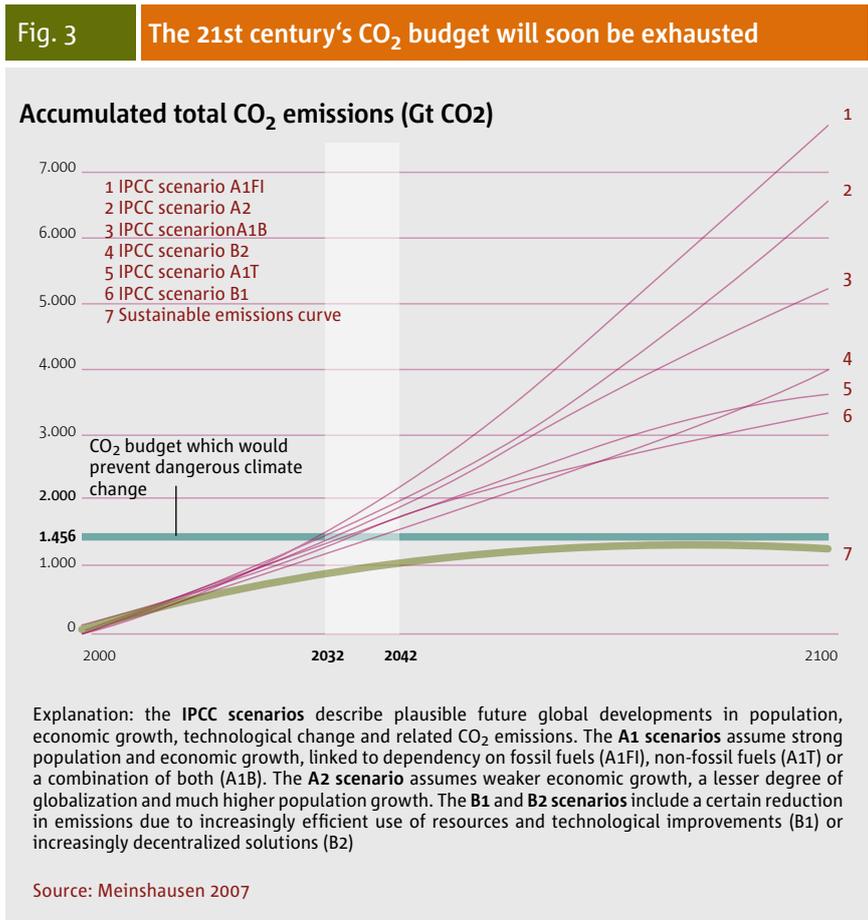


Fig. 3: IPCC Scenarios. Source: Human Development Report (HDR 2008, p. 20)

IF THE CLIMATE IS NOT PROTECTED, RISES OF UP TO 7° C ARE POSSIBLE

A further temperature increase of between 0.4 to 0.6° C is expected to occur between 2005 and 2030. This will be caused by existing emissions of greenhouse gases, independent of how emissions develop in the near future. According to the WBGU (2007: 60), only a drastic event such as a meteorite impact could alter this prognosis. The continents will heat up more than the oceans; higher latitudes will also warm up more as melting snow and ice cover results in more solar radiation being absorbed instead of reflected.

Inhabitants of polar areas will be particularly affected as temperatures there will rise rapidly. It is much harder for nature and humans to cope with a rapid rise than a gradual, slow increase. The effects will also be severe on the population in areas where the climate is already hot. Heat waves like that in 2003 in Europe will be the norm in 2050.

In the long term, very different rising temperature patterns are possible, depending on which emissions scenario actually occurs. If greenhouse gas concentrations are stabilised at below 450 ppm (parts per million, the usual measure of greenhouse gas concentrations in the atmosphere), global warming could be held at a total of 2° C above pre-industrial levels. Increases beyond this raise to over 50 % the probability of climate change reaching dangerous levels. If the climate is not protected, rises of up to 7° C are possible. These are global averages; the figures on the continents, especially in the most vulnerable areas, are much higher. In the IPCC's two most extreme scenarios, the temperature is predicted to rise 2.4 – 6.4 % (worst case) or 1.1 to 2.9° (best case) by 2100 (IPCC 2007a: 749).

Alterations to precipitation patterns are much more difficult to predict. Some tendencies are relatively clear, for example



More frequent flooding is one of the effects of climate change

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that arid subtropical zones, the Mediterranean region and southern Africa will become drier, whereas areas of high rainfall in the tropics and in higher latitudes will become even wetter (WBGU 2007: 62). However, it is not clear how rainfall patterns will develop in the Sahel zone. The long-term developments in hurricane occurrence are also very uncertain. The total rise in sea levels is also difficult to predict, mainly because it depends largely on how much inland ice melts. If no action is taken, the sea level is projected to rise by up to half a metre compared to 1990 levels, possibly even up to 140 centimetres (Rahmstorf 2007). If global warming is stabilised at 3° C compared to the pre-industrial average, the sea level may rise by 3 to 5 metres by 2300 (WBGU 2007: 38).

Looking at specific regional projections (e.g. in IPCC 2007a: ch. 11, 2007b: ch. 9-16; WBGU 2007: ch. 7), it must be noted that, at best, changes in the weather can be projected. Regional or even national projections of how vulnerable the population will be in the face of these changes are still very uncertain at present and are sometimes even dismissed as “pure speculation” (Feinstein IC 2008: 7).

III.1 GLOBAL PROJECTIONS: IMPACTS

The following diagram (Fig. 4) from the German Advisory Council on Global Change (WBGU 2007: 176) shows possible effects of rising global temperatures.

An update of the IPCC’s Reasons for Concern from 2001 was published in March 2009 (Smith et al. 2009). These climate concerns include threatened systems (island states, tropical glaciers etc), extreme weather events, the unequal distribution of climate change impacts and massive alterations to the earth system (tipping elements). The update shows that ecosystems are reacting more quickly, extreme weather events are happening more frequently and are more severe

than anticipated. Greater risks and severe consequences following even slight temperature rises are to be expected in all aspects. The international Scientific Congress on Climate Change confirms that the IPCC’s worst case scenarios are occurring and that societies are extremely vulnerable to even moderate changes in climate.

IV. Climate change and poverty reduction

IV.1 CLIMATE CHANGE, POVERTY AND POVERTY REDUCTION: HOW ARE THEY RELATED?

We have already shown the most important link between climate change and poverty reduction: climate change causes and exacerbates poverty, while also impeding development and poverty reduction by making the future availability of natural resources doubtful. However, poverty and lack of development also reduce people’s ability to react to climate change; in other words, poverty itself aggravates the consequences of climate change for those affected.

There are however other links between climate change, poverty reduction and development. Does poverty also play a part in causing climate change? That would be the case where poverty contributes to non-sustainable land use practices, producing high greenhouse gas emissions. In the Amazon region of Brazil, for example, poor smallholder farmers are involved in the destruction of the rainforest, but only as the weakest link in a chain mainly consisting of more powerful actors – the timber, beef and soja industries. So each case

CLIMATE CHANGE CAUSES AND EXACERBATES POVERTY, WHILE ALSO IMPEDING DEVELOPMENT AND POVERTY REDUCTION BY MAKING THE FUTURE AVAILABILITY OF NATURAL RESOURCES DOUBTFUL

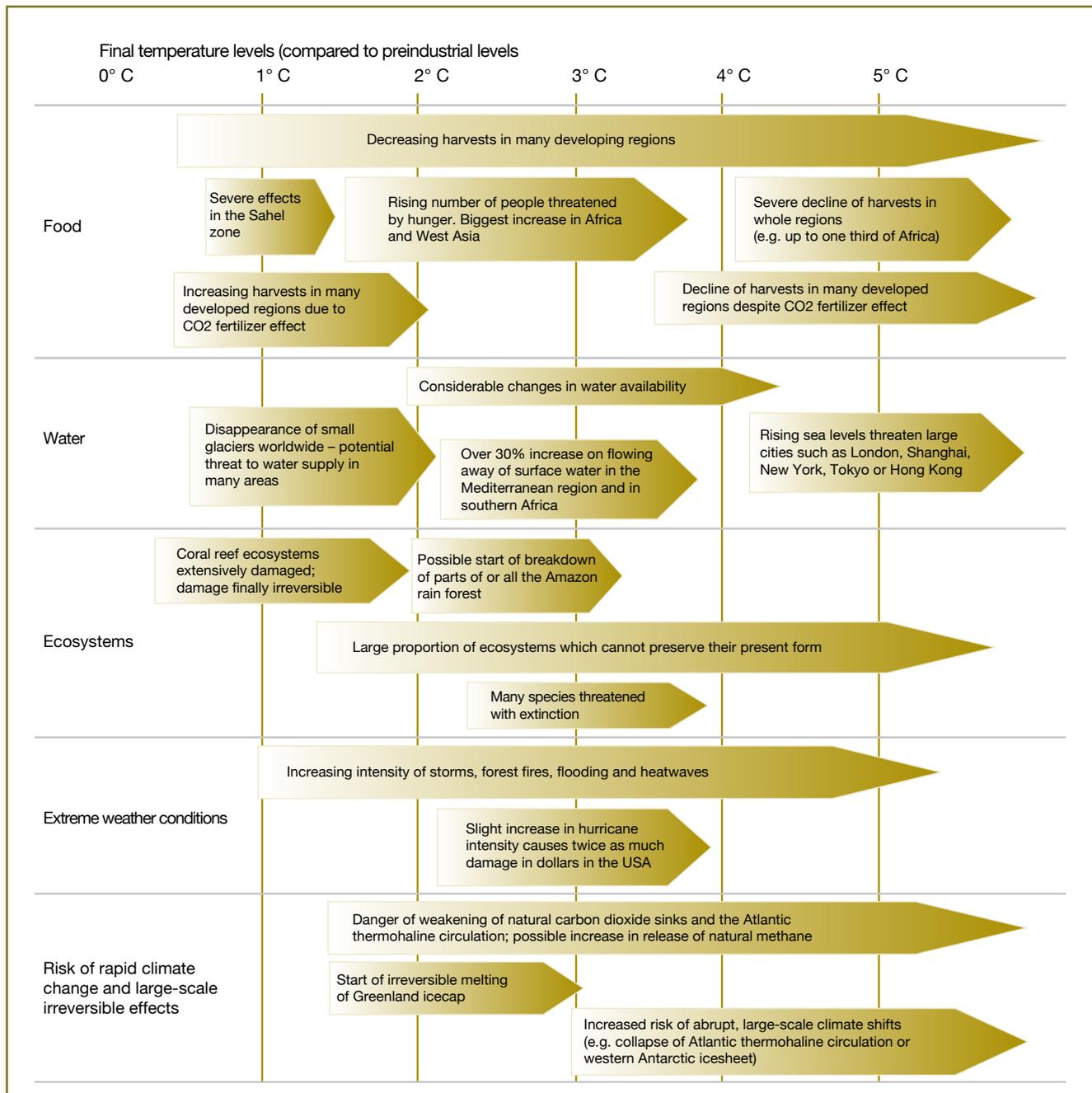


Fig. 4. Source: WBGU 2007, S. 176

must be considered carefully in determining whether poverty causes emissions.

Does poverty reduction also reduce emissions? If so, it would be true to say not only that “climate protection equals poverty reduction”, in that reducing climate change would at

BOX 2: MI BOSQUE. CLIMATE PROTECTION = POVERTY REDUCTION

The CARE project Mi Bosque (my forest) in western Guatemala combines community-based adaptation to climate change impacts with avoidance of further climate change. Tree planting helps prevent erosion, produces fruit to be eaten and marketed and improves soil quality. Reforestation also counteracts deforestation, itself the cause of CO₂ emissions, as well as binding additional CO₂ which would otherwise reinforce the greenhouse effect.

Currently, tree planting binds over 200 t per hectare. Additional benefits of this sustainable land use are improvements in agricultural productivity, a corresponding reduction in migration to seek paid work and income from selling the wood. Efforts are being made to measure and certify the CO₂ savings more effectively and to market them.

The project exemplifies the concept of Reducing Emissions from Deforestation and Degradation (REDD). Deforestation and damage to forests cause up to 25 % of total anthropogenic greenhouse gases. Protecting forests to avoid these emissions is a cost-effective climate change strategy (Stern 2006). At present it is still unclear how forest preservation can be rewarded financially. Possible alternatives are recognition of CO₂ avoidance on the emissions certificates markets or voluntary financing through funds.

least benefit the poor of the future, but also that “poverty reduction equals climate protection”. However, reducing large-scale emissions on a national level, whether in industrialised, emerging or developing economies, is the more important task.

Is poverty reduction rather than climate protection the primary goal? By boosting and industrialising the economy, development and poverty reduction themselves could contribute to climate change. On the other hand, some argue that climate protection will impede poverty reduction in that avoiding emissions will slow down the growth necessary to overcome poverty.

Sometimes a win-win option benefiting all sides makes it possible to implement sustainable development, reducing both poverty and emissions at the same time. One example would be strategies to enable the poor to benefit directly from economic profits from climate protection. In this case, climate protection and poverty reduction go hand in hand, preventing poverty arising from climate change and reducing existing poverty. The poor can often reduce CO₂ emissions or bind them in biomass (e.g. by planting trees) in relatively simple ways. If they are then given access to markets where they can sell these savings, they can actually earn more, especially if they already gain an income from these activities (see box 2).

AVOIDING EMISSIONS WILL NOT BE SUFFICIENT TO PREVENT NEGATIVE IMPACTS OF CLIMATE CHANGE

IV.2 ADAPTING TO THE IMPACTS OF CLIMATE CHANGE

As the CARE project Mi Bosque (Box 2) shows, it is possible to combine efforts to avoid climate change with adapting to its impacts. For years, the focus has been on avoidance; more recently, adaptation has begun to take centre stage. There are several reasons for this (Füssel/Klein 2002):

1. The effects of greenhouse gases already in the atmosphere will be felt in the future; in other words, climate change is unavoidable. The global population must adapt to it in any case. Equally, the positive effects of successful emissions avoidance strategies will not be felt for decades.
2. Adaptation measures at local, regional or national level can protect the population directly from the effects of climate change. Avoidance measures are more dependent on international cooperation.

3. Adaptation measures also protect the population from the effects of climatic variations - short-term variations which currently have damaging effects particularly on the lives of the poor.

Avoiding emissions is indisputably necessary, but this will not be sufficient to prevent negative impacts of climate change. The suggestions for combining poverty reduction and climate protection described below focus on adaptation at local level, sustained by the local community and supported by projects and organisations which tackle poverty.

Adaptation to climate change is already happening, not just in organised form. This makes it essential for organizations to take into account the ways in which people are already adapting to environmental changes and local climate change effects. The population may be forced by their situation to take unsustainable measures. In Toineke, some families have increased their salt production by “salt boiling”. This uses up a large amount of wood, leading to over-use of the surround-



Adaptation to climate change can mean keeping ducks instead of chickens

© CARE

ing forest which otherwise provides erosion protection and a source of food. This type of maladaptation can be avoided by suitable support. On the other hand, the local population usually know their local environment well. Measures to support them in their adaptation strategies should be compatible with this knowledge and can gain from it.

IV.3 SUPPORTING RESILIENCE

People must be viewed as active agents in connection with climate change, for the reasons shown above. This viewpoint is the basis of the livelihood concept, which is widespread in development research and in organizations which work to reduce poverty.

It covers the strategies people use to ensure their survival and fulfil their needs based on their capabilities and available resources. Some of these strategies involve maintaining access to certain resources, including social capital (e.g. integration in the community), human capital (e.g. knowledge, health), physical capital (housing) and financial capital (savings). The most important factor is natural capital – fruitful land, regular rainfall and other ecosystem services.

The livelihoods perspective includes the way people's ability to actively ensure their survival is affected by changes to the available resources. It also covers three other aspects of poverty. The first of these is people's vulnerability to the impacts of climate change as mentioned above. Vulnerability means the extent to which people's opportunities to sustain their livelihood are damaged by these impacts. In this case, poverty reduction means overcoming this vulnerability.

The second aspect is resilience. A population's vulnerability depends on how it can react when climate change impacts affect its means of livelihood in the form of sporadic shocks



The use of firewood affects local ecosystems

RESILIENCE DRAWS ON AVAILABLE LOCAL RESOURCES, BUT ALSO ON ACCESS TO EXTERNAL AID

(e.g. a storm) or long-term pressures such as dwindling water resources. Resilience includes first, solving the problem and second, adapting to the new conditions (Handmer/Dovers 1996). If people can only react by absorbing the changes – e.g. eating even less if harvests fail – this will not decrease their vulnerability. In the long term, therefore, absorbing or coping strategies are not sustainable (Davies 1993). Adaptation to the changed conditions, however, can reduce vulnerability. On the other hand, reducing vulnerability can open up new opportunities for a population to adapt in their own ways to the new conditions (Kelly/Adger 2000). For example, if water access is ensured and storage facilities improved by external support, it may become possible to increase food production, which acts as a buffer. So resilience draws on available local resources, but also on access to external aid (IISD 2003: 6).

Strengthening resilience is central to an approach to poverty reduction. Measures may be specifically tailored to a particular threat: if climate change reduces rainfall, drought-resistant types of grain can be provided for smallholders. A prerequisite for this is definite knowledge of both the threat itself and the efficacy of the measures against it. This is not the case if the newly introduced grains are drought resistant, but growing them is incompatible with the farmers' other activities.

However, strengthening the population generally will continue to be very important. Because it is so hard to predict the consequences of climate change and how effective strengthening resilience in a particular aspect will be, it is essential to maintain people's general capacity to act and react. This includes their health as a prerequisite as well as income to enable access to additional resources and social networks to compensate for unforeseen vulnerability (IISD 2003:7). Finally, security must be mentioned. Poverty reduction as practised by CARE and other organizations involves more

than simply ensuring that people have adequate and effective access to resources which provide their livelihood and fulfil their needs. It is also necessary to ensure that this access is guaranteed for the long term. However, climate change impacts undermine these efforts. So the strategies and activities of the people themselves, as well as those aimed at poverty reduction, must be climate secure: they must still function even if the effects of climate change are more severe or different from those anticipated. They should also be no regret measures, useful even without climate change.

IV.4 CRITERIA FOR SUCCESSFUL ADAPTATION MEASURES

A 2007 paper analysed 130 case studies of adaptation and development policy in reaction to climate change. The measures were placed on a spectrum (McGray et al. 2007: 18, cf. Fig. 5).

At one end are activities which concentrate on structural causes of poverty and vulnerability in general (left). At the other end are those related to climate change itself (right). In between are measures which strengthen people's capacity to react to climate change impacts and those which integrate foreseeable climate risks into economic, political and other decision-making processes.

The aim of this arrangement is not so much to fit measures correctly into one category or another; the spectrum shows various aspects and approaches which ideally should be implemented together. If all these aspects are taken into account in a single project, it may be less focussed on particular aspects. However, this can be an advantage over concentrating too exclusively on a single aspect. A holistic approach is more effective than precision, since local climate change impacts the population in different ways at the same time.

Effectiveness is one of several criteria which adaptation measures, in the sense of livelihood-oriented poverty reduction, aim to fulfil. A survey evaluating previous forms of adaptation (IDS 2008: 27f.) proposes five criteria, as follows:

These criteria are not only important at the planning stage. The local population's own ways of adapting to climate

change impacts, and the effect these have at a social level (e.g. increased energy requirements due to increased use of air conditioning), can be tested against them. National adaptation policies should also take them into account.



EXISTING STRATEGIES MUST BE MADE CLIMATE SECURE

IV.5 MEASURES

CARE differentiates between measures for (1) support, (2) protection and (3) livelihood provision, according to urgency. The third type comprises emergency aid designed to keep people alive in an acute situation.

Longer-term adaptation to climate change involves the first two categories. The following table shows these distinctions; measures to ensure food security have been supplemented to include general adaptation to climate change (CARE 1998, Cord et al. 2008, IDS 2008).

CRITERION	DESCRIPTION
EFFECTIVENESS	The population's vulnerability is really reduced, their resilience strengthened, their access to resources secured. Effectiveness also depends on measures being compatible with the population's circumstances, strategies and culture. Therefore it is essential that people participate in the development and implementation of measures. The measures should not conflict with each other.
FLEXIBILITY	Because the future is so unpredictable, measures should be flexible enough to have positive effects whatever climate change brings (no regret measures). They should also involve low levels of sunk costs (i.e. costs which cannot be recovered).
FAIRNESS	Poverty reduction measures aid different groups to varying extents; they should not reinforce existing inequalities – even though it is sometimes easier to strengthen less vulnerable groups. Poverty reduction efforts should be distributed fairly anyway, for ethical reasons – but also for strategic reasons, since otherwise the measures will lack support and long-term effects will not be achieved.
EFFICIENCY	Maladaptation also occurs when the most cost-effective measures are not used and/or the costs of adaptation are higher than its usefulness. However, it is difficult to quantify usefulness: how much is it worth to enable people to maintain their livelihoods? This perspective is known as the economics of adaptation.
SUSTAINABILITY	Before measures are adopted, their long-term effects should be considered: whether they will be stable and are efficient in the long term. Sustainability also requires that measures have no negative effects on local ecosystems, social cohesion etc. The main factor is that measures should be so firmly rooted in people's everyday lives that they are sustained once the aid organization has withdrawn its support.

Table 1. Source: as in IDS (2008: 27f) with some changes

PROTECTION AND MAINTENANCE OF LIVELIHOODS

- General: protection/restoration of secure access to resources or means of production.
- Basic raising of awareness: what is happening due to climate change and how does it affect the population? Enable locals to participate and combine their knowledge about effects with external knowledge.
- Ensure that dealing with climate change becomes the new norm, so people are aware of it and adapt their livelihood strategies on their own initiative.
- Apply aid payments to ensure people do not sell their means of production in a crisis.
- Set up early warning systems and track climate change; make risk prognosis and information about possible impacts available (radio etc.).
- Emergency plans to enable quick, effective reaction to unexpected events.
- Management of remaining risks, e.g. in the form of microinsurances against weather events.
- Material infrastructure to defend against immediate effects of climate change (e.g. dykes, building regulations/technologies, irrigation systems, water reservoirs in arid areas).
- Improvement of soil, forest and water management e.g. to maintain agriculture (e.g. tree planting to protect against erosion).
- Health and other measures to ensure that people are not so weakened by disease or undernourishment that they lose the capacity to act and react.
- Institutionalizing and „automating“ local protective measures: who is responsible for what, ensuring communication between these people and institutions etc.
- Related to this: training local individuals responsible for these particular roles.

SUPPORTING LIVELIHOODS

- Stabilizing harvests by diversifying crops and adapting them to the projected climate conditions.
- Developing alternative income-generating activities, esp. those less dependent on the natural environment (e.g. not agricultural) or less likely to be affected by climate change.
- Providing conditions and incentives to adopt these alternative strategies.
- Ensuring access to new technologies, grain types and other innovations as prerequisite for new practices.
- Strengthening strategies which have proved sustainable, not maladaptations e.g. seasonal job migration.
- Improving storage capacities for reserves in case of failed harvests.
- Improved management of community assets which are affected by climate change but cannot easily be protected by individual owners.
- Education to improve people's capacity to act and react.
- Improving access to political decision-making, so community adaptation is designed to meet actual needs.
- Empowerment e.g. of women to enable them to take more part in decision making.

Table 2. Source: CARE 1998, Cord et al. 2008, IDS 2008

THE UNUSUAL EXTENT AND SPEED OF CURRENT CLIMATE CHANGE IS CHALLENGING PEOPLE'S CAPACITY FOR ADAPTATION

V. Poverty reduction and strategies to secure livelihoods: case studies and lessons learned

As Table 2 shows, the instruments of the livelihood approach to poverty reduction can be applied to promote adaptation to climate change impacts. It is not necessary to invent new forms of poverty reduction; however, existing strategies must be made climate secure. If this can be achieved, these instruments are particularly suitable, because they strengthen the self-preservation capacity of poor populations. This capacity is endangered by climate change, but is also an important part of the solution. Decentralized, community-based adaptation can not only cover actual needs, but also make use of local adaptation capacities.

We now describe some cases of reaction to climate change impacts. People often react on their own initiative. Climate variations are not a new phenomenon to most of them, but the unusual extent and speed of current climate change challenge their adaptation capacity. However, adaptation is taking place, so poverty reduction efforts must support this or, if necessary, offer alternatives. Here we show in more detail how these reactions and adaptations combat poverty and what can be learned from this. We relate this to the criteria mentioned above – effectiveness, flexibility, fairness, efficiency and sustainability. The case study on the village of Toineke in West Timor, Indonesia, was carried out especially for this paper by ZEF in cooperation with CARE.

V.1 SMALLHOLDER FARMERS IN TANZANIA: SPECIALISING AND REDUCING DEPENDENCE ON AGRICULTURE

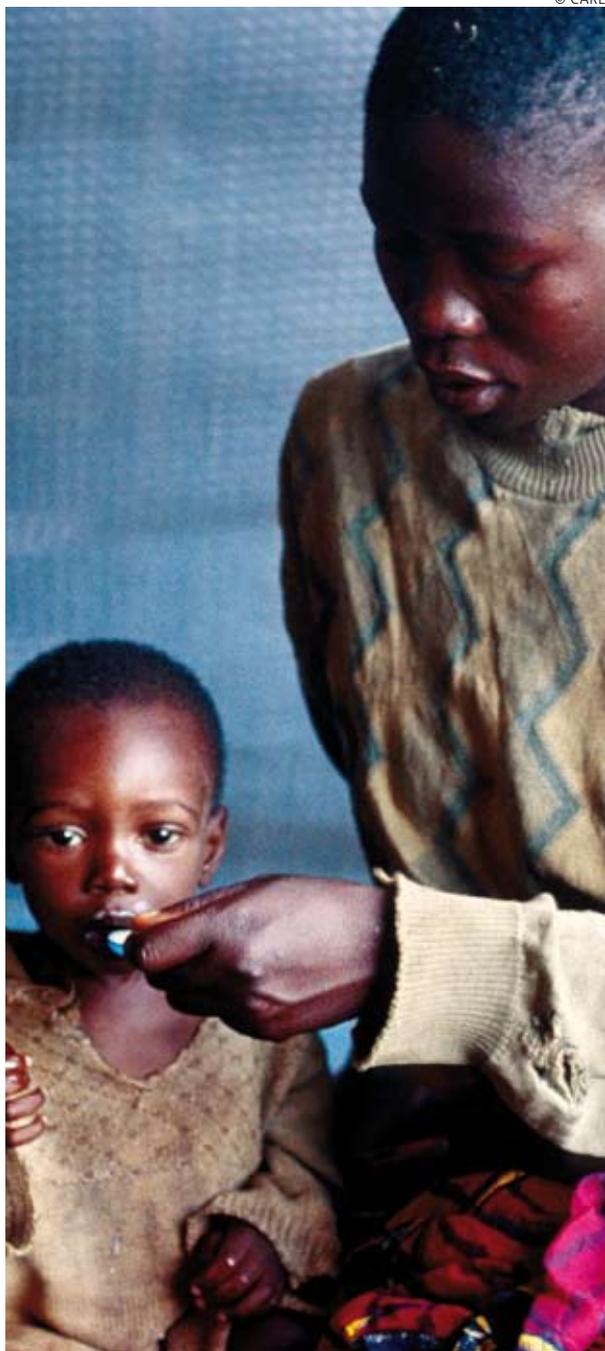
The livelihood approach to poverty reduction emphasises diversification of economic activities (Ellis 1998). This reduces the population's vulnerability, in that they can fall back on other income sources.

The disadvantage is that they must maintain both activities simultaneously and so can invest less effort in each. Sometimes it seems more advantageous to specialise. This was observed among smallholder farmers in Kenya and Tanzania (Eriksen/Brown/Kelly 2005).

CARE carried out a country-wide study of climate change impacts and adaptation in Tanzania (Ehrhart/Twena 2006). Tanzania is the largest, most densely populated country in East Africa, but also the poorest. The primary threat is the anticipated increase in frequency and severity of extreme weather events. About 80 % of the population is dependent on rain-fed subsistence agriculture which is susceptible to climate variations. Undernourishment is widespread and food aid is often necessary.

The study investigated smallholder farmers in the Saweni district in northeast Tanzania, to see how they coped with drought and maintained food security (Eriksen/Brown/Kelly 2005). Harvests in this area often fail due to drought. Water, grazing land and firewood are in short supply. Smallholder farmers cultivate a fairly wide range of crops, the most popular being maize. Animal husbandry has diminished drastically in recent decades. Imports of additional produce from the surrounding area have been increasing since the late 1970s. Non-agricultural income is becoming more important, although most households continue to practise agriculture. Young people seek paid work; young men often migrate.

In the past, fruit and tubers were gathered and animals and poultry sold during periods of drought. Other coping mecha-



Climate change is increasing hunger worldwide

nisms included occasional work, family support and emergency aid. The local people differentiate between main and secondary strategies. The former are regular activities producing a reliable income over longer periods; these replace agriculture. Small businesses (e.g. shops) or crafts such as carpet weaving are common strategies. Secondary strategies entail using individual opportunities, e.g. making and selling rope, when the main strategy is not possible. The main strategies are intensive, specialised and bring a cash income. Money has become important, above all for purchasing additional food and health services.

The authors identified increasing monetarization and dwindling significance of local produce as reasons why local people specialise in a few activities to cope with droughts. This includes the possibility that several people in one household – not the whole household – concentrate on one activity. Although agriculture is still the preferred activity, people continue to practise the specialised, cash-oriented activity so they do not lose touch with it and can continue it during phases of drought (Eriksen/Brown/Kelly 2005).

This response to climate change impacts has been initiated by the local population. Access to preferred methods of gaining a specialised, cash-bringing livelihood is unequal; e.g. it is easier for the better qualified. This form of coping is effective because the population is more dependent on money anyway than in the past. Money may also make them more flexible, because it can be used for a variety of purposes, unlike agricultural produce.

However, coping is not the same as adaptation. Constantly coping with environmental stress and pressure on livelihood activities is not sustainable and does not reduce the population's structural vulnerability. It may be that the coping strategies for drought observed in Tanzania are not "maladaptations". However because of low growth, local job markets can

INSURANCE IS ALSO AN INCENTIVE TO PEOPLE TO MAKE THEIR OWN LIVELIHOOD CLIMATE SECURE

only absorb a limited amount of non-agricultural activities. The greater the number of people concentrating on this coping strategy, the less effective it is, because the potential income declines. People who specialise in non-agricultural activity also lose the food security which subsistence agriculture can provide despite climate change impacts. A cash income may fail or lose its purchasing power, for example when global food prices rise. The strategy of gaining independence from agriculture and natural resources in response

to climate change is risky; other economic sectors will also be affected by climate change, so the population's vulnerability may only be postponed, not reduced.

V.2 MICROINSURANCE IN INDIA: THE POOR PROTECT THEMSELVES AGAINST RISKS

Microfinancial services have been used for many years now to support people in breaking out of the poverty trap. Micro-loans, for example, enable the beneficiaries to set up small businesses.

BOX 3: MICROINSURANCES AND WEATHER-RELATED DISASTERS: CARE INDIA AND BAJAJ ALLIANCE

CARE India and the Indian insurance company Bajaj Alliance together provide microinsurance for about 92,000 people in the coastal regions of the Indian state Tamil Nadu. According to RN Mohanty, head of CARE India Microinsurance, the main challenge the concept entails is convincing people to include risk provision in their livelihood strategies and to develop a culture of making provision for the future: "Almost 90 % of our customers are first-time insurance takers. [...] The hardest task is to teach and train the people."

To succeed, the system must gain people's trust, so it is of prime importance to regulate claims satisfactorily. The system was put to the test in November 2008, when tropical storm Nisha hit the Tamil Nadu coast, making thousands homeless. Project workers went at once to the affected areas to assess the damage and make payments as quickly as possible. That showed people how useful it was to invest in insurance, leading to growing interest .

Recently, microinsurance has also been initiated, to insure people who have few possessions and can only afford small premiums. This provides a form of livelihood protection: if sudden or long-term events - storms, drought - destroy means of production, the threatened income can be secured by insurance payments.

Insurances, especially index-based insurances, also have the advantage that they reward risk provision. Payment is triggered by a physical factor, e.g. a certain level of rainfall, not by the actual damage a farmer suffers. He can reduce the risk by cultivating more robust crops (Arnold 2008). In this way, the insurance is also an incentive to make one's livelihood climate secure.

Risk reduction gives the poor scope to adapt to climate change impacts (Lemos/Tompkins 2008). Because microinsurance secures existing livelihoods and encourage improvements, they are a good instrument to protect people from slipping (back) into or enable them to rise out of poverty. The poor, however, often can not afford this insurance (Reiner 2008). Only a small numbers of insurances reach the poor (Arnold 2008, Pierro/Desai 2008). This could be countered by assistance in paying premiums - this could be taken on by the

countries primarily responsible for anthropogenic climate change. To suit these users, insurance must be straightforward and easy to understand; it should also be possible to pay flexible premiums, since otherwise people with irregular incomes would soon drop out of the system.

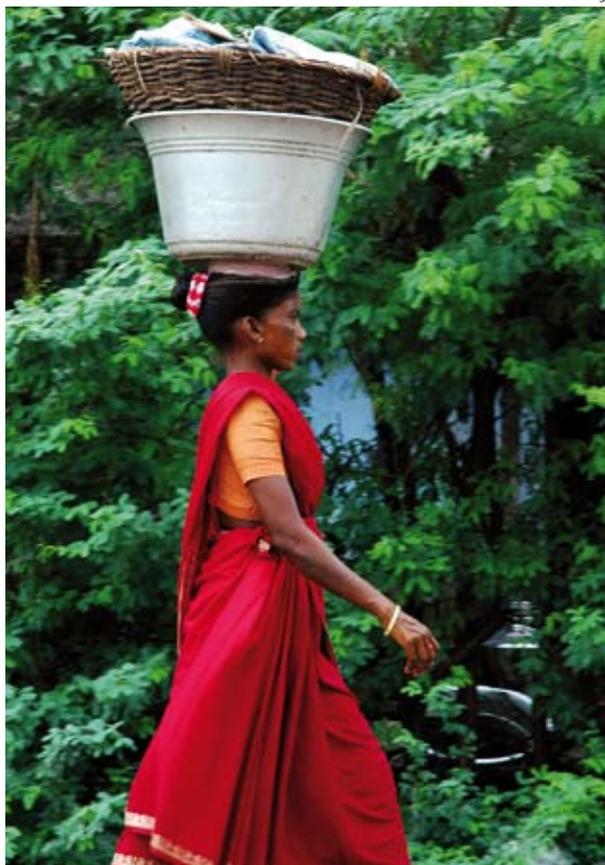
Insurances are not the only way in which the poor can deal with climate change risks, such as losses caused by natural disasters. Financial and social capital (savings, knowledge and training, family support) are also important components of livelihood resources. However, these can be overstretched

when one disaster follows another too quickly. In that case, people can be forced to sell possessions, take out loans and so fall back into poverty (Arnold 2008). Natural disasters also tend to affect all members of a community, so in order to function, insurances must spread the risk; otherwise, the premiums will become too expensive or the insurer will not be able to afford to make payment.

Climate change is also making it more difficult to sustain this system. Potential damage from extreme weather events is becoming more frequent and extensive, so some insurers are withdrawing from the market. This has already been observed in coastal areas. The system will only be worthwhile in the long term, on a scale large enough to spread the risk. Reinsurance must also be built up and investments in improved infrastructure are necessary, to reduce the demand for insurance.

Finally, new types of insurance tailored to local needs are being tested, to limit insurers' costs. Bajaj Alliance India's health insurance is one example. Working with CARE, a cooperative system has been developed in which the local community itself administers the insurance, retaining 67 % of the premiums. This is sufficient to cover most claims. Bajaj Alliance only takes over when a case exceeds the community's capacity. After a year, it appears that 80 to 90 % of cases can be covered in the community (Alliance 2009).

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Microinsurances are an innovative form of adaptation

IF SEA LEVELS RISE ONE METRE, INDONESIA WILL LOSE 2,000 ISLANDS AND 400,000 HECTARES OF LAND

VI. Case study West Timor, Indonesia

The following example of the village of Toineke in West Timor, Indonesia, shows clearly how climate change impacts people's survival strategies and how they deal with the situation – more or less successfully.

VI.1 IMPACTS OF CLIMATE CHANGE IN (EAST) INDONESIA

In part 1, we referred to the uncertainty of making concrete predictions about the effects of climate change on local weather conditions. However, regional projections do exist (IPCC 2007a: ch. 11, 2007b: ch. 9-16; WBGU 2007: ch. 7).

Warming in Southeast Asia will be at 2.5° C, similar to the global average. Rainfall will increase by about 7 %, but with concentrations in particular regions (Boer, Faqih 2004). Indonesia will probably be badly affected by rising sea levels: a rise of one metre would lead to the loss of 2,000 islands and 400,000 hectares of land (IPCC 2007b: 485). Local developments could be very different from these regional trends, due to the complex geography of the region; temperatures may rise much more in inland areas. East Indonesia in particular is affected by the El Nino southern oscillation (ENSO) phenomenon, where reduced rainfall leads to longer dry seasons and droughts. This happened, for example, in 1982/1983, 1991, 1994 and 1997/1998 (Hulme/Sheard 1999). Where rainfall increases, the trend to sudden, heavy rainfall is also strengthened, resulting in erosion and flooding (IPCC 2007a: 886). Little is known about the development of the tropical storms which occur especially in East Indonesia, but they are expected to increase in intensity (by about 10 – 20 % if the sea surface temperature rises between 2 to 4° C, IPCC 2007b: 479), while their frequency may actually decrease. Indonesia,

the third largest global emitter of greenhouse gases, is usually perceived as damaging the climate (Weck 2007, J.Müller 2008). This case study shows that in Indonesia, as in the rest of the world, it is the poor who usually profit least from the overexploitation of the natural environment but who suffer most from its effects.

VI.2 TOINEKE, WEST TIMOR: ECONOMY AND SOCIETY

Toineke is a village located at the mouth of River Noemuke in the Indian Ocean. It comprises 680 households (approx. 3,000 inhabitants), two primary schools, five churches and four local health centres.

GENERAL DATA ON WEST TIMOR, INDONESIA

Province: Nusa Tenggara Timur

Provincial capital: Kupang

Island: Timor

Area: 14,394.90 km²

Inhabitants: 1.7 m.

Ethnicity: Atoin Meto, Tetum, Bunak, Kemak

Languages: Indonesian, Uab Meto, Helong, Rotinese, Tetum

Religions: 55 % Catholic, 34 % Protestant, 8 % Muslim; ancestor worship and belief in spirits are widespread

Climate: West monsoon/rainy season (Nov. o April), east monsoon/Dry season (May to Oct).

Economic sectors: Agriculture (40 % GNP; 68,5 % of working pop.), trade (15,9 %; 6,5 %), construction (7 %; 2,4 %), transport and communications (6,2 %; 4 %), manufacturing industry (1,7 %; 8,2 %), mining (1,3 %; 0,8 %), electricity, gas (0,4 %; 0,1 %)

Source: Badan Pusat Statistics, NTT, 2008.

SINCE THE EARLY 1990S, TOINEKE HAS EXPERIENCED MASSIVE LOCAL ALTERATIONS IN THE CLIMATE

The population has lived from subsistence farming for generations, making them very dependent on the natural environment. They also have vegetables gardens and orchards, keep animals, trade on a small scale and practise home industries. Very few families fish in the nearby sea. Apart from agricultural and animal produce, goods are manufactured for sale, including woven goods, palm leaf containers, arts and crafts, coconut oil and sweets. Carpentry products and construction material from the putak palm, firewood, coconut seedlings, betel nuts and cigarettes are also traded. A few families use the electricity supply available at night to produce ice cream. Others sell salt, produced by boiling sea water for hours. This method of “boiling salt” entails chopping down large numbers of trees for firewood. Originally the soil was very fertile, attracting a continually increasing population since the 1960s. In 1960, there were 78 households in the village; within 10 years, the figure had risen to 180. As a result, Toineke’s population is a mixture of ethnic groups from different places. The great majority of the villagers live in small one to three room houses, made

of wood (frame and roof timbers), dried putak palm twigs (walls) and palm stalks (roofing). The floor is usually of tamped earth. Cooking takes place on three stones in the fire on the floor. More modern wooden, stone or concrete houses are the exception.

VI.3 PERCEPTIBLE LOCAL IMPACTS OF CLIMATE CHANGE

Until the 1980s, the West Timorese climate was typified by a relatively reliable division into a dry season from May to October and a rainy season from November to April. The start of the rainy season was marked by several days of constant rain. Farmers started planting after two or three days of continual rain.

However, since the early 1990s, Toineke’s population has observed massive local alterations in the climate. Since then, the dry season has been getting longer and the village suffered several prolonged droughts, lasting the whole year (in 1992, 1994, 1995, 1997, 1998, 2006, 2007 and 2008). Four of the seven village wells dried out between 1992 and 1995, so fetching water involved far more effort. The extra time required had negative effects on home industries, water shortages reduced harvests in vegetable and fruit gardens and damaged the health of people and animals. Field harvests were also badly affected. People sold their smaller animals, flooding the market and resulting in falling prices. The situation for agriculture recovered somewhat between 1997 and 2006, with a pattern of two years of extended dry season followed by a year with a good rainy season.

On the evening of 16 May 2000, a rapidly rising flood inundated the village. The houses at ground level were standing in water containing loam and some salty sediments for up to two months. The flood destroyed fields, vegetable gardens



Map of Toineke. Source: Google-Maps

and home industries, damaged houses and washed away possessions; many animals drowned. The standing water brought mosquitoes and diseases, in particular malaria and diarrhoeal diseases, but also dengue fever. In parts of the village, wells and soil were contaminated with salt.

The village had previously only experienced flooding in 1972 and 1990; villagers stated that the earlier floods were nothing in comparison with that of 2000. Since then, the village has been inundated several times every year between December and May, though not on the scale of the 2000 flood. The water and sediment remain for up to three weeks in some parts of the village. The villagers differentiate between water and sediment from the mountain and from the river in their effects for agriculture. Mountain water is considered positive and fruitful, whereas river water is mixed with sea water and damages agriculture.

Compared to the dry periods in the 1990s, the rainy season has been more reliable since 2000. However, the precise timing and duration are not reliable. In some years, the rain



Toineke was hit by several severe droughts in the 1990s, resulting in drastically reduced harvests in fields and gardens

CASE STUDY: IBU YANSE TON

Ibu Yanse Ton (age unknown, 2 years primary school, widowed, 4 adult children) lives with her son, his wife and two children in a badly damaged house build of local materials at ground level, in the regularly flooded part of the village. In 2000, the flood washed away all their possessions, their animals were drowned and parts of the house collapsed. Her family fell ill with malaria and diarrhoea, necessitating a week in hospital.

© Anna-Katharina Hornidge



Since 2000, the family has got used to the floods but does not attempt any preventive measures or pursue any longer-term adaptive strategy. Instead, Ibu Yanse leaves her house when the water rises and stays with relatives who live on higher ground. When the water level falls and her house is no longer flooded, she returns and gets rid of the sediment and any water left. Ibu Yanse explains this with the lack of financial and human capital. "It's already hard enough to get food each day. How could we plan to build a secure house as well?" She used to keep small animals (particularly chickens). "Now the floods make it more difficult to earn a little more money." When the water and sediment destroy the harvest yet again, she gathers wild cassava and tamarind seeds in the forest as food substitutes. However, that is also becoming more difficult. There is less and less wild cassava in the forest, she reports.

THE INCREASING IRREGULARITY OF THE WEATHER ENDANGERS AGRICULTURE AND SO LIVELIHOOD SECURITY

starts in October but then stops. Pak Martinus Taneo says, “In the past, when the rainy season started, it didn’t stop raining. Now it rains, we plant our fields and then the rain stops, sometimes until January or February”. The subsequent heat kills the newly sown plants, so that when the rains return in December or January, new seeds have to be bought and planted. The Birch effect, the increased release of nutrients to plants after the first rain, which is responsible for 30 % of the harvest, is lost (Wood 1995: 76). In other years, the rain

does not start until the second week in December or in January and then continues until May. Since 2005, the villagers have observed that the rainy season is getting longer again, sometimes lasting from October to May. However, during this period the rain falls in short, abrupt phases, followed by days without rain. This is often combined with flooding. In the last three years, in contrast, the dry seasons were extremely long and hot, like the droughts in the 1990s. However, it rained occasionally, which is unusual for the dry season.

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Toineke suffered one of the worst floods in the village’s history in May 2000. The houses were under water for up to two months

VI.4 COPING AND ADAPTATION STRATEGIES

The increasing irregularity of the weather endangers agriculture and so livelihood security. However, the locals do not see these alterations in the context of global climate change. They perceive them as concrete changes in the local environment and weather and discuss them in these terms. Two frequently heard sentences are, “alam sudah berubah” (nature has changed) and “musim sudah berubah” (the seasons have changed). Some villagers also see the changes as God’s way of challenging them to find ways to live in future with these changes.

So far the villagers have undertaken a variety of collective efforts to stem the flooding, but with very little success. There is no long-term adaptation strategy for the whole village, though possibilities are being discussed with the support of third parties.

At an individual level, a number of successful short-term coping strategies have been developed, measures to predict changes in the weather and some longer-term adaptation strategies. Among the short-term measures, the population falls back on traditional ways of securing food in times of hunger. However, because this has been more frequently necessary in recent years, the resources used for this strategy are being overstretched.

a. Preventive measures to avert the impacts of climate change

The villagers have attempted to undertake some measures to influence their surroundings and the village location so that they are less affected by current climate change impacts – such as to protect the village from flooding. For example, in July 2000 the village elders attempted to arrange for the village to be relocated. However, this failed because it would have been necessary to negotiate with the ministry for agri-

CASE STUDY: PAK AUGUSTINUS LEBISA UND IBU NAEMA BANOET

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Pak Augustinus Lebisa and Ibu Naema Banoet (age unknown, married, no children) live in a small, one-roomed house made of local materials, furnished with a wooden bench, wooden bed and open cooking fire. They store maize under the roof in the traditional way. They originally come from

Kollbana and Nununamat, but set up home in Toineke. Unfortunately they had no children. Today, Ibu Naema (no schooling) has been blind for two years and Pak Augustinus (three years primary school) is hard of hearing. Distant relatives cultivate their one hectare of land on the hill in exchange for 20 kilogrammes of maize a year. This is not enough to live on, but Pak Augustinus and Ibu Naema can no longer cultivate the land themselves. Instead, they keep animals. Their five cows drowned in 2000. Nowadays they keep a pig and two hens.

Ibu Naema says: “When we were young, we grew maize and it flourished. Nowadays it’s too hot and dry, followed by floods.” When Pak Augustinus senses that the rains are coming, he builds a stable on stilts. He and his wife, however, wait until the water comes and then climb onto their roof. The sediment the water brings is often over their knees, so Ibu Naema cooks on the roof for days. They would like to build a house on stilts, but they have neither the materials nor the strength.

Pak Augustinus and Ibu Naema have no access to state systems of social security, nor do they have family to provide for them. Their opportunities of adjusting to the changed conditions are minimal. Pak Augustinus explains, “We are old. We have no money. We are waiting to die.”

culture and forestry in Jakarta, which is responsible for the land they hoped to use. The current village head explains: “For one thing, we haven’t enough money to fly to Jakarta and for another, we are little people without much education. We can’t meet with rich, intelligent people.” In the same year, the district government began to dredge the river annually. However the sediment fills up the river bed again, so this does not prevent flooding.

In 2004, the village built a 5,600 metre long canal above the village, to prevent the sediments and water brought by the floods from reaching the village. They received funding from an Indonesian NGO for this project. The one-meter deep barrier was built by hand – but one flood was sufficient to fill it in. The present village head considers that it was built in the wrong direction, so the water collected in it instead of flowing away towards the river.

In 2006/2007, the villagers planted about 20,000 trees at the foot of the mountain behind the village, where the forest had been gradually cleared in the previous decades. The next dry period killed half the trees. Since then, the village elders have not planned to plant any more trees above Toineke.

b. Short-term reactive coping strategies

Other measures were reactive, consisting of immediate, short-term responses to acute dangers. Most of the strategies mentioned here are traditional coping measures for periods of shortages. They are rooted in traditional practices and local knowledge. To some extent, they are the same as the everyday livelihood strategies but are used more intensively when food is scarce:

- If flooding occurs, climbing onto the roof or staying with relatives who are not affected;
- looking for food in the forest (e.g. Putak palm pith, tamarind seeds, wild cassava);

- selling animals to buy food – sacrificing long-term capital for short-term survival;
- production and sale of coconut oil, salt and palm wine (Iris Tuak), kapok (plant-derived mattress filling) and pelepah (construction material from the putak palm);
- fishing in the sea
- searching for temporary work in surrounding towns (as household workers, motorcycle taxi drivers, tofu sellers etc.);
- taking children out of school; spending the schoolbook money on food;
- during floods: not sending children to school for fear of further floodwaves and drowning.

C. Future oriented coping strategies

Future oriented coping strategies are implemented before flooding or drought, to be prepared for these times of scarcity. However, they are also chosen because they are relatively easy and cheap to carry out. The locals do not know whether or when the floods or droughts may return and whether the new climate will stabilize or change further, so they choose the cheaper provisional measures rather than the more expensive adaptation. Relatively short-term reactive strategies are mentioned above all in connection with drought, whereas the longer-term coping strategies are more important when facing the floods:

- “When I see black clouds, I put all our possessions up in the roof: tax return, marriage certificate, baptism and confirmation certificates, school reports and clothes.”
- Elevating the cooking and sleeping accommodation and the animals’ quarters;
- Keeping clean to minimize the danger of contagion;
- Laying in stocks of Kayu ular (snakewood, Lat.: *Strychnos lucida*) for malaria outbreaks (boiled in water; the liquid is drunk);

“WHEN I SEE BLACK CLOUDS, I PUT ALL OUR POSSESSIONS UP IN THE ROOF”

- Stocking up on firewood, drinking water in closed containers, water for washing, lamp petroleum;
- Planting vegetables in parts of the garden which do not become flooded;
- Taking animals (to relatives) to higher ground.

d. Long-term adaptation strategies

Long-term adaptation strategies (as opposed to coping strategies) for climate change impacts are more expensive, so people’s ability to adopt these strategies depend on many factors: income, social networks, access to other land, required knowledge, as well as personal readiness to make decisions and adopt innovations. To use the vocabulary of the vulnerability perspective (see Section IV.3), it depends on the available financial, social, physical and natural capital.

The most common adaptation strategy in Toineke is to adopt different crops and planting times. Instead of the traditional

maize, rice is increasingly often sown. Maize plants grow well in the floods, but the harvest is poor. Rice seed (paddy go-rah), on the other hand, flourished last year; as a result, some villagers are considering terracing and irrigation systems.

Maize is still cultivated on higher ground. Green beans are also central to food security. In the last few year, the beans planted in the rainy season either drowned in the floods or were destroyed by sediments or salt water. To prevent this happening again, the villagers are planting a fast-growing bean variety at the start of and during the rainy season in areas less affected by flooding. They can harvest these plants before the first floods, so protecting them from sediments.

The women describe diversification of varieties in fruit and vegetable production. Fruit varieties which grow on tall plants or trees, such as bananas, coconuts and sugar cane, are becoming more important. Vegetables do not survive the floods, so they are only grown during the rainy season by farmers whose land is located higher up, and in the dry sea-



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The villagers are increasingly turning to rice cultivation, because rice, unlike maize, flourishes in standing water



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However, the rice paddies lie fallow during the dry season

CASE STUDY: IBU YANSE LAKABU

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Ibu Yanse Lakabu (62), daughter of a Protestant pastor, widow of the former village policeman, retired teacher and mother of the current village school teacher, is one of the better-educated and better-off villagers. She lives with her daughter and two grandchildren in a house on “jalan air”, one of the waterways created by the annual floods. She plans to pay to

have her garden terraced and to use the water flowing past her house for rice growing.

In her view, the alterations in the natural environment are god-given and it is the villagers’ task to react appropriately. Terracing the village could make use of the god-given floodwater to cultivate rice, which is also the goal defined by Bupati.

Ibu Yanse sees it as essential to retain her ability to act in the face of droughts and flooding. The priority is to secure food for people and animals. Knowledge is central, in her view. “I have plenty of things to sell, but if I don’t know the prices, I will be cheated by the Javanese or people from Flores.” In her opinion, knowledge enables people to act and find solutions; she sees this as much more important in the attempt to adapt successfully and to survive under the changed conditions than financial resources (e.g. to raise houses on stilts) or personal networks (e.g. to access land in higher locations).

son by those who have access to good water. To spread the risk in the dry season, a wider range of different vegetables is cultivated.

The villagers have also extended the range of items produced in home industries, particularly in the use of products gained from resources not affected by the floods (e.g. coconut oil, coconut seedlings, coconut lampshades etc.).

Finally, some villagers have begun to establish a secondary source of income as carpenters, motorcycle taxi drivers or opening a kiosk, in addition to subsistence agriculture. This shows that some of the local population already perceive the impacts of climate change so clearly that their dependence on agriculture seems too risky. Practising small scale trading and home industries to generate income in addition to

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The people of Toineke practice home industries, for example making lampshades and containers from coconut shells or Putak palm leaves

subsistence farming is not a new strategy, but the increasing importance of these income sources indicates the often predicted exodus from agricultural production. This typically begins with the development of alternative income sources in rural areas (initially a strategy to avoid immediate migration) and ends with the large-scale migration of young people from rural areas into the large cities of their country. In contrast to the situation described in Tanzania, the villagers in Toineke seem to concentrate more on diversifying crops, varying planting times and seeking alternative income sources rather than specialising in a few profitable but also risky income sources. Three other long-term adaptation strategies were observed: first, moving house, animals and cultivated land; second, raising the house and third, protecting cultivated land by fencing. The prerequisite for moving house, animals and cultivated land is access to higher ground in the village. However, most villagers do not have access to higher ground for construction, so they concentrate on securing higher land for cultivation or ask owners to permit them to cultivate their land for them and share the harvest. Success in these cases depends on social capital such as family relationships and personal networks. To raise the houses, local construction materials (wooden pillars) or home-made cement blocks are used depending on income. Fencing the vegetable gardens is intended to protect the cultivated areas from floodwater, sediments and branches carried by the floods.

As well as these positive adaptation measures, there are some negative adaptations or maladaptations (see Section IV.2). One example is salt boiling, as already mentioned, which requires large amounts of firewood. Pak Noh Hun (45) describes how his family carries out traditional subsistence agriculture as well as salt production. However, flooding has made agriculture so difficult that they are increasingly depending on salt production for their livelihood. The use of the forest around the village for firewood not only causes

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Raising the houses is a protection from flooding. Although local construction materials are used, they are still too expensive for the poorer villagers

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The best protection from flooding is a house built of stone and cement, like Pak Alexander and Ibu Johanna's house, shown here. However, only the better-off villagers can afford houses like this

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The fence around Pak Martinus' vegetable garden protects the plants from water, sediments and wood washed down by the floods

CASE STUDY: PAK YANDRI A. NENO UND IBU ANTONIA MISA

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Pak Yandri A. Neno (47, completed grammar school), Ibu Antonia Misa (43) and their four children were caught by surprise in their house by the flood on the evening of 16 May 2000, three days after the birth of their fourth child. Within a few minutes, the water rose chest high. Pak Yandri lifted his wife and the baby to safety on a two-meter high roof beam. Next morning he carried them three kilometers to higher ground. He called his new daughter Aiti Mena, which in Uab Meto means, “who will carry her?” The flood destroyed their house and their cow, calf, hens and goats were drowned or died later from the after-effects. Pak Yandri turned to the village chief to ask permission to build a new house above the village on land which had once be-longed to his father. Today he has a quarter hectare of vegetable garden around his new house, a hectare on the hill for maize and a quarter hectare near the old house. He plans to plant rice on the lower-lying land next rainy season. His social capital in the form of connections and family possessions has enabled him to secure a long-term income for his family.

It is a recurring problem for Pak Yandri to find the cash for school fees. For some reason, he receives nothing from the state fund (Keluarga Harapan programme) set up for such situations (114 of the 680 households receive Rp. 200,000.00 per child per quarter). So Pak Yandri and Ibu Mia sell cassava roots and leaves at the weekly market and Pak Yandri also works in the fields and as a carpenter. The move away from the village centre makes the job hunt more difficult. He has to visit possible employers regularly, whereas previously he saw them every day anyway.

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additional CO₂ emissions; the local ecosystem is also further stressed and the village has less erosion protection. Another maladaptation with serious consequences is taking the children out of school, in order to buy food with the money saved from the fees. This reduces the children’s ability to face the challenges of the future; knowledge and innovative thinking are of central importance when dealing with the impacts and uncertainties caused by climate change.

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„Boiling salt“ is an example of maladaptation. Large quantities of firewood are needed, resulting in the felling of great numbers of trees, releasing CO₂ and increasing the danger of erosion.

IN RECENT YEARS, THE PLANTS HAVE EITHER BEEN INUNDATED OR DESTROYED BY SEDIMENTS OR SALT

VI.5 TOINEKE: AN EXAMPLE OF LIFE IN POVERTY IN CONDITIONS OF CLIMATE CHANGE

The people of Toineke are currently living under constantly changing climatic conditions which have direct, immediate consequences for agriculture, the basis of their existence. Their methods of dealing with the situation exemplify many of the links mentioned between poverty and climate change.

Like subsistence farmers in many other countries, the farmers of Toineke are extremely dependent on their natural environment. Climate change signifies direct damage caused by drought and flooding as well as increasing climatic uncertainty. They are becoming ever more vulnerable, both because it is not clear how they should best react and also because they simply lack the money. They only achieve partial successes: small innovations (such as the protective fences around their fields), lessening the risks by planting more or different crops etc.

Various forms of knowledge are crucial to enable people to maintain their capacity to act and cope with the uncertainties caused by climate change. Local knowledge of traditional strategies to be used in times of scarcity are important (e.g. using the putak palm for food). Local innovations (such as protective fencing around the gardens, raising houses on stilts) and external knowledge (e.g. new varieties of seed) are also significant. In addition, the population requires the basic understanding or awareness that changes in their living conditions are more extensive and longer-lasting than they have ever experienced. Lack of knowledge about climate change as a global process delays the development of local adaptation strategies and makes it more difficult, because the locals concentrate their few resources on short-term provisional coping strategies.

These various forms of knowledge are combined in daily dealings with impacts of climate change with more or less

success, working together to enable people to develop coping and adaptation strategies. In this way, local knowledge adjusts to the demands of climate change impacts. The key factor is how flexible and innovative people are in thinking about their situation. The case studies presented show clearly that success is closely related to the degree of formal education received; the majority of those who have developed new strategies and techniques had been to secondary school. This means that poverty reduction efforts should make education available to enable people to implement the knowledge they already have, new ideas and their capacity to change.

People's ability to react to climate change also depend on how prosperous they already are. In this way, climate change deepens the gulf between the poor and the better-off and leads to new inequalities, both within village communities and between villages, regions and countries. The better-off families were often able to utilize their capital – social, financial (see section IV.3) – to counter the changing conditions successfully and in some cases, even to use them positively. Others, such as Ibu Yanse Ton and Pak Augustinus and Ibu Naema, lose even the little livelihood base they had. In such cases, climate change impacts result in a huge overload of people's livelihood strategies and coping capacity.

VII. Recommendations: poverty reduction in times of climate change

The following recommendations are primarily related to the work of organizations such as CARE international. Although they were mainly implemented as local measures and projects carried out directly in cooperation with poorer populations, various conclusions can be drawn from them for the national or international level.

1. Community-based adaptation. Poverty reduction should encourage adaptation to new living and economic conditions. This should take place at local level and with local participation, and, above all, should be based on existing local coping and adaptation strategies. These may (or may not) be good starting points for local measures and “home grown” best practices for other organizations and projects.
2. Supporting local knowledge. Detailed local knowledge of ecosystems and alternative options should be gathered and updated. It is important to gain new knowledge about adaptation options on the spot. It is also important to create awareness that current weather variations are part of a global process which is set to continue. Village communities like Toineke must be encouraged to test their knowledge to see how far it will help them to deal with climate change impacts. The experience of other regions with flooding or drought should be shared. “Global” knowledge, e.g. findings from climate research, must be made available, so it can be related to local knowledge. There must be a continuous process of updating local climate management knowledge, because the climate is not likely to stabilize in the near future.
3. Critical analysis of existing practices. Existing coping and adaptation mechanisms may have become widespread and may be assumed to be in the interests of at least some groups. However, they should be examined in the context of the five criteria mentioned above – effectiveness, flexibility, fairness, efficiency and sustainability – particularly in relation to the poorest. For example, an adaptation mechanism may be successful and also “home grown”. However, it may at the same time exacerbate inequality and so increase absolute poverty. It may be well established, but possibly by more powerful groups and to the disadvantage of women or marginal social groups.
4. Raising awareness for climate change impacts which are not yet acute. Finally, adaptation processes should be enabled, even where they do not appear urgent. It is essential to raise awareness of the fact that climate change is not always dramatic; it can also take place gradually. People are already aware of some climate change impacts. Others are not yet known or dealing with them is postponed in favour of other tasks which seem more urgent.
5. Recognizing uncertainties. Projections of climate change processes and impacts give the impression that poverty reduction can be based on concrete weather developments. However this cannot be taken for granted, because the models are uncertain and the climate change

POVERTY REDUCTION SHOULD ENCOURAGE ADAPTATION TO NEW LIVING AND ECONOMIC CONDITIONS



Local knowledge makes an essential contribution to adaptation to climate change

process depends on humanity's future actions. Making poverty reduction measures climate secure does not mean basing them on one projection. First, it is not clear how people will react to the measures and whether they will be effective, even if the climate predictions are fulfilled. Second, the climate might develop in unforeseen ways. Poverty reduction strategies are climate secure only if they have positive effects in various scenarios (no regret criterion).

6. Careful handling in the face of the urgency of adaptation to climate change impacts. The pressure to implement

adaptation measures is enormous: however, this should not lead to imposing strategies on the local population, ignoring their local knowledge and existing adaptation practices. Nor should it lead to hasty fixing on particular scenarios as a basis for quick and apparently suitable measures. This does not mean underestimating the urgency of climate change; on the contrary, it means guaranteeing that measures are really effective and sustainable.

7. Poverty reduction means maintaining basic capacity for action. In order to be realistic and to concentrate efforts, poverty reduction should concentrate on the poorest and on maintaining their basic capability of action. The population's resilience should be strengthened generally, not just in relation to specific risks. It is likely that climate change will cause even more rapid reactions in future, so it is important to focus on the short-sighted maladaptations. Governments must also maintain room to manoeuvre, to cope with climate change and poverty. The economic effects of climate change must not be allowed to cause further reductions in state funding for poverty reduction. Development aid can be a temporary source of assistance during the global economic downturn and financial crisis.
8. Broad-based, in-depth analysis of climate change impacts and measures. As the case studies show, climate change impacts and adaptation mechanisms often have unexpected consequences. Some apparently appropriate suggestions such as diversifying income sources have turned out to be counter-productive. Organizations tackling poverty should invest sufficiently in research to estimate the complex consequences. They should take even more careful account of particular local conditions and the ways in which ecosystems and social systems interact. Holistic analysis is essential to cover all the interactions as fully, even if not as precisely, as possible.

Bibliography

(websites as available on 11 May 2009)

Allianz 2009: "Microinsurance Tested: Cyclone Nisha Batters India". <http://knowledge.allianz.com/en/globalissues/microfinance/microinsurance/>

Allianz 2009: "Microinsurance Tested: Cyclone Nisha Batters India". <http://knowledge.allianz.com/en/globalissues/microfinance/microinsurance/>

Arnell, N. W. (2004): "Climate change and global water resources: SRES emissions and socio-economic scenarios." In: *Global Environmental Change* 14, pp. 31–52.

Arnold, Margaret (2008): "The role of risk transfer and insurance in disaster risk reduction and climate change adaptation". Background paper from the Commission of Climate Change and Development, www.ccdcommission.org/Filer/pdf/pb_risk_transfer.pdf

Badan Pusat Statistik: Nusa Tenggara Timur Dalam Angka 2008, Kupang: Badan Pusat Statistik, 2008.

Boer, R./Faqih, A. (2004): "Current and future rainfall variability in Indonesia." In: *An Integrated Assessment of Climate change Impacts, Adaptation and Vulnerability in Watershed Areas and Communities in Southeast Asia*, www.aiaccproject.org/Final%20Reports/Final%20Reports/FinalRept_AIACC_AS21.pdf.

CARE (T. R. Frankenberger/M. K. McCaston) (1998): The household livelihood security concept. <ftp://ftp.fao.org/docrep/fao/X0051t/X0051t05.pdf>

Cord, Louise/Hull, Catherine/Hennet, Christel/van der Vink, Gregory (2008): "Climate Change and Poverty: An Integrated Strategy for Adaptation". The World Bank PREM Notes, no. 3/2008. http://siteresources.worldbank.org/INTPREMNET/Resources/489836-1217526310172/Note3_Climate_Change_and_Poverty.pdf

Davies, S. (1993): "Are coping strategies a cop out?" In: *Institute of Development Studies Bulletin* 24 (4), pp. 60–72.

Ehrhart, Charles/Twena, Michelle (2006): *Climate Change and Poverty in Tanzania. Realities and response options for CARE*. CARE Länderprofil, www.careclimatechange.org/files/TanzaniaCountryProfile_0.pdf

Ellis, Frank (1998): "Household strategies and rural livelihood diversification". In: *Journal of Development Studies* 35 (1) pp. 1–38.

Eriksen, Siri H./Brown, Katharina/Kelly, P. Mick (2005): "The dynamics of vulnerability: locating coping strategies in Kenya and

Tanzania". In: *The Geographic Journal* 171 (4), pp. 287–305.

Feinstein International Center (2008): *The Humanitarian Costs of Climate Change*. [http://www.reliefweb.int/rw/lib.nsf/db900sid/STRI-7P8SZ2/\\$file/tufts-dec2008.pdf?openelement](http://www.reliefweb.int/rw/lib.nsf/db900sid/STRI-7P8SZ2/$file/tufts-dec2008.pdf?openelement)

Füssel, Hans-Martin/Klein, Richard (2002): "Assessing Vulnerability and Adaptation to Climate Change: An Evolution of Conceptual Thinking." www.pik-potsdam.de/~fuessel/download/undp02_final.pdf

Handmer, J. W./Dovers, S. R. (1996): "A typology of resilience. Rethinking institutions for Sustainable Development". *Organization and Environment* 9 (4), pp. 482–511.

HDR (2008): Bericht über die menschliche Entwicklung 2007/2008: Deutsche Zusammenfassung. http://hdr.undp.org/en/media/HDR_20072008_Summary_German.pdf

Hulme, Mike/Sheard, Nicola (1999): *Climate Change Scenarios for Indonesia*, Norwich: Climate Research Unit.

IDS (Hedger, M./Mitchell, Tom/Leavy, Jennifer/Greeley, Martin/Downie, Anna/Horrocks, Lisa) (2008): *Evaluation of Adaptation to Climate Change from a Development Perspective*. <https://cms.ids.ac.uk/index.cfm?objectid=E7F528D9-D84A-8558-5512ADF4C4807209>

IISD (2003): *Livelihoods and Climate Change*. Outline paper from the working group "Climate Change, Vulnerable Communities and Adaptation", International Institute for Sustainable Development IISD, Stockholm Environment Institute, International Union for Conservation of Nature IUCN, InterCooperation. www.iisd.org/pdf/2003/natres_livelihoods_cc.pdf

IPCC (2007a): *Climate change 2007: The physical science basis*. Contribution of working group I to the fourth assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. www.ipcc.ch/ipccreports/ar4-wg1.htm

IPCC (2007b): *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the IPCC, Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. www.ipcc.ch/ipccreports/ar4-wg2.htm

IPCC (2007c): *Climate Change 2007: Mitigation*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Technical Summary, Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, www.ipcc.ch/ipccreports/ar4-wg3.htm

Kelly, P. M./Adger, W. N. (2000): "Theory and practice in assessing

- vulnerability to climate change and facilitating adaptation". In: *Climatic Change* 47 (4), pp. 325–352.
- Knutson, Thomas R./Sirutis, Joseph J./Garner, Stephen T./Vecchi, Gabriel A./Held, Isaac M.: (2008):** "Simulated reduction in Atlantic hurricane frequency under twenty-first-century warming conditions". In: *Nature Geoscience* 1, pp. 359–364. www.nature.com/ngeo/journal/v1/n6/abs/ngeo202.html
- Lemos, Maria C./Tompkins, Emma L. (2008)** "Creating Less Disastrous Disasters" In: Tanner, Thom/Mitchell, Tom: *Poverty in a Changing Climate*. Institute of Development Studies Bulletin 39 (4), pp. 60–66.
- Lenton, Timothy M./Held, Hermann/Kriegler, Elmar/Hall, Jim W./Lucht, Wolfgang/Rahmstorf, Stefan/Schellnhuber, Hans Joachim (2008):** "Tipping elements in the Earth's climate system." In: *Proceedings of the National Academy of Sciences* 105 (6), pp. 1786–1793.
- McGray, Heather/Hamill, Anne/Bradley, Rob und E./Schipper, Lisa/Parry, Jo-Ellen (2007):** "Weathering the Storm. Options for Framing Adaptation and Development". Report from the World Resources Institute, http://pdf.wri.org/weathering_the_storm.pdf.
- Milly, P. C. D./Betancourt, Julio/Falkenmark, Malin/Hirsch, Robert M./Kundzewicz, Zbigniew W./Lettenmaier, Dennis P./Stouffer, Ronald J. (2008):** "Stationarity Is Dead: Whither Water Management?" In: *Science* 319 no. 5863, Policy Forum, pp. 573–574.
- Müller, Christoph (2009):** *Climate Change Impact on Sub-Saharan Africa? An overview and analysis of scenarios and models*, German Institute for Development Policy Discussion Paper 3/2009, [www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/\(ynDK_contentByKey\)/ANES-7RBHTP/\\$FILE/DP%203.2009.pdf](http://www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/(ynDK_contentByKey)/ANES-7RBHTP/$FILE/DP%203.2009.pdf)
- Müller, Johannes (2008):** „Indonesien in der Zwickmühle. Strategiesuche zwischen Energie- und Armutspolitik“. In: *Welt.Sichten Dossier 5/2008 Klimawandel und Armut. Eine Herausforderung für gerechte Weltpolitik*, pp. 14-15. www.pik-potsdam.de/infotehek/broschueren/klimawandel-und-armut.pdf
- Nakicenovic, N./Swart, R. (Hg.) (2000):** *Special report on emission scenarios*, Cambridge: Cambridge University Press.www.ipcc.ch/ipccreports/sres/emission/index.htm
- Philipona, R./ Dürr, B./Marty, C./ Ohmura, A./Wild, M. (2004):** "Radiative forcing – measured at Earth's surface – corroborate the increasing greenhouse effect." In: *Geophysical Research Letters* 31, <http://www.agu.org/pubs/crossref/2004/2003GL018765.shtml>
- Pierro, Rachele/Desai, Bina (2008):** "Climate Insurance for the Poor: Challenges for Targeting and Participation". In: Tanner, Thom/Mitchell, Tom: *Poverty in a Changing Climate*. Institute of Development Studies Bulletin 39 (4), pp. 123–129.
- Rahmstorf, S. (2007):** "A semi-empirical approach to projecting future sea-level rise." In: *Science* 315, pp. 368–370.
- Reiner, Dirk (2008):** „Abgesichert gegen Armut? Mikroversicherungen gegen Klimarisiken“. In: *Welt.Sichten Dossier 5/2008 Klimawandel und Armut. Eine Herausforderung für gerechte Weltpolitik*, pp. 20-22. www.pik-potsdam.de/infotehek/broschueren/klimawandel-und-armut.pdf
- Scholz, I./Bauer, S. (2006):** „Klimawandel und Desertifikation“. In: Klingebiel, S. (Hg.): *Afrika-Agenda 2007: Ansatzpunkte für den deutschen G8-Vorsitz und die EU-Präsidentschaft*. Bonn: Deutsches Institut für Entwicklungspolitik (DIE), pp. 63–70.
- Smith, Joel B. et al. (2009):** "Assessing dangerous climate change through an update of the Intergovernmental Panel on Climate Change (IPCC) "reasons for concern". In: *Proceedings of the National Academy of Sciences, Environmental Sciences*, 106 (11), pp. 4133–4137.
- Stern (2006): Stern Review: The Economics of Climate Change.** www.hm-treasury.gov.uk/stern_review_report.htm
- The Global Carbon Project (2008):** *Carbon Budget 2007*. <http://www.globalcarbonproject.org/carbonbudget/07/index.htm>
- Toggweiler, J. R./Russel, Joellen (2008):** "Ocean circulation in a warming climate." In: *Nature* 451, pp. 286–288.
- Wassmann, R./Hien, N. X./Hoanh, C.T./Tuong, T.P. (2004):** "Sea level rise affecting the Vietnamese Mekong Delta: water elevation in the flood season and implications for rice production." In: *Climatic Change* 66, pp. 89–107.
- WBGU (2006):** *Die Zukunft der Meere – zu warm, zu hoch, zu sauer*. Special report from Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen, Berlin, Heidelberg: Springer-Verlag http://www.wbgu.de/wbgu_sn2006.pdf
- WBGU (2007):** *Welt im Wandel – Sicherheitsrisiko Klimawandel*. Hauptgutachten des Wissenschaftlichen Beirats der Bundesregierung Globale Umweltveränderungen, Berlin, Heidelberg: Springer-Verlag. www.wbgu.de/wbgu_jg2007.html
- Weck, Winfried (2007):** *Indonesien*. In: *Klimareport International*. Konrad-Adenauer-Stiftung, Berlin, pp.63–65.
- Weller, Gunter (2007):** *Summary and Synthesis of the Arctic Climate Impact Assessment*. www.acia.uaf.edu/PDFs/ACIA_Science_Chapters_Final/ACIA_Ch18_Final.pdf
- WMO (2006):** *World Meteorological Organization: Summary Statement on Tropical Cyclones and Climate Change*, www.wmo.int/pages/prog/arep/press_releases/2006/pdf/iwtc_summary.pdf
- Wood, Martin (1995):** *Environmental Soil Biology*, Glasgow: Blackie Academic & Professional.

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