Division 44
Environmental Management,
Water, Energy and Transport

Measures to Implement the UNFCCC

Adaptation to Climate Change in German Official Development Assistance

An Inventory of Activities and Opportunities, with a Special Focus on Africa

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Foreword

Adapting to climate change is, first and foremost, a development-policy issue. Most scientists agree that developing countries will suffer most from the negative effects of climate change, as a result of their more vulnerable ecosystems and settlement forms, as well as their limited capacity to adapt to climate change in the medium to long term. Thus, the response to climate change is a new and ever-increasing challenge for developing countries and development co-operation.

This study should help to define the need for development-policy action. Using the example of southern Africa, which particularly suffers from the adverse effects of climate change and increasingly extreme weather events, the study provides an overview of how German development co-operation can deal with the problem of adapting to climate change. Adaptation measures have more than a merely protective role for all those worst hit by climate change and the consequences thereof. They also help to ensure food security, protect lives and homes, prevent diseases that are favoured by climate change, ensure better cropping options for farmers as weather conditions change, help to protect the environment and contribute directly and indirectly to fighting poverty.

The importance of adapting to the changing climate was stressed in the United Nations Framework Convention on Climate Change (UNFCCC) signed in 1992 at the Earth Summit in Rio de Janeiro. The most recent UN report on climate change, which has attracted a great deal of attention, strongly indicates that the atmosphere is warming up faster than expected, that developing countries are worst hit by the adverse impacts of climate change and that they will continue to suffer disproportionately under climate change in the future. In addition to support for the development of environmentally sound transport and energy systems in the South, adaptation to climate change will need to be incorporated in the German development co-operation.

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Acknowledgements

This study was initiated in the wake of the fifth session of the Conference of the Parties (COP-5) to the United Nations Framework Convention on Climate Change, which was held in Bonn in November 1999. At COP-5 the Potsdam Institute for Climate Impact Research and the Bangladesh Centre for Advanced Studies organised a side event on "Adaptation Responses to Climate Change". This side event aimed to promote a dialogue between science and policy on the issue of adaptation to climate change. At the time of COP-5, awareness of the need and opportunities to adapt to climate change was growing but there was still a way to go before adaptation was placed high on the agenda of negotiators. In part this was due to the unfamiliarity of many negotiators and policymakers with the issue. German negotiator Wolfram Klein, for example, was reluctant initially to be a panellist at the side event and then as a panellist admitted his scepticism about adaptation. It is an illustration of the success of the side event and of Wolfram Klein's courage and open-mindedness that he acknowledged almost immediately after the event that Germany needs to take adaptation to climate change seriously in its international climate policy. A first step has been the commissioning of this study by the Federal Ministry for Economic Co-operation and Development.

This study could not have been completed without the help of many people in the Federal Ministry for Economic Co-operation and Development, the Deutsche Gesellschaft für Technische Zusammenarbeit and the Kreditanstalt für Wiederaufbau. I thank Wolfram Klein and Holger Liptow for initiating and co-ordinating this study. I also thank Markus Breuer and Philipp Knill for their continuous involvement and suggestions and Beatrix Blümli and Cornelia Schichtel for the excellent organisation of the study and my visits to Bonn and Eschborn. The study has benefited greatly from the pleasant conversations I had with Wolfgang Bichmann, Andreas Gettkant, Burkhard Hinz, Ralph Kadel, Burghard Rauschelbach, Christine Werner and Günter Winckler. Finally, I am indebted to Ian Burton, Saleemul Huq and Brett Orlando for reviewing this report and making valuable suggestions and to Donna Haw for her efficient proofreading. Any remaining errors in this report are my responsibility.

Potsdam, April 2001
Richard Klein

Executive Summary

Adaptation in the context of climate change refers to any adjustment in natural or human systems in response to actual or expected impacts of climate change aimed at moderating harm or exploiting beneficial opportunities. For the German government adaptation represents a new focus in its international climate policy, which until recently was geared towards limiting climate change only. However, as it becomes clear that climate change is a reality and impacts will occur the need to consider adaptation is increasingly recognised. The need for adaptation will be greatest in developing countries, which are most vulnerable to climate change.

Adaptation is particularly relevant for projects that have achievements expected to last over a period of decades. This is typically the case with infrastructure (both institutional and physical) that has a long turnover time and with land-use systems that involve species with low migration rates or little migration potential. Examples include the establishment of new environmental regulations and institutions, the development of water supply and coastal infrastructure and the management of forests. For these projects anticipatory adaptation to climate change is important and could take any of the following forms:

- Increasing robustness of infrastructural designs and long-term investments;
- Increasing flexibility of vulnerable managed systems;
- Enhancing adaptability of vulnerable natural systems;
- Reversing trends that increase vulnerability ("maladaptation");
- Improving societal awareness and preparedness.

In view of the current uncertainty surrounding the impacts of climate change the emphasis would be on those options that have immediate benefits as well as future ones (*i.e.*, no-regret options). This pertains in particular to increasing the flexibility of systems and, above all, reducing maladaptation.

Aware of the increasing need for adaptation the German Federal Ministry for Economic Co-operation (BMZ) has begun to assess its activities in light of existing and future requirements and opportunities for climate adaptation. This study is a first step in a process to improve the understanding of the importance of climate adaptation to official development assistance (ODA), as well as to increase recognition of the opportunities to integrate climate adaptation in ODA projects. To this end, this study has the following three objectives:

- To identify environment-relevant development projects funded by the German government that include activities related to adaptation to climate change;
- To identify opportunities to incorporate adaptation to climate change in future German-funded development projects;
- To enhance awareness of the need and opportunities for adaptation to climate change within relevant parts of the German government.

The study focuses on German-funded ODA projects in Africa, mainly aimed at technical co-operation in five different types of natural resource management. It serves to give a first indication of the extent to which adaptation to climate change has been considered in the formulation and implementation of these ODA projects.

None of the 136 project descriptions that have been analysed refer to climate change and very few refer to environmental or economic stress related to weather or climate variability. In all cases this relates to drought and desertification. This limited consideration of climate-related stress is striking in light of the intricate balance between the productivity of Africa's natural resources and prevailing climate conditions. Africa's climate can be a major constraining factor to the sustainable development of its resources.

The five projects that have been analysed in more detail provide a similar picture. Climate variability is considered to some extent but the management of its effects is primarily reactive. The projects do not consistently plan to prepare for climate extremes such as droughts and floods, whilst scenarios of climate change are not considered at all. In general, climate

change is considered a long-term issue, the importance of which is eclipsed by more immediate concerns such as food security, sanitation, safe water supply and education.

The non-consideration of climate change means that opportunities to take measures that would reduce climate vulnerability both now and in the future are missed. Many measures, ranging from setting up a monitoring network to enable the early warning of weather-related hazards to supporting the role of non-governmental organisations to ensure public involvement in decision-making, would have both immediate and long-term benefits. Similarly, many measures would not only reduce climate vulnerability but also contribute to other objectives, such as combating desertification and conserving biodiversity. In countries that are particularly vulnerable to climate change there is a need to go beyond no-regret measures and measures with secondary benefits.

There are two approaches to seizing opportunities to incorporate adaptation to climate change in future ODA projects. First, the application of risk assessment, vulnerability assessment and environmental impact assessment techniques can serve to evaluate the extent to which climate change is relevant to the long-term sustainability of projects. Climate change can be relevant to ODA projects in three ways:

- The risk of climate change to the ODA project and its deliverables;
- The vulnerability to climate change of the community or ecosystem that is intended to benefit from the ODA project;
- The possible effects of the ODA project and its deliverables on the vulnerability of communities or ecosystems to climate change.

Second, there are procedural opportunities to encourage explicit consideration of climate change in ODA projects. These opportunities relate to the development of evaluation criteria and performance indicators, which could either be done at the project level in the project planning stage or by introducing long-term project sustainability as a new general project criterion in addition to target groups, poverty, gender and environment.

It is the responsibility of BMZ to provide clear guidance as to if, when and how these two approaches towards integrating climate adaptation in German ODA projects should be followed. BMZ is also responsible for the international co-ordination of its activities, particularly in relation to the Global Environment Facility and other multilateral and bilateral funding organisations. Finally, BMZ needs to initiate a process of in-house capacity building, targeted at all relevant parts and levels of the German government and highlighting all the various aspects of adaptation to climate change.

The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) has an important role to play in the enhancement of adaptive capacity of developing countries and in creating an enabling environment for adaptation to climate change. It can also seek the creation of synergies between the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification and the Convention on Biological Diversity.

The Kreditanstalt für Wiederaufbau (KfW) could begin to assess the effect of planned investments on the vulnerability of communities and ecosystems to climate variability and change so as to prevent maladaptation. In infrastructural projects KfW needs to be aware of the increasing unreliability of weather and climate statistics and of the need to take a precautionary approach to the increasing probability of extreme events. Both GTZ and KfW could promote technology transfer for adaptation to climate change.

1. Introduction

Adaptation is increasingly recognised as an appropriate and necessary response option to climate change, especially since it has been established that humans are—at least in part—responsible for climate change and that some impacts can no longer be avoided. For the German government adaptation represents a new focus in its international climate policy, which until recently was geared towards mitigation of climate change only (*i.e.*, reduction of greenhouse-gas emissions and enhancement of carbon sinks).

Aware of the increasing importance of adaptation to climate change in developing countries the German Federal Ministry for Economic Co-operation and Development (BMZ) has identified the need to assess its activities in light of existing and future requirements and opportunities for climate adaptation. As a first step, BMZ initiated a study with the following three objectives:

- To identify environment-relevant development projects funded by the German government that include activities related to adaptation to climate change;
- To identify opportunities to incorporate adaptation to climate change in future German-funded development projects;
- To enhance awareness of the need and opportunities for adaptation to climate change within relevant parts of the German government.

Similar studies have been carried out by Van Rijn (1999) for The Netherlands and by Burton and Van Aalst (1999) for the World Bank.

This report is the final product of a seventeen-day study that was commissioned via a contract with the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) under project number 93.2058.1-031.80. The study focused on Africa as this continent is widely considered to comprise some of the most vulnerable countries to climate change, where adaptation needs are greatest (*e.g.*, Watson *et al.*, 1998a; Sokona and Denton, 2001).

The report is structured as follows. Chapter 2 describes the rationale of this study and outlines its methodology. Chapters 3 and 4 then provide background information on adaptation to climate change: Chapter 3 explains what adaptation to climate change is and why it is considered important, whilst Chapter 4 describes the current international policy and funding mechanisms for adaptation. Next, Chapter 5 discusses the issue of no-regret adaptation and secondary benefits. Chapter 6 presents the results of the analysis of project descriptions and interviews with experts and project managers, whilst Chapter 7 identifies opportunities to incorporate climate adaptation in future development projects. Finally, Chapter 8 presents conclusions and recommendations.

2. Rationale and Methodology

In its Second Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) concluded that:

> "There is evidence of an emerging pattern of climate response to forcings by greenhouse gases and sulphate aerosols in the observed climate record. This evidence comes from the geographical, seasonal and vertical patterns of temperature change. Taken together, these results point towards a human influence on global climate" (Santer *et al.*, 1996, p. 412).

This observed "human influence on global climate" is particularly important in the light of the considerable time lags between the emission of greenhouse gases and their consequent effects on global temperature and especially sea level. Even if atmospheric greenhouse-gas concentrations are stabilised over the next decades, global temperatures are still projected to increase for another few decades, whilst sea level will continue to rise for a number of centuries. These lagged effects, attributable to past emissions, are often termed the "commitment to climate change" that nature and society have to face.

The awareness of this "commitment", combined with the notion that it is unlikely that current patterns of greenhouse-gas emission will soon be curbed, has led scientists and policymakers to recognise the increasing need for adaptation to climate change, whilst continuing mitigation efforts (see Chapter 3).

The IPCC Workshop on Adaptation to Climate Variability and Change (San José, Costa Rica, 1998) provided a strong impetus to this wide recognition of the need for adaptation. This workshop aimed to assess and improve the current understanding of both the theory and practice of climate adaptation. It also served to produce materials for consideration by the IPCC for its Third Assessment Report, which has recently been finalised. The IPCC Third Assessment Report, to be published later in 2001, features adaptation more strongly than before in its discussions of vulnerable sectors and regions. In addition, it contains a chapter devoted entirely on adaptation in the context of sustainable development and equity. This chapter re-emphasises the need for adaptation and stresses the importance of enhancing the adaptive capacity of developing countries.

From an international policy perspective, the importance of adaptation was confirmed at the third Conference of the Parties (COP-3, 1997) to the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, which defined a Clean Development Mechanism (CDM) that explicitly mentions adaptation as an expenditure goal. At COP-4 in Buenos Aires (1998) governments decided that funding could be made available to developing countries for preparatory adaptation activities (see Chapter 4).

At COP-5 and COP-6 (Bonn, 1999 and The Hague, 2000, respectively) governments subsequently discussed how the CDM and the above-mentioned decision made at COP-4 could be made operational. These discussions focused particularly on Articles 4.8 and 4.9 of the UNFCCC. Article 4.8 commits Parties to give full consideration as to what actions are necessary to meet the specific needs and concerns of developing countries arising from the adverse effects of climate change, including funding, insurance and transfer of technology. Developing countries that are listed as having specific needs and concerns include small island countries, countries with low-lying coastal areas, countries with arid and semi-arid areas, forested areas and areas liable to forest decay, countries with areas prone to natural disasters and countries with areas liable to drought and desertification. In addition, Article 4.9 commits Parties to take full account of the specific needs and special situations of the least developed countries in their actions with regard to funding and transfer of technology.

In preparing to meet its commitment under Articles 4.8 and 4.9 the German government requires a better and more complete understanding of the nature of adaptation to climate change, its characteristics, its process, its relationship to other forms of development co-operation and the needs and opportunities for investment. This study was initiated to contribute to this improved understanding by pursuing three objectives.

First, the study aimed to identify to what extent German-funded official development assistance (ODA) projects in Africa—aimed mainly at technical co-operation in natural resource management—already consider the risk of climate change, as well as opportunities for adaptation. To date, no projects have been initiated in which adaptation to climate change is an explicit objective. However, as the successful management of natural resources is often affected by weather and climate variability (*e.g.*, droughts, storms), projects may have components that serve to reduce vulnerability to such variability and, in doing so, also to climate change. Thus, adaptation to climate change, whilst not an explicit objective, could be a secondary benefit of these projects (see Chapter 5).

Second, the study aimed to explore opportunities to incorporate adaptation to climate change in future German-funded ODA projects. Climate change is not the only problem facing developing countries and many other problems are perceived as more urgent. For adaptation to climate change to be effective, it needs to be integrated with ongoing ODA activities. In addition, synergies might be created with other environmental policies, such as those aimed at combating desertification and conserving biological diversity.

Third, the study was meant as a first step towards enhancing awareness of the needs and opportunities for adaptation to climate change amongst the staff of BMZ, GTZ, the Kreditanstalt für Wiederaufbau (KfW) and other relevant parts of the German government. By showing that it is not an abstract process but an extension of ongoing sectoral policies and activities aimed at long-term sustainability, it is expected that adaptation will be increasingly considered an important issue to be integrated in ODA projects.

The information necessary to fulfil the first of the above three objectives was obtained from the database PBS (Projektbearbeitungssystem), which is used at GTZ to administer German ODA projects aimed at technical co-operation, as well as from interviews with experts and project managers in BMZ, GTZ and KfW. In the PBS, ODA projects are categorised in around 180 thematic areas, each with their own Creditor Reporting System (CRS) code. For this study five thematic areas were selected:

- Agricultural land resources (CRS 31130);
- Forest development (CRS 31220);
- Environmental policy and management (CRS 41010);
- Biodiversity (CRS 41030);
- Rural development (CRS 43040).

Project descriptions were analysed of all projects initiated in Africa since 1990 within these five thematic areas. This amounted to 136 projects in total: 29 on agricultural land resources, 24 on forest development, 15 on environmental policy and management, 26 on biodiversity and 42 on rural development.

Based on this initial analysis of GTZ project descriptions, four projects were selected for more in-depth analysis, including interviews with project managers or other relevant experts. One of the selected projects was a joint GTZ-KfW project, whilst a fifth selected project, not listed in the PBS, was co-ordinated by KfW only.

The interviews also served to provide information to fulfil the second and third of the aforementioned objectives of this study. In addition, fulfilling these objectives required a literature survey, aimed at understanding the process of project initiation and implementation at GTZ as well as the priorities for other global environmental issues, especially desertification and biodiversity.

3. What Is Adaptation?

The UNFCCC is the single most important document on climate change for both scientists and policymakers. The UNFCCC was one of the products of the United Nations Conference on Environment and Development (UNCED), which was held in Rio de Janeiro, Brazil, in June 1992. The ultimate objective of the UNFCCC, as expressed in Article 2, is:

> "... stabilisation of greenhouse-gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

The challenges presented to scientists and policymakers alike include determining what might be regarded as "dangerous". The extent to which natural ecosystems, global food supply and sustainable development are vulnerable depends in part on the magnitude, rate and nature of climate change and consequent impacts but also on the ability of the impacted systems to adapt.

In line with these two determinants of vulnerability, the UNFCCC identifies two main responses to climate change: mitigation and adaptation. Mitigation comprises all human activities aimed at reducing the emissions or enhancing the sinks of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Adaptation refers to any adjustment in natural or human systems in response to actual or expected impacts of climate change, which moderates harm or exploits beneficial opportunities.

Figure 1 shows how adaptation influences the manifestation of impacts of climate change. Both anticipatory adaptation (adaptation before initial impacts take place) and reactive adaptation (adaptation in response to initial impacts) can reduce potential impacts. Figure 1 illustrates the importance of considering adaptation in assessments of a system's or sector's vulnerability to climate change.

Despite the fact that the UNFCCC refers to both mitigation and adaptation, adaptation has played only a marginal part in the international climate change negotiations so far. As a result, national and international climate policies to date have mainly focused on mitigation. In part this reflects the uncertainty about climate change being caused by human activity, which existed until the publication of the IPCC Second Assessment Report in 1996. It also reflects the lack of theoretical and practical knowledge about adaptation to climate change, which in turn was the result of the limited attention given to adaptation by scientists. In his review of the IPCC Second Assessment Report, Kates (1997) suggested the reason for this limited attention lies in the existence of two distinct schools of thought about climate change, both of which have chosen not to engage in adaptation research.

On the one extreme Kates identified the "preventionist" school, which argues that the ongoing increase of atmospheric greenhouse-gas concentrations could be catastrophic and that drastic action is required to reduce emissions. Preventionists fear that increased emphasis on adaptation will weaken society's willingness to reduce emissions and thus delay or diminish mitigation efforts. On the other extreme one finds what Kates referred to as the "adaptationist" school, which sees no need to focus on either adaptation or mitigation. Adaptationists argue that natural and human systems have a long history of adapting naturally to changing circumstances and that active adaptation would constitute interference with these systems, bringing with it high social costs.

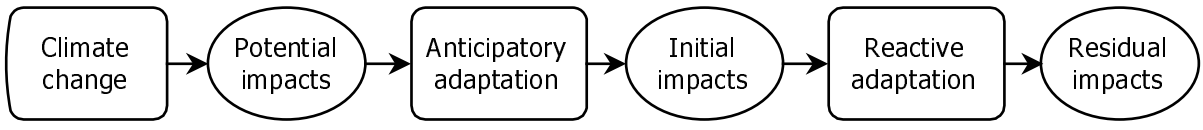

Figure 1. *The role of adaptation in determining residual impacts of climate change.*

Following the publication of the IPCC Second Assessment Report a distinct third school of thought has emerged, which has been labelled the "realist" school by Klein and MacIver (1999). The realist school positions itself in between the two extreme views of the preventionists and adaptationists. Realists regard climate change as a fact, but acknowledge that impacts are still uncertain. Furthermore, realists appreciate that the planning and implementation of effective adaptation options takes time. Therefore, they understand that a process must be set in motion to consider adaptation as a crucial and realistic response option along with mitigation (*e.g.*, Parry *et al.*, 1998; Pielke, 1998).

In addition to the distinction between anticipatory and reactive adaptation, as shown in Figure 1, there are several other ways to distinguish between types of adaptation. A second distinction can be based on the system in which the adaptation takes place: the natural system, in which adaptation is by definition reactive, or the human system, in which both reactive and anticipatory adaptation are observed. Within the human system a third distinction can be based on whether the adaptation decision is motivated by private or public interests. Private decision-makers include both individual households and commercial companies, whilst public interests are served by governments at all levels. Figure 2 shows examples of adaptation activities for each of the five types of adaptation that have thus been defined.

In addition to the ones made above, other adaptation distinctions are discussed by Smit *et al.* (2000). A useful distinction that is often made is the one between planned and autonomous adaptation (Carter *et al.*, 1994). Planned adaptation is the result of a deliberate policy decision that is based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain or achieve a desired state. Autonomous adaptation involves the changes that natural and most human systems will undergo in response to changing conditions irrespective of any policy plan or decision. Instead, autonomous adaptation will be triggered by market or welfare changes induced by climate change. Autonomous adaptation in human systems would therefore be in the actor's rational self-interest, whilst the focus of planned adaptation is on collective needs (Leary, 1999). Thus defined, autonomous and planned adaptation largely correspond with private and public adaptation, respectively (see Figure 2).

The extent to which society can rely on autonomous adaptation to reduce the potential impacts of climate change to an acceptable level is an issue of great academic and policy interest. Autonomous adaptation forms a baseline with which the need for planned anticipatory adaptation can be evaluated. Some studies show considerable faith in market mechanisms and thus in the capacity of private human systems to adapt autonomously (*e.g.*, Mendelsohn *et al.*, 1996; Yohe *et al.*, 1996). Other studies highlight the constraints for such autonomous adaptation, such as limited information, knowledge and access to resources, and emphasise the need for anticipatory planned adaptation (*e.g.*, Tol *et al.*, 1996; Fankhauser *et al.*, 1999). The increasing role of climate information in reducing vulnerability in Southern Africa is discussed by Dilley (2000). He shows that seasonal climate forecasting and monitoring of

		Anticipatory	Reactive
Natural Systems			· Changes in length of growing season; · Changes in ecosystem composition; · Wetland migration.
Human Systems	**Private**	· Purchase of insurance; · Construction of house on stilts; · Redesign of oil-rigs.	· Changes in farm practices; · Changes in insurance premiums; · Purchase of air-conditioning.
	Public	· Early-warning systems; · New building codes, design standards; · Incentives for relocation.	· Compensatory payments, subsidies; · Enforcement of building codes; · Beach nourishment.

Figure 2. *Types of adaptation to climate change, including examples.*

El Niño and the Southern Oscillation increases the potential to better manage drought risks. However, the limited reliability and availability of such information at a local scale remains problematic.

Article 3.3 of the UNFCCC suggests that anticipatory planned adaptation (as well as mitigation) deserves particular attention from the international climate-change community:

> "The Parties should take precautionary measures to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost. ..."

Anticipatory adaptation is aimed at reducing a system's vulnerability by either minimising risk or maximising adaptive capacity. Five generic objectives of anticipatory adaptation can be identified (*cf.* Klein and Tol, 1997):

- *Increasing robustness of infrastructural designs and long-term investments*—for example by extending the range of temperature or precipitation a system can withstand without failure and/or changing a system's tolerance of loss or failure (*e.g.*, by increasing economic reserves or insurance);
- *Increasing flexibility of vulnerable managed systems*—for example by allowing mid-term adjustments (including change of activities or location) and/or reducing economic lifetimes (including increasing depreciation);
- *Enhancing adaptability of vulnerable natural systems*—for example by reducing other (non-climatic) stresses and/or removing barriers to migration (such as establishing eco-corridors);
- *Reversing trends that increase vulnerability ("maladaptation")*—for example by introducing setbacks for development in vulnerable areas such as floodplains and coastal zones;
- *Improving societal awareness and preparedness*—for example by informing the public of the risks and possible consequences of climate change and/or setting up early-warning systems.

The implementation of adaptation options can only be successful when done in an appropriate economic, institutional, legal and socio-cultural context. Therefore, adaptation strategies are most effective as part of a broader, integrated management framework that recognises immediate as well as longer-term sectoral needs. To this end, planned adaptation must be considered a process that entails more than simply the implementation of a policy or technology. The process of planned adaptation has been described as a multi-stage and iterative process, involving four basic steps (Klein *et al.*, 1999):

- Information collection and awareness raising;
- Planning and design;
- Implementation;
- Monitoring and evaluation.

The process of planned adaptation to climate change can thus be conceptualised as depicted in Figure 3. Climate variability and/or climate change—together with other environmental stresses brought about by existing management practices—produce actual or potential impacts. These impacts trigger efforts of mitigation to remove the cause of the impacts or of adaptation to modify the impacts. The process of adaptation is conditioned by policy criteria and development objectives and interacts with existing management practices.

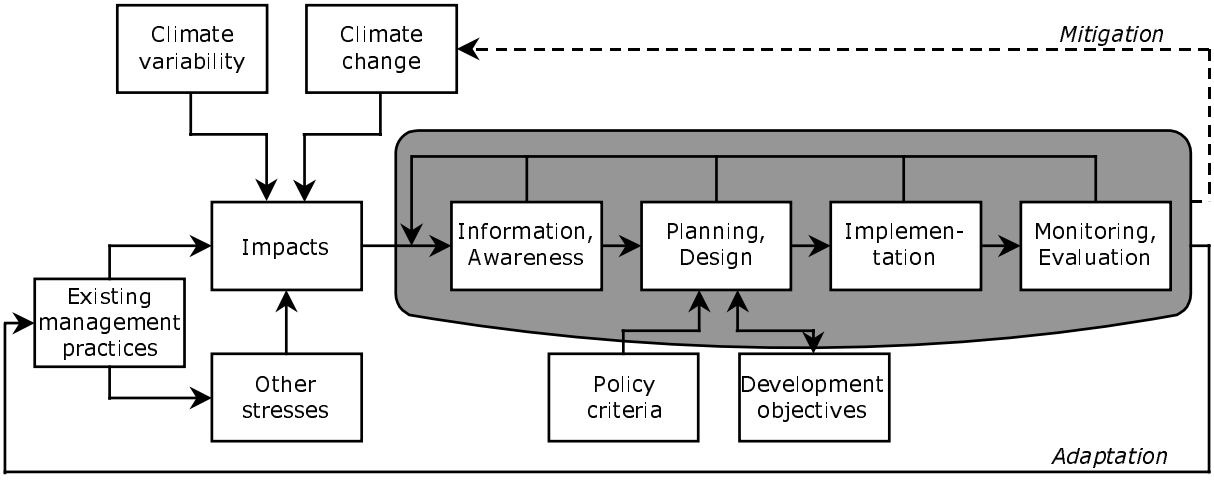

Figure 3. *Conceptual framework showing in the shaded area the iterative steps involved in planned adaptation to climate variability and change.*

Figure 3 has been developed in response to the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations (Carter *et al.*, 1994). These Technical Guidelines provide the basis for a large number of national climate change vulnerability studies. They offer a generic framework comprising seven main steps of analysis, designed to be applicable to any natural and socio-economic system potentially affected by climate change. It appears that these seven steps are strongly orientated towards implementation, with considerable attention being given to pre-implementation evaluation (Klein *et al.*, 1999). Other aspects of adaptation planning are not discussed and neither is the need to collect information and raise awareness and to conduct post-implementation evaluation (see Figure 3). Further, the relationship of adaptation to climate change with other policy issues is not considered.

It is increasingly argued that an assessment of adaptation following the IPCC Technical Guidelines does not provide the kind of information that is useful to policymakers. Implicit in vulnerability studies using the IPCC Technical Guidelines is the assumption that there are no constraints in implementing the adaptation options identified and analysed. The extent to which mechanisms are in place and technologies, expertise and other resources are available to implement effective adaptation options is usually not assessed, although information on these aspects is likely to give a more reliable picture of vulnerability to climate change than merely an assessment of the effectiveness of available options. It is the capacity to adapt rather than the availability of adaptation options that determines vulnerability.

Thus, rather than focusing only on the identification and appraisal of adaptation options, it is increasingly recognised that adaptation assessment must consider the full context in which adaptation takes place, including the factors that influence the capacity of a country, community or sector to adapt. Adaptive capacity, as one of the two determinants of vulnerability to climate change along with impact potential, can be defined as the ability to plan, prepare for, facilitate and implement adaptation measures. Factors that influence the adaptive capacity of human systems include economic wealth, technology, information and skills, infrastructure, institutions and equity.

Adaptive capacity is not a concept that can be measured in a straightforward way. The literature on adaptive capacity, whilst still in its infancy, is growing rapidly. Table 1 provides examples of indicators that are assumed to be useful predictors of adaptive capacity. These indicators relate to the determinants of adaptive capacity listed above. A major research effort is required to evaluate the relative importance, validity and reliability of these and other indicators as well as their applicability in different countries.

Adaptive Capacity Indicators
• GDP/capita (in purchasing power parity)
• Gini coefficient
• Literacy
• Incidence of poverty
• Life expectancy
• Insurance mechanisms
• Degree of urbanisation
• Access to public health facilities
• Access to education
• Community organisations
• Existing planning regulations at national and local levels
• Existing warning and protection from natural hazards
• Institutional and decision-making frameworks
• Political stability

Table 1. *Examples of indicators that could be used to assess a country's adaptive capacity to climate change.*

Given the focus on technical co-operation with developing countries, enhancing the adaptive capacity of vulnerable countries, communities and sectors would be perfectly in line with GTZ's mission. Many ongoing projects aim to improve one or more of the indicators listed in Table 1. In doing so, these projects are likely to enhance adaptive capacity, although without a clear awareness of which aspects of adaptive capacity are particularly critical and deserve highest policy priority in light of climate change.

4. Adaptation Funding

As stated before, the identification of human-induced climate change as an actual rather than a theoretical phenomenon has led to increased recognition of the need to prepare for adaptation. In fact, Article 4.1(b) of the UNFCCC already commits Parties to:

> "Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures ... to facilitate adequate adaptation to climate change."

The references to adaptation in the text of the UNFCCC are usually rather general. The most specific characterisation of possible adaptation measures under the UNFCCC is given in Article 4.1(e), which states that Parties shall:

> "Co-operate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods."

4.1. Funding Arrangements under the UNFCCC

The financing of adaptation measures is addressed in Article 4.3 of the UNFCCC, which states that:

> "The developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources ... needed by the developing country Parties to meet the agreed full incremental costs of implementing measures that are covered by paragraph 1 of this Article. ..."

Article 4.4 of the UNFCCC contains another, more explicit, commitment to financing adaptation measures for developing countries that are particularly vulnerable:

> "The developed country Parties and other developed Parties included in Annex II shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects."

As indicated in Article 21, the Global Environment Facility (GEF) is the international entity entrusted with the operation of the financial mechanism of the UNFCCC. Until recently the focus of the GEF has been primarily on mitigation of climate change, although the types of adaptation activities to be addressed by the GEF were already classified at the tenth session of the Intergovernmental Negotiating Committee of the UNFCCC. Its decision was endorsed at COP-1 in Berlin in 1995 (Decision 11/CP.1). The decision identifies three stages in the adaptation process:

- *Stage I:* Planning, which includes studies of possible impacts of climate change, to identify particularly vulnerable countries or regions and policy options for adaptation and appropriate capacity building;
- *Stage II:* Measures, including further capacity building, which may be taken to prepare for adaptation, as envisaged by Article 4.1(e);
- *Stage III:* Measures to facilitate adequate adaptation, including insurance and other adaptation measures as envisaged by Articles 4.1(b) and 4.4.

According to the GEF Operational Strategy (GEF, 1996), Stage I activities could encompass the following:

- Assessment of national, regional and/or subregional vulnerability to climate change; where appropriate rely on related data-gathering systems to measure climate-change effects in particularly vulnerable countries or regions and strengthen such systems as necessary; and identify a near-term research and development agenda to understand sensitivity to climate change;
- Evaluation of policy options for adequate monitoring systems and response strategies for climate change impacts on terrestrial and marine ecosystems;
- Assessment of policy frameworks for implementing adaptation measures and response strategies in the context of coastal zone management, disaster preparedness, agriculture, fisheries and forestry, with a view of integrat-

ing climate-change impact information, as appropriate, into national strategic planning processes;
- In the context of undertaking national communication, building of national, regional and/or subregional capacity, as appropriate, to integrate climate-change concerns into medium and long-term planning.

With respect to financing, Decision 11/CP.1 states the following:

> "For Stage I, the Conference of the Parties ... shall entrust to the Global Environment Facility (GEF) ... the task of meeting the agreed full costs of the activities required by Article 12.1 of the Convention. This would include meeting the agreed full costs of relevant adaptation activities undertaken in the context of the formulation of national communications; such activities may include studies of the possible impacts of climate change, identification of options for implementing the adaptation provisions ... and relevant capacity building."

With respect to Stages II and III, Decision 11/CP.1 states that:

> "Based on the outputs of the Stage I studies, as well as other relevant scientific and technical studies ..., the Conference of the Parties may decide that it has become necessary to implement the measures and activities envisaged in Stages II and III. ..."

In line with this, Decision 11/CP.1 includes the provision that:

> "If it is decided ... that is has become necessary to implement the measures envisaged in Stages II and III, the Parties included in Annex II to the Convention will provide funding to implement the adaptation measures envisaged in these stages in accordance with their commitments contained in Articles 4.3 and 4.4 of the Convention."

At COP-4 in Buenos Aires (1998) governments adopted Decision 2/CP.4, which states that:

> "... the GEF should provide funding to developing country Parties to implement adaptation response measures under Article 4.1 of the Convention for adaptation activities envisaged in decision 11/CP.1, paragraph 1(d)(ii) (Stage II activities) in particularly vulnerable countries and regions identified in Stage I activities, and especially in countries vulnerable to climate-related natural disasters ..."

In spite of this decision no additional funds have been made available to the GEF to fund Stage II projects. In addition, no clear guidance exists as to which type of activities would be eligible under Stage II, which constrains the development of proposals. As it became clear that such guidance would not be provided in the foreseeable future, countries and organisations have begun to give their own interpretations to the text of Decision 11/CP.1. A number of regional project proposals have recently been submitted to the GEF, aimed mainly at further adaptation assessment and the identification of adaptation needs. One such project that has received GEF funding under Stage II is "Assessments of Impacts of and Adaptation to Climate Change in Multiple Regions and Sectors" (AIACC), proposed jointly by the United Nations Environment Programme (UNEP) and the IPCC.

At this stage it is unclear when and if Stage III activities will become eligible for funding. According to Decision 11/CP.1 Stage III activities are still only aimed at facilitating adaptation, whereas the need for actual adaptation in the most vulnerable countries is increasingly recognised. One problem is that adaptation to climate change can be costly and therefore has the potential to lay a large claim on available GEF funds. On the other hand, in the current situation no GEF funds are available at all for the implementation of actual adaptation measures.

One possible future source of funding could come from the Clean Development Mechanism (CDM), which was established at COP-3 as part of the Kyoto Protocol. The purpose of the CDM is to assist developing countries in achieving sustainable development and in contributing to the ultimate objective of the UNFCCC and to assist Annex I (*i.e.*, industrialised) countries in limiting greenhouse-gas emissions (Article 12.2 of the Kyoto Protocol). In addition, Article 12.8 states that:

> "The Conference of the Parties ... shall ensure that a share of the proceeds from certified project activities is used ... to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation."

However, the recent failure at COP-6 to reach agreement amongst Parties on the functioning of the CDM has likely delayed its implementation and thereby the availability of additional adaptation funding from this source.

4.2. Barriers to Adaptation Funding

Even if money were to become available for the implementation of adaptation measures under the UNFCCC, two major barriers to the international funding of such measures remain. First, in line with Article 3.3 of the UNFCCC the GEF Operational Strategy prescribes that activities need to have global benefits in order to be eligible for funding. Mitigation activities, aimed at reducing atmospheric greenhouse-gas concentrations, clearly have global benefits. For adaptation activities on the other hand, it is difficult to imagine how global benefits can be produced. Adaptation takes place at the scale of an

impacted system, which is regional at best, but mostly local.

Second, the GEF would not cover the full costs of adaptation (however defined). The GEF assumes that some development and upgrading of systems will take place irrespective of climate change. It would fund only the incremental costs of adaptation, which are the additional costs required to maintain a system climate-safe (*i.e.*, prepared for and able to cope with today's climate variability). In theory, these costs can be estimated by comparing two impact scenarios: one with and one without climate change (see also Chapter 5). By then comparing the costs of alternative adaptation options with their respective benefits one can determine the (economically) optimal option, which is the one with the highest benefit-cost ratio. In practice, however, estimates of the costs and especially benefits of adaptation to climate change are difficult to make.

Fankhauser (1997) and Callaway *et al.* (1998) show that, in principle, the benefits of adaptation would be the climate-related damage costs one avoids by taking adaptive measures (assuming that climate change would have adverse consequences). Thus, if one quantifies the potential impacts of climate change on a system (assuming no adaptation) as well as its residual impacts (assuming both anticipatory and reactive adaptation; see Figure 1), the benefits of adaptation are given by the difference between the two. From the value thus obtained one can subtract the costs of implementing the adaptation options (including transition costs) to arrive at the net benefits of adaptation. A mathematical representation and deduction can be found in Callaway *et al.* (1998).

There are, however, a number of caveats involved in such analysis aimed at identifying the "optimal" adaptation option, as prescribed by the GEF. Two types of caveats are distinguished: caveats related to the uncertainty of future scenarios and methodological caveats. Both types are discussed below.

To date, very few studies have succeeded in incorporating all types of adaptation (anticipatory, reactive, natural system, human system, planned, autonomous) in their impact analyses. Many of the early studies used a so-called "dumb farmer"[1] scenario: they assumed present-day behaviour and activities would continue unchanged in the future, irrespective of how they may be affected by climate change. By ignoring any adaptation these studies, which are not unique for agriculture, did not distinguish between potential and residual impacts and thus their damage-cost values represent serious overestimates. On the other hand, they served to generate awareness of the potential magnitude of impacts and of the need for anticipatory adaptation.

Most studies do now consider adaptation to varying degrees. In doing so, however, they invariably encounter the problem of how to deal with uncertainty: not only are impacts of climate change themselves uncertain but they will occur in a future world that is complex and uncertain as well. Some studies accommodate this problem by using a "clairvoyant farmer" scenario, which assumes that adaptation will be perfect. The results of these studies represent serious underestimates.

Other studies take a normative—prescriptive—approach to adaptation. These studies evaluate what would be the optimal adaptation strategy given certain climate and, possibly, non-climate scenarios. Typically they assess a limited set of—often arbitrary—adaptation options, which are assessed for their optimality without giving thought to their appropriateness in a broader societal context, nor to their performance in a world in which not only climate changes but most other relevant factors as well. Moreover, one tends to lose sight of the fact that the results obtained are only valid for the presupposed scenarios, which are surrounded by uncertainty.

An important uncertainty of all climate scenarios relates to the effect of a changing climate on the frequency, magnitude and spatial occurrence of extreme weather events such as floods, cyclones and droughts. To date, climate models have been unable to present unambiguous results for extreme events. Consequently most impact and adaptation studies assume only gradual changes in climate. However, as shown by West and Dowlatabadi (1999), considering extremes can lead to estimates of damage costs and hence to conclusions on optimal adaptation that differ significantly from those based only on gradual changes (*cf.* Yohe *et al.*, 1996; Yohe and Neumann, 1997). The reason for this is intuitive: most damage will not be caused by gradual changes in climate but by occasional extreme events. Reactive adaptation will therefore be triggered mainly by the impacts of extremes, whilst appropriate anticipatory adaptation will need to be designed to cope with these extremes.

In addition to the above caveats associated with uncertainty there are methodological issues that constrain the assessment of adaptation benefits. These

[1] The dumb farmer is a metaphor for any impacted economic agent that does not anticipate climate change or act upon its manifestation. Instead, it continues to act as if nothing has changed. By not responding to changing circumstances, the agent reduces its profitability or fails to take advantage of emerging opportunities. It thus incurs larger damages than would have been the case had some adaptation taken place. The clairvoyant farmer, on the other hand, has perfect knowledge and foresight and is able to minimise damages or maximise benefits. As always, reality will be somewhere in between.

methodological issues may relate to the economics of assessing future costs and benefits or to an incomplete consideration of the full process of adaptation.

To start with the latter, when calculating the costs of adaptation most studies consider only the costs of implementing adaptation options. Furthermore, they consider only those options that are well-defined and (infra)structural or technological by nature (as opposed to legal, institutional, financial or behavioural options). Chapter 3 showed that the process of adaptation represents a continuous and iterative cycle involving four steps. A single focus on implementation and its costs is too limited. Such a focus ignores that successful implementation depends on the availability of various types of resources to assist the other three steps shown in Figure 3 (*i.e.*, the capacity to adapt). There is a cost to raising adaptive capacity and creating an enabling environment but this is what is required for adaptation to have any benefits at all. To assume that the full benefits of an option can be reaped only at its implementation cost is therefore misleading.

A large literature exists on the economics of calculating future uncertain costs and benefits. This literature discusses issues such as the use of discount rates, intergenerational equity, risk assessment, opportunity costs, the precautionary principle, weighting uncertainty in cost-benefit analysis and so on. Each of these issues is a source of intense academic debate and there appears to be no consensus as to what would be the appropriate way of assessing the benefits of adaptation. Multiple "optimal" adaptation strategies can therefore be recommended for the same expected climate impacts, depending on the methods and assumptions used. This scientific discord blurs the analytical picture and hampers the straightforward interpretation of results, both by fellow scientists and policymakers.

An additional and recurring methodological issue is the use of what are often considered western decision tools for situations in non-western societies. The prevalent decision framework in western countries is based on maximising economic efficiency and effectiveness, with the optimal—or "rational"—decision being the one where marginal costs equal marginal benefits. This framework presupposes that all relevant values can be expressed and compared in monetary terms. However, many non-western societies put a strong emphasis on socio-cultural and subsistence values, which are generally considered to be inappropriate or impossible to express in monetary terms. Therefore, western decision tools cannot be universally applied to assess adaptation benefits and determine the optimality—in terms of its societal desirability—of adaptation options.

In addition to the barriers for adaptation funding raised by the GEF Operational Strategy there is the fact that adaptation is often not considered a development objective. Consequently it has a low priority for foreign direct investment. As opposed to the implementation of mitigation technologies, which can contribute to the development of a country's energy-consuming sectors, adaptation is primarily aimed at preventing or reducing damage to these and other sectors. Moreover, since adaptation often addresses site-specific issues it will have to be designed and implemented keeping local considerations in mind. This could hamper the effective transfer of successful adaptation options, thus making adaptation less interesting from a commercial investment perspective.

5. No-Regret Adaptation and Secondary Benefits

Chapter 4 has shown that the international funding of adaptation to climate change faces a number of political, as well as scientific, challenges. These challenges are not limited to the GEF: very few projects have been initiated, funded and implemented with a specific focus on climate change as part of bilateral or multilateral development programmes as well. However, bilateral and multilateral development assistance has the advantage of being potentially more flexible and thus more effective than the GEF in making funding decisions. The need for such flexibility pertains in particular to the distinction between climate change and climate variability and the related issue of incremental costs.

Its mandate requires the GEF to make a distinction between adaptation to a future, scenario-based climate change and adaptation to today's climate variability. Adaptation to climate change would be eligible for funding, whereas adaptation to climate variability is not. Both types of adaptation, however, are very similar by nature and they can mutually reinforce each other. For example, both types of adaptation would include protection against weather extremes and related hazards. Weather extremes occur independently of climate change but their magnitude and frequency of occurrence is likely to be affected as a result of climate change. Adapting to extremes that result from today's variability would be a good start to prepare for the extremes associated with a future climate.

Particularly if one accepts that human-induced climate change is already taking place, the distinction between the two types of adaptation becomes highly theoretical. It assumes that one is able to identify the relative contributions to weather extremes of human-induced climate change and natural climate variability. This is not only impossible but also immoral. The attribution question and related issues of funding eligibility are highly irrelevant to people who lose their lives or livelihoods as a result of weather extremes.

As far as the calculation of incremental costs of adaptation is concerned, this too requires information of a type that is not always possible to obtain. As explained in Chapter 4, incremental costs are the additional costs required to keep a system climate-safe. This definition assumes that systems that are subject to adaptation to climate change are already climate-safe (see Chapter 4). Alternatively, it assumes that it is the responsibility of the individual countries to make these systems climate-safe, using alternative—possibly their own—funds.

The protection of a coastal area against storm surges by means of a seawall provides a simple case to illustrate what are the incremental costs of adaptation to climate change. The level at which the seawall should offer protection is essentially a policy decision and reflects the population density and the value of the land and assets in the area at risk of flooding. This protection level determines the design height of the seawall, which for today's storm-surge variability can be calculated using meteorological, morphological and hydraulic data and information. If one were to protect not only against today's storm-surge variability but also to prepare for a climate change-induced sea-level rise, the design height of the seawall would have to be increased. The cost difference between a seawall that only offers protection against today's variability and a higher one that also prepares for sea-level rise reflects the incremental costs of adaptation to climate change.[2]

In this example it is immediately clear what the incremental costs of adaptation to climate change are. However, reality is often not as straightforward. As explained in Chapter 3, adaptation is a process that can comprise a range of different legal, institutional, economic and structural measures. It involves information development and awareness building regarding the needs and opportunities to adapt, the planning and design of adaptation measures, their implementation in line with existing policy criteria and development objectives and the monitoring and evaluation of the adaptation performance (Figure 3). In addition, it requires the development of an ena-

[2] The use of this example does not suggest that building seawalls is the most appropriate way to protect coastal areas. Alternative management strategies are increasingly applied to minimise ecosystem impacts and changes in erosion and sedimentation patterns (Klein *et al.*, in press).

bling environment for implementing adaptation measures.

Thus, the range of measures countries may wish to take to adapt to climate change is much broader than only structural measures such as building a seawall. An adaptation strategy may include actions such as:

- Setting up a monitoring network to enable the early warning of weather-related hazards;
- Changing institutional arrangements to enhance the effectiveness of political decisions;
- Strengthening a country's legal system to improve compliance with existing regulations;
- Changing fiscal arrangements to provide adaptation incentives to the private sector;
- Supporting the role of non-governmental organisations to ensure public involvement in decision-making.

It is clear that measures like these would have benefits that go beyond those of adaptation to climate change. However, it is also clear that it will be impossible to determine the relative contributions of these measures to the various types of benefits. As a result, the incremental costs of adaptation measures that are less straightforward than building a seawall are difficult or even impossible to determine.

It goes without saying that the two issues sketched above will be a major constraint when it comes to providing funds for actual adaptation to climate change by the GEF (*i.e.*, beyond Stage III). The effectiveness of adaptation to human-induced climate change depends on a country's own initiative and ability to adapt to today's climate variability. If no funds are available for the latter type of adaptation, adaptation to climate change is unlikely to be successful.

This dilemma presents an opportunity for bilateral and multilateral assistance programmes. Not bound by requirements such as the ones discussed above concerning incremental costs and the distinction of climate variability and climate change, bilateral and multilateral assistance programmes can make a real contribution towards enhancing the adaptive capacity of vulnerable countries and implementing measures that have benefits that go beyond those of adaptation to climate change.

The recent series of natural disasters in the developing world has shown that many current systems cannot be assumed to be climate-safe. Hundreds of thousands of people died in weather-related disasters in Honduras, Venezuela, India and Mozambique, illustrating the urgent need to adapt to today's climate variability. Measures to reduce the vulnerability of these countries to climate variability will be a good starting point to reduce vulnerability to climate change. But even if climate change were not to take place such measures would still be important and beneficial and would therefore be justifiable in their own right. Analogous to "no-regret" mitigation measures (which help to reduce greenhouse-gas emissions but also have immediate benefits to society that make them worthwhile to implement irrespective of climate change) adaptation measures that have both immediate and long-term benefits can be termed "no-regret" adaptation measures.

Projects that have been initiated with different goals in mind may also have benefits in terms of adaptation to climate change. Such benefits can be considered secondary benefits, since adaptation to climate change was not the primary purpose of the project. Secondary benefits result in win-win situations, which may be particularly prevalent in projects aimed at combating desertification and preserving biological diversity. Synergies may exist between these two goals and adaptation to climate change. The following sections explore such possible synergies.

5.1. Desertification

Desertification is the degradation of land in arid, semi-arid and dry sub-humid areas. It does not refer to the expansion of existing deserts. Desertification is primarily caused by human activities and climatic variations. It occurs because dryland ecosystems, which cover over one third of the world's land area, are vulnerable to overexploitation and inappropriate land use. Four human activities are usually the most immediate causes of desertification:

- *Overcultivation* exhausts the soil;
- *Overgrazing* removes the vegetation that protects the soil from erosion;
- *Deforestation* cuts the trees that bind the soil to the land;
- *Poorly drained irrigation* turns cropland salty.

Combating desertification is essential to ensuring the long-term productivity of inhabited drylands. Recognising the seriousness of the problem, the United Nations adopted the Convention to Combat Desertification (UNCCD) in 1994. Article 2.1 of the UNCCD states its objective:

> "... to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international co-operation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas."

Drought can trigger or aggravate desertification. The UNCCD defines drought as "the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems". In other words, drought is part of natural climate variability. However, the frequency, intensity and geographical patterns of drought events are expected to alter as a result of climate change. Climate models suggest that precipitation patterns will change, resulting in increases in droughts in many areas that are already affected by, or are vulnerable to, desertification. This would add to existing stresses on water resources, food security and human health. In turn the effects of desertification on soil and vegetation could exacerbate global climate change.

It is clear that desertification and climate change are related issues and that combating desertification and adapting to climate change can be mutually reinforcing. This is confirmed in Article 8.1 of the UNCCD, which refers to the relationship of the UNCCD with other conventions:

> "The Parties shall encourage the co-ordination of activities carried out under this Convention and, if they are Parties to them, under other relevant international agreements, particularly the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity, in order to derive maximum benefit from activities under each agreement while avoiding duplication of effort. The Parties shall encourage the conduct of joint programmes, particularly in the fields of research, training, systematic observation and information collection and exchange, to the extent that such activities may contribute to achieving the objectives of the agreements concerned."

There is increasing recognition of the potential benefits of taking a joint approach to combating desertification and adapting to climate change in dryland areas. Integrated dryland management provides just such an approach. It is currently being tested in many countries as a way of balancing the social, economic and ecological interests of drylands and the people who depend on them. IUCN–The World Conservation Union views integrated dryland management as an important response strategy because it is supportive of efforts towards economic development and improving social welfare, thus reducing the underlying causes of desertification.

The potential synergies between the UNCCD and the UNFCCC have become the subject of a growing number of policy statements, in part because such synergies are expected to be economically efficient. Hoffmann (2000) identified three areas of possible and complementary linkages between the two conventions:

- *Procedural and organisational linkages*—for instance in the area of administrative arrangements;
- *Scientific and technological linkages*—for instance in the area of vulnerability, degradation and carbon sequestration;
- *Social and institutional linkages*—for instance in the case of capacity building, education, training, public awareness, outreach and involvement of key groups.

According to Hoffmann (2000), attention to date has focused predominantly on scientific and technological linkages, leading to improved understanding of linkages, feedbacks, vulnerabilities and synergies (*e.g.*, Watson *et al.*, 1998b). This improved understanding now provides an opportunity to focus more strongly on procedural and organisational linkages and social and institutional linkages.

However, Grainger *et al.* (2000) suggest knowledge of links between desertification and climate change is still limited, which constrains the realisation of synergies between the UNCCD and the UNFCCC, as well as international funding. A sound understanding of how desertification and climate change interact at the local and national scale is necessary to enable countries to identify and evaluate measures to combat desertification and prepare for drought. Possible measures to prepare for drought, as listed in Article 10.3 of the UNCCD, include:

- Establishment and/or strengthening of early-warning systems;
- Strengthening of drought preparedness and management, including drought contingency plans;
- Establishment and/or strengthening of food security systems, including storage and marketing facilities;
- Establishment of alternative livelihood projects that could provide incomes in drought-prone areas;
- Development of sustainable irrigation programmes for both crops and livestock.

The implementation of many of these measures can have secondary benefits in terms of adaptation to climate change if the measures are designed keeping projections of climate change and its impacts on precipitation, runoff, soil moisture and other relevant factors in mind.

5.2. Biodiversity

Biological diversity (or biodiversity) is the term given to the variety of life on Earth and the natural

patterns it forms. Today's biodiversity is the result of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. Increasing human demands on the world's natural resources have placed a heavy burden on biodiversity. Species have been disappearing at 50 to 100 times the natural rate and these numbers are predicted to rise dramatically. The loss of biodiversity threatens food supplies, sources of wood, medicines and energy and opportunities for recreation and tourism. It also interferes with essential ecological functions.

In recognition of the fact that the conservation of biodiversity is a common concern to humankind and an integral part of sustainable development, the Convention on Biological Diversity (CBD) was adopted in 1992. Its objectives, as stated in Article 1 of the CBD, are:

> "... the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding."

The fragmentation, degradation and loss of forests, wetlands, coral reefs and other ecosystems pose the greatest threats to biodiversity. Global atmospheric changes, such as ozone depletion and climate change, add to these threats. Climate change is already changing habitats and the distribution of species (Malcolm and Markham, 2000). The expected rapid increase in global mean surface temperature could lead to the extinction of many species that are already under severe stress. Thus, the ultimate objective of the UNFCCC (see Chapter 3), which states that ecosystems should be allowed to adapt naturally to climate change, appears difficult to meet.

Malcolm and Markham (2000) investigated three important climate-related threats to terrestrial biodiversity:

- Rates of global warming that may exceed the migration capabilities of species;
- Losses of existing habitats during progressive shifts of climatic conditions;
- Reductions in species diversity as a result of reductions in habitat patch size.

They found that species at 17 to 21% of the world's land surface would require migration rates of more than 1,000 metres per year to keep up with climate change. In Canada, Russia and Scandinavia such migration rates would be required for species at 33 to 38% of the land surface. Required migration rates for plant species appear to be ten times higher than the rates recorded at the end of the last ice age. For cold-adapted systems, such as arctic and alpine systems, global warming will impose species loss irrespective of migration capabilities. The tropics, in spite of lower required migration rates, could still face a strong impact in terms of species loss because no previous selection for high mobility has occurred.

In addition to the high migration rates required for species to keep up with climate change, human infrastructure and agricultural areas, as well as large water bodies, represent barriers to species migration. As stated in Chapter 3, enhancing the adaptability of natural systems, for example by reducing other (non-climatic) stresses and/or removing barriers to migration, can be an important objective of anticipatory adaptation to climate change. Increasing the connectivity amongst habitats within developed landscapes would help species to attain their maximum migration rates and thus reduce species loss.

The importance of coastal and freshwater wetlands in terms of the goods and services they provide to human society is often underestimated, which has caused a rapid loss of wetlands. Wetlands are characterised by a large number of ecological niches and harbour a significant percentage of the world's biodiversity. As wetlands are highly dependent on water levels changes in climatic conditions that affect water availability will highly influence the nature and function of specific wetlands, including the type of plant and animal species within them.

Bergkamp and Orlando (1999) have explored opportunities to create synergies between the Ramsar Convention on Wetlands and the UNFCCC. One of the four joint action themes they propose concerns the role of wetlands in adapting to and reducing the impacts of climate change. Important functions of wetlands include water storage, groundwater recharge, storm protection, flood mitigation, shoreline stabilisation, erosion control and retention of carbon, nutrients, sediments and pollutants. The importance of these functions will increase as climate changes. Bergkamp and Orlando (1999) therefore argue that wetland rehabilitation and sustainable wetland management are important adaptation strategies to climate change.

The above discussion shows that there is a clear link between climate change and biodiversity decline, although there are many other factors involved as well. The CBD, unlike the UNCCD, makes no explicit reference to the UNFCCC. However, some measures identified in the CBD allow for the creation of synergies with adaptation to climate change. Examples of such measures are identification and monitoring, in-situ conservation, sustainable use of components of biodiversity, research and training,

public education and awareness raising, impact assessment and minimising adverse impacts, exchange of information and technical and scientific co-operation. To date, measures have focused primarily on four areas: forest ecosystems, marine and coastal areas, agricultural biodiversity and inland water biodiversity.

One could argue that the three aforementioned types of linkages between the UNCCD and the UNFCCC also apply to the CBD and the UNFCCC. Scientific and technological linkages have received ample attention, leading to an increased understanding of the impacts of climate change on biodiversity, as well as of the role of ecosystems as sinks for carbon dioxide. Procedural and organisational linkages and social and institutional linkages between the CBD and the UNFCCC have received less attention thus far.

Strengthening the latter two types of linkages could enable countries to take an ecosystem approach to adaptation to climate change. An ecosystem approach, as endorsed by the Conference of the Parties to the CBD, is a strategy for the integrated management of land, water and living resources that promotes their conservation and sustainable use in an equitable way (UNEP/CBD/COP/5/23, Decision V/6). The underlying assumption is that biodiversity provides goods and services of economic and social importance, such as water storage, erosion control and retention of carbon, nutrients, sediments and pollutants. An ecosystem approach aims to maintain and enhance these goods and services, which would become increasingly important to society in the face of climate change. It requires countries to recognise the broader context in which biodiversity loss and climate change occur, as well as the need to develop plans and policies to address these issues in an integrated fashion, taking into account other considerations of sustainable development. As such, an ecosystem approach can be a strategy for implementing no-regret measures to adapt to climate change and produce secondary benefits (Orlando and Klein, 2000).

Protected areas are of particular relevance to biodiversity conservation. Protected areas are designed and managed in such a way that many of the threats to biodiversity, such as erosion, overexploitation of resources and pollution, are minimised. However, protected areas cannot be isolated from the threat of climate change. The potential impacts of climate change on biodiversity present a challenge to the design and management of protected areas. Minimising the impacts on biodiversity requires protected areas to create conditions under which species migration can take place whilst the integrity of ecosystems is maintained.

6. Inventory of Relevant German-Funded Development Projects in Africa

As stated in Chapter 2, one of the objectives of this study was to identify the extent to which German-funded ODA projects in Africa, mainly aimed at technical co-operation in natural resource management, already consider the risk of climate change as well as opportunities for adaptation. First, 136 GTZ project descriptions from five different CRS categories were analysed. Next, three GTZ projects, one KfW project and one joint GTZ-KfW project were selected for more detailed analysis. The insights obtained from both types of analysis are presented in this chapter.

The five thematic areas that were selected for the purpose of this study are the following:

- Agricultural land resources (CRS 31130);
- Forest development (CRS 31220);
- Environmental policy and management (CRS 41010);
- Biodiversity (CRS 41030);
- Rural development (CRS 43040).

These five areas were selected in consultation with GTZ because of their potential for no-regret adaptation and for generating secondary benefits (Chapter 5). It is clear, however, that these are not the only five thematic areas that have this potential. In fact, a number of other CRS categories seem more directly related to climate variability (especially in relation to water) and therefore potentially relevant for adaptation to climate change. Examples of potentially relevant categories that have not been analysed are *River development and regulation* (CRS 14040), *Agricultural water resources* (CRS 31140) and *Protection against high water* (CRS 41050)[3].

In addition, Africa is of course not the only continent where projects directed at natural resource management could have relevance to adaptation to climate change. This analysis is therefore not intended to be comprehensive. It only serves to give a first indication of the extent to which adaptation to climate change has been considered in the formulation and implementation of ODA projects aimed at sustainable natural resource management.

[3] Note that climate change itself is not a CRS code. The project "Measures to Implement the United Nations Framework Convention on Climate Change", to which this study is a contribution, is carried out under the category *Environmental policy and management* (CRS 41010).

6.1. Initial Analysis

For each of the aforementioned five CRS categories the project descriptions of projects that have been initiated since 1990 were obtained from the PBS database. As stated, this amounted to 136 projects in total: 29 on agricultural land resources, 24 on forest development, 15 on environmental policy and management, 26 on biodiversity and 42 on rural development.

The level of detail in which these project descriptions have been prepared varied strongly, ranging from only a standard form with the technical and budgetary details filled out to detailed descriptions of project objectives, methodologies and achievements of up to ten pages. Unfortunately the former type of project descriptions was more prevalent in the PBS than the latter. No time was available to seek additional information on those projects for which no detailed project descriptions were available.

An important finding from the initial analysis of the 136 project descriptions is that none of them explicitly refers to climate change. Given that none of the projects has been initiated with the aim to reduce vulnerability to climate change this may not be surprising. However, it may be more surprising that only very few of the project descriptions refer to environmental or economic stress related to weather or climate variability. In all cases this relates to drought and desertification.

This sparse mentioning of weather or climate variability in descriptions of projects on natural resource management in Africa is particularly striking in light of the intricate balance between the productivity of Africa's natural resources and prevailing weather and climate conditions. Africa's climate can be a major constraining factor to the sustainable development of its resources. As a result, ODA project activities need to take climate conditions into con-

sideration. It is difficult to imagine that the lack of attention in the project descriptions on the need to adapt to today's climate reflects any ignorance of the importance of the issue. It is more likely that the need to consider climatic conditions is so obvious to project managers that its importance, whilst implicitly recognised, is overlooked when preparing the project descriptions.

In conclusion, the GTZ project descriptions as obtained from the PBS are not a useful tool to assess the extent to which German-funded ODA projects in Africa aimed at natural resource management consider climate-related vulnerability and adaptation. Many project descriptions are too succinct to yield any useful information. Nonetheless, it is assumed that the importance of considering current climate conditions in projects aimed at natural resource management in Africa is generally recognised. The fact that it is not mentioned in most project descriptions is believed to validate this assumption rather than vitiate it. Climate change, however, does not appear to be a priority issue in the 136 projects analysed.

6.2. Case Studies

Based on the initial analysis of the 136 project descriptions, three GTZ projects were identified for closer investigation, as well as one KfW project and one joint GTZ-KfW project. GTZ projects are generally aimed at technical co-operation, capacity building and institutional development, whilst KfW projects tend to focus more on the development of and investment in structural measures, including infrastructure. As such, GTZ and KfW complement each other in German ODA: GTZ, whilst having its own identity and mission in development assistance, can serve to create an enabling environment for the implementation of hard technologies by KfW.

The following five projects were selected in this study:

- Combating desertification in Mauritania (GTZ project numbers 90.2091.8 and 97.2033.5);
- Integrated nature protection at Mount Cameroon (GTZ 91.2248.2);
- Development of a National Environment Agency in The Gambia (GTZ 93.2267.8);
- Water sector reform and water supply in Zambia (GTZ 97.2180.4 and 98.2116.6 and KfW 97.65.728);
- Erosion protection in Betsiboka, Madagascar (KfW 94.65.824 and 97.70.130).

The intended approach to this part of the study was to analyse available project materials and to interview the project managers or other staff involved in the projects. However, for some of the above projects it appeared difficult to obtain the project materials in time or to make an appointment with project managers, largely because they were abroad for longer periods. In addition, some project managers faced this study with some scepticism, possibly because they do not consider climate change an immediate development priority and view its consideration an unnecessary burden on their projects. Additional interviews were therefore held with the co-ordinators of the GTZ projects aimed at the implementation of the UNCCD and the CBD to provide a broader overview of project activities under these two conventions and their possible synergies with climate adaptation.

6.2.1. Combating desertification in Mauritania

This project was selected to represent a range of German ODA projects that focus on combating desertification in Africa. African countries in which German ODA has been targeted at combating desertification include Algeria, Benin, Burkina Faso, Cape Verde, Chad, Egypt, Ethiopia, The Gambia, Ivory Coast, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Morocco, Namibia, Niger, Rwanda, Senegal, South Africa, Tanzania, Tunisia, Uganda and Zimbabwe. According to Schuldes and Fleuth-Leferink (1999), projects aimed at combating desertification should take an integrated approach and emphasise action to promote sustainable development at the community level.

The project descriptions for the desertification projects in Mauritania also highlight the importance of combining structural measures with legal measures and capacity building and of targeting these activities primarily at local populations. Structural measures carried out in the first phase of the project included dune stabilisation, afforestation and soil and water conservation. As stated in the second project description, however, these measures have rarely been effective and sustainable. No reason is given as to why this is the case. The second phase of the project focused on the development of a legal framework ("code pastoral") based on both traditional and modern resource-use arrangements. The code pastoral involves a participatory form of resource use and spatial planning aimed at ensuring the viability of both crop-based and livestock-based activities.

Chapter 5 illustrated the potentially close links between combating desertification and adapting to climate change. Marginal lands affected or threatened by desertification are particularly vulnerable to possible increases in drought frequency or intensity. The above measures, if successful, can therefore also be useful anticipatory measures to adapt to climate

change. If climate change does not lead to an increase in drought frequency or intensity these measures will at least have addressed desertification and are therefore no-regret adaptation measures.

The project documentation does not suggest that the adequacy of the measures taken as part of these two projects in Mauritania has been tested for a situation in which desertification is exacerbated by more frequent and intense droughts. According to Günter Winckler, co-ordinator of the BMZ project that aims to incorporate the UNCCD into German ODA, this kind of sensitivity analysis is not commonly conducted as part of projects such as those in Mauritania. Projects to date have focused almost exclusively on the immediate priorities of food security and sustainable natural resource management and development. These priorities are usually formulated by the African countries themselves in their National Environmental Action Plans. Co-ordination between the implementation of the UNCCD and the UNFCCC is generally not an issue, which is in part due to the fact that in most countries the implementation of the two conventions is the responsibility of different government agencies. In addition, awareness of the relationship between desertification and climate change is limited, both in Germany and in the African countries. Winckler states that the UNCCD and the UNFCCC are important at a political level but they have yet to prove their relevance at the operational level of ODA projects.

6.2.2. Integrated nature protection at Mount Cameroon

The Mount Cameroon region is known for its exceptionally high biological diversity, which is considered to be of global importance. However, this biodiversity is threatened by increasing population and development pressures, leading to the degradation of the extensive forest ecosystem of the region. This project aims to involve the local population and decision-makers in the development of a land-use plan that strikes a balance between biodiversity conservation and the development needs of the population. The plan would involve the setting aside of parts of the mountain region for conservation and of other parts for sustainable resource development. The plan includes the development of forestry, livestock farming and tourism to provide compensation to people who are adversely affected by the conservation scheme. It also includes awareness-raising activities and educational programmes, involving a local non-governmental organisation.

Mountain ecosystems are amongst the most vulnerable to climate change because they have limited to no migration potential. The project documentation only refers cursorily to the uniqueness of the alpine ecosystem at the high parts of Mount Cameroon and remains silent about the threats of climate change to this ecosystem. In view of the fact that the project is directed exclusively at the immediate conflict between development and biodiversity conservation, which is evident at the lower parts of the mountain, this omission is understandable.

However, climate change will also be relevant for the forest ecosystem at which this project is targeted. It is unclear from the project documentation if the migration potential of the forest ecosystem will be considered in the zonation of the forest. According to Andreas Gettkant, who is responsible for incorporating the CBD into German ODA, climate change is generally not considered a priority issue as far as biodiversity conservation is concerned. It is therefore unlikely that the zonation in the Mount Cameroon region has considered the migration potential of the forest as climate changes. It is also unlikely that the education and awareness-building programmes will focus on the potential impacts of climate change on biodiversity and the use of natural resources. Whilst this project includes many elements of an ecosystem approach (see Chapter 5) the issue of medium to long-term sustainability is not considered.

6.2.3. Development of a National Environment Agency in The Gambia

The National Environmental Action Plan of The Gambia has identified a range of environmental issues that require policy action, including deforestation, soil erosion, desertification, falling groundwater levels, salinisation and coastal erosion. Socio-economic sectors that are affected include agriculture, water supply, public health and tourism. In 1993 a National Environment Agency was founded with the aims of, *inter alia*, co-ordinating cross-sectoral environmental policies and programmes, developing, implementing and enforcing environmental laws and regulations, raising environmental awareness of the public and introducing and implementing environmental quality standards.

This German ODA project provided support to the National Environment Agency mainly by providing advice and building capacity with regard to the development and co-ordination of environmental policy concepts and activities. These concepts and activities are primarily related to forestry, soil and water management, family planning and rural water supply.

In spite of the relevance of climate change to a number of the aforementioned environmental issues, in particular desertification, salinisation and coastal erosion, the National Environment Agency does not seem to consider climate change in its activities. For

example, it is not the government agency that co-ordinates The Gambia's activities under the UNFCCC, despite its aim of co-ordinating cross-sectoral environmental policies and programmes. Burghard Rauschelbach, who has been involved in the project as an expert and has visited The Gambia a number of times, confirms that there is a risk of institutional fragmentation but that climate change was primarily considered an issue for climatologists and energy experts. The potential of creating win-win situations between adaptation to climate change and ongoing environmental policy activities was not recognised at the project initiation stage.

6.2.4. Water sector reform and water supply in Zambia

GTZ and KfW are both involved in water-related projects in Zambia: GTZ's interest is in reforming the water sector in Zambia so as to enhance efficiency and sustainability, whilst KfW's activities are directed at improving water supply and waste water treatment in rural parts of Zambia. These and other water-related projects in Zambia build on the principles of the WASHE concept, which stands for Water, Sanitation and Health Education. The overall goal of WASHE is to develop and manage safe, sustainable and cost-effective water supply and waste water sanitation services for the rural population of Zambia. WASHE takes an integrated approach to the assessment, planning and management of rural water and sanitation services, mainly by education, building capacity, improving decision-making, privatising the water sector and making communities responsible for management.

It should be noted that this project has not been developed in response to water availability problems. Dry periods do not lead to acute problems in Zambia because the population has adjusted its activities to cope with water shortages. In other words, adaptation to climate variability has been successful. Whether or not this autonomous adaptation will be sufficient to cope with future climatic conditions, for example if dry periods become more pronounced in duration and intensity, is unknown. Moreover, the quality of the available water is still problematic on a substantial scale. For example, in the East Province of Zambia only 30% of the population have access to safe drinking water. There is no information on how climate change may further deteriorate this situation.

According to project manager Christine Werner there are opportunities to further improve the climate safety of the water and sanitation sector in Zambia. For example, poor management and lack of good equipment have led to a relatively inefficient water supply system. A more efficient supply of water would be a no-regret adaptation measure in the face of climate variability and change. Another example concerns the development and construction of sewage systems. According to Werner, rules of thumb are used to determine the diameter of the pipes and thus the maximum drainage capacity of the sewerage. During tropical storms this can lead to the sewerage overflowing, which can affect public health. Calculating the required diameter of sewage pipes to allow the system to cope with storms of a certain return period would allow for another no-regret adaptation measure. Incorporating a possible increase in storm intensity as a result of climate change into the calculations would enable adaptation to climate change at an incremental cost.

Whilst the existence of opportunities such as these is recognised, the current projects do not attach a high priority to climate considerations. This is mainly due to the presence of more immediate concerns such as improving access to safe drinking water, reducing health risks and improving cost recovery. In part it may also be due to a lack of understanding of the possible consequences of climate change on the water supply and waste water sanitation services in rural Zambia.

6.2.5. Erosion protection in Betsiboka, Madagascar

This KfW project is one of the German contributions to a programme initiated by the World Bank, which is aimed at preserving the unique biodiversity of Madagascar. The programme aims to identify (*i*) the factors that lead to a decline in biodiversity, (*ii*) the underlying mechanisms that trigger these factors and (*iii*) the current societal and institutional arrangements that have led to these mechanisms having an adverse effect on biodiversity. The overall goal of the programme is then to develop an institutional framework in which the factors and underlying mechanisms can be addressed.

There are three national parks in Madagascar, each of them situated in the upstream part of a river catchment. As such, the vegetation helps to stabilise the soils on the slopes of the river catchments, as well as the runoff of river water, which is important for downstream agriculture (mainly cultivation of rice in paddy fields). However, increasing development pressure has led to an increase in soil erosion, which has affected river flow and thereby agriculture.

According to Ralph Kadel, project manager at KfW, the former arrangements whereby the local population did not have any rights of access or use of the national parks had an adverse effect. The local population was unaware of the importance of the national

parks for the stability of downstream ecosystems and economic activities and continued to use the protected forests as a source of wood and for cattle grazing, despite increasing erosion.

The newly proposed institutional framework is based on a participatory approach in which natural resources, management responsibilities and income are shared with the population. The new executive agencies for the national parks are semi-private / semi-public organisations, whilst there is also an increasing role for non-governmental organisations. The funding for the national parks, which is now almost exclusively derived from ODA, will have to be diversified with trust funds and tourism as important new contributors.

Climate change and variability have never been considered explicitly in this project. However, the very idea behind the preservation of upstream ecosystems is the part these ecosystems play in regulating the microclimate of the river catchments. The vegetation, in ensuring the stability of soils and river flows, reduces the catchment's vulnerability to both droughts and tropical storms. Preserving the vegetation is thus a good precautionary and no-regret measure to prepare for climate change.

7. Opportunities to Incorporate Adaptation in Future Development Projects

It appears from Chapter 6 that vulnerability and adaptation to climate change have not been explicit considerations in German-funded development projects in Africa to date. However, Chapter 5 has shown that there is significant potential for implementing no-regret adaptation strategies and for generating secondary benefits, particularly in relation to combating desertification and conserving biodiversity. This chapter outlines possible ways to seize opportunities to incorporate adaptation to climate change in future ODA projects. It distinguishes between assessment techniques to evaluate the extent to which climate change is relevant to the long-term sustainability of projects and procedural opportunities to encourage explicit consideration of climate change in projects.

7.1. Assessment of Long-Term Project Sustainability

To consider climate change in development projects would add a long-term sustainability component to development assistance. There are three ways in which climate change is relevant to ODA projects:

- The risk of climate change to the ODA project and its deliverables;
- The vulnerability to climate change of the community or ecosystem that is intended to benefit from the ODA project;
- The possible effects of the ODA project and its deliverables on the vulnerability of communities or ecosystems to climate change.

The first of these three considerations is particularly important in light of a project's long-term viability and should be part of its risk assessment before implementation. A project that intends to prevent soil erosion by planting trees is unlikely to be successful in the long run if the trees selected are sensitive to possible changes in one or more meteorological variables. For example, if the trees require more water than is projected to be available as climate changes, the project could fail and investments would not render the desired outcome. Similarly, a project that involves the construction of infrastructure could fail if design standards are not adjusted to reflect changing probabilities of extreme events such as floods, droughts and storms. For example, if a river's peak runoff is projected to increase, a new bridge may be washed away if this increase has not been considered in the design of the bridge. These examples show that climate change is relevant to the cost-effectiveness of ODA projects that are intended to generate benefits over a longer period of time.

The second consideration can have a similar—albeit more indirect—effect on the long-term success of ODA projects. For example, a project that intends to develop agriculture in a low-lying coastal area could fail if sea-level rise were to cause increased flooding and eventually permanent inundation of the area. The productivity of the agricultural land would decline, resulting in reactive adaptation: either people would move away to higher areas or measures would be taken to protect the land and its inhabitants from flooding. Both types of adaptation would come at a cost, which shows that climate change is an important factor to determine the cost-effectiveness of ODA projects that invest in vulnerable areas. It is therefore prudent to assess and consider the extent to which communities or ecosystems are vulnerable to climate change before project implementation.

The third consideration reflects the fact that a natural or human system's vulnerability to climate change is in part determined by its interaction with non-climate stresses. Figure 3 showed that changes in existing management practices could both increase and decrease vulnerability to climate change. Adaptation serves to reduce vulnerability, whilst maladaptation refers to trends that increase vulnerability (see Chapter 2). As discussed in Chapter 5, ODA projects unrelated to climate change may generate secondary benefits that help to reduce climate vulnerability. On the other hand, ODA projects may also unintentionally increase natural or human vulnerability to climate change. For example, new coastal infrastructure could disturb the offshore sediment balance, resulting in erosion in adjacent coastal areas. Additional examples of maladaptation may include irrigation (which can lead to salinisation of groundwater and affect wetlands) and development of floodplains (which can lead to a reduced buffering capacity for river water and thus to increased peak runoff).

Determining the extent to which ODA projects would affect a system's vulnerability to climate change—either by producing secondary benefits that reduce vulnerability or by causing maladaptation that increases vulnerability—would be a useful step before the project is implemented.

Thus, in line with the three ways in which climate change can be relevant to ODA projects, three types of assessment are recommended in the project formulation or preparation stage. These types of assessment, which concern the risk of climate change to an ODA project, the vulnerability to climate change of the community or ecosystem to benefit from the project and the project's effect on this latter type of vulnerability, are the following:

- *Risk assessment*—aimed at quantifying the extent to which potential impacts of climate change pose a risk to the cost-effectiveness and other aspects of the viability of a project;
- *Vulnerability assessment*—aimed at evaluating the vulnerability to climate change of the community or ecosystem at which a project is targeted;
- *Environmental impact assessment*—aimed at analysing the extent to which a project would affect—either positively or negatively—a system's vulnerability to climate change.

It is beyond the scope of this report to elaborate on these three types of assessment. However, additional information on project risk assessment can be found in Institution of Civil Engineers and Institute of Actuaries (1998), a framework and methods for climate change vulnerability assessment are discussed by Carter *et al.* (1994) and Feenstra *et al.* (1998), whilst Petts (1999) and Modak and Biswas (1999) provide good introductions to environmental impact assessment. BMZ (1995) provides guidance on environmental impact assessment in development co-operation projects but this guidance does not include vulnerability to climate change. Bormann (1999) points at the need to establish better systems and procedures to evaluate the effectiveness and impact of German development co-operation.

7.2. Procedural Opportunities

In addition to these three types of assessment, which help to understand how climate change could influence the long-term sustainability of ODA projects, there are a number of procedural opportunities to make climate concerns an explicit consideration for ODA projects. The development, planning and implementation of ODA projects follow a number of procedural steps, in which it is indicated how the project is expected to perform on a number of key indicators. Some criteria are generic for all ODA projects, whilst other indicators are defined in the planning process of the project. This planning process is conducted using an objective-orientated project planning approach (*Ziel Orientierte Projekt Planung—ZOPP*), which is similar to the Logical Framework approach used by the United Nations Development Programme and other international organisations (Helming and Göbel, 1997).

The ZOPP approach is based on the explicit formulation of project goals and sub-goals, each of which is monitored and evaluated using performance indicators. All projects analysed in this study have been planned, prepared and implemented with the aid of the ZOPP approach, which has allowed for a systematic evaluation of project goals and achievements. However, vulnerability and adaptation to climate change are typically not considered in the formulation of project goals and sub-goals and even the explicit consideration of climate variability has been found to be rare.

Thus, there is an opportunity to integrate the issues of climate safety and long-term sustainability of project achievements in the ZOPP planning phase. However, seizing this opportunity may not be a trivial task. As Helming and Göbel (1997) put it, indicators should not be used simply because they are imposed by regulations. They are likely to be ineffective when project partners are not interested in whatever is measured by the indicators. It is important therefore that there is a broad understanding of the relevance of incorporating considerations of climate change into the project planning, as well as of the opportunities to do so.

The need to consider climate safety and sustainability over a longer time horizon is particularly relevant for projects that have achievements expected to last over a period of decades. This is typically the case with infrastructure (both institutional and physical) that has a long turnover time and with land-use systems that involve species with low migration rates or little migration potential. Examples include—but are not limited to—the establishment of new environmental regulations and institutions, the development of water supply and coastal infrastructure and the management of forests. For these projects anticipatory adaptation to climate change is important and could take any of the five forms defined in Chapter 3. In view of the current uncertainty surrounding the impacts of climate change the emphasis would be on those options that have immediate benefits as well as future ones (*i.e.*, no-regret options). This pertains in particular to increasing the flexibility of systems and, above all, reducing maladaptation.

Which indicators are most appropriate to evaluate a project's effect on climate adaptation and adaptive capacity depends on the type of project and its objectives. The information produced by applying one or more of the aforementioned three types of assessment will help to formulate indicators. Whether or not projects have been successful in creating no-regret adaptation and/or secondary benefits will, in general, be impossible to assess until long after a project has been completed. For example, a desertification project that has aimed to prevent soil erosion and improve the soil moisture situation cannot be proven to be also successful in the face of climate change until the impacts of climate change are statistically discernible in that particular region. One then needs to assume that if climate change scenarios suggest that droughts could become more frequent and intense, an improved soil moisture situation helps to reduce vulnerability to climate change.

The success of projects aimed at awareness raising and capacity building can be measured by evaluating the extent to which climate change has become an inherent consideration of decision-makers in the measures, policies and investments they plan. This is not to say that each measure, policy or investment would be different from those in which climate change is not considered but consideration of climate change reduces the risk of maladaptation, as well as financial project risks over the medium to long term.

An alternative to developing project-dependent indicators such as those discussed above is the introduction of an additional general criterion to be considered in all ODA projects. Currently projects need to give explicit attention to the criteria *target groups*, *poverty*, *gender* and *environment*. In view of the fact that environment is already one of the four criteria there appears to be no reason to add climate change as a fifth one. One can argue that the current guidance on environmental impact assessment (BMZ, 1995), which does not refer to climate, needs to be expanded so as to guide the analysis of the extent to which a project would affect a system's vulnerability to climate change. On the other hand, climate change is more than merely an environment issue. As stated in the beginning of this chapter, to consider climate change in development projects would add a long-term sustainability component to development assistance. Long-term sustainability is not yet captured by the above four general criteria for ODA projects, although this should clearly be of interest to BMZ, GTZ and KfW. The introduction of a fifth criterion on long-term project sustainability should concern all aspects of sustainability, including financial, environmental and equity-related issues.

8. Conclusions and Recommendations

This report has been intended as a first step in a process to improve the understanding within BMZ, GTZ and KfW of the importance of adaptation to climate change to official development assistance, as well as to increase recognition of the opportunities to incorporate concerns of climate vulnerability and adaptation in ODA projects. To date climate change has played a negligible role in ODA projects aimed at the sustainable development and use of natural resources, although impacts of climate change could be substantial in many sectors and opportunities exist to reduce vulnerability to climate change as a secondary benefit of other activities. In addition, there are opportunities to reduce vulnerability to extreme weather events that are the result of natural climate variability, which would be a sensible first step to reducing vulnerability to climate change.

In part the lack of attention given to climate change in ODA is due to the limited understanding of the process of adaptation, whilst uncertainties concerning the location and magnitude of the impacts of climate change remain considerable. However, anticipatory action can be taken despite this uncertainty, aimed at increasing robustness and flexibility, enhancing adaptive capacity, reducing maladaptation and increasing awareness and preparedness. In addition, there are clear opportunities to create synergies with projects directed at other environmental issues, most notably combating desertification and conserving biodiversity. Synergies can exist in the development of an enabling environment for addressing these issues, the strengthening of monitoring and early-warning systems, the establishment of sustainable and participatory resource-use programmes and the implementation of policies and measures aimed at reversing environmental degradation. Thus, projects that have been initiated with a different goal than reducing vulnerability to climate change may have benefits similar to those of adaptation projects. Such benefits can be considered secondary benefits, since they were not the primary purpose of the original project.

Another reason for the lack of attention given to climate change in ODA could be the current international funding arrangements for climate adaptation. The Global Environment Facility prescribes that only the incremental costs of adaptation to climate change are eligible for funding. This presupposes that systems that are subject to adaptation to climate change are already climate-safe or that countries use alternative funds to make them climate-safe. The recent series of natural disasters has shown that one cannot assume systems are already climate-safe. Hundreds of thousands of people died in weather-related disasters in Honduras, Venezuela, India and Mozambique, illustrating the urgent need to adapt to today's climate variability, if not climate change. It is here that opportunities exist for bilateral funding agencies such as BMZ. Many of these opportunities would be no-regret opportunities, since they involve measures that are justified in their own right, on account of natural climate variability. However, they also serve to reduce vulnerability to climate change.

In spite of the attractiveness of no-regret measures and measures with secondary benefits, there is a need to go beyond such measures in countries that are particularly vulnerable to climate change. Least-regret measures can involve measures that involve some cost but which increase the effectiveness of adaptation. Examples of least-regret measures include data and information collection, training and other forms of capacity building, scientific research and institutional development. Another type of least-regret measures involves the additional investment in infrastructure with long turnover times to take anticipated climate change into account. When the investment is relatively small compared to the cost of retrofitting the infrastructure at a later stage (*e.g.*, for a bridge or a sewage system) this would be a prudent and justifiable strategy.

Investments aimed at enhancing adaptive capacity and creating synergies amongst and between short-term and long-term development objectives could be considered in the context of National Strategies for Sustainable Development (NSSDs). NSSDs are an international development target for which all member states of the Organisation for Economic Co-operation and Development (OECD) have pledged support.

BMZ, GTZ and KfW each have their own roles and responsibilities as far as increasing the focus of adaptation to climate change in German ODA is concerned. To start with the latter, KfW could begin to assess the effect of planned investments on the vulnerability of communities and ecosystems to climate variability and change so as to prevent maladaptation. In infrastructural projects KfW needs to be aware of the increasing unreliability of weather and climate statistics and of the need to take a precautionary approach to the increasing probability of extreme events.

GTZ has an important role to play in the enhancement of adaptive capacity (both at local and national levels) and in creating an enabling environment for adaptation to climate change. GTZ would also be particularly well equipped to seek the creation of synergies between the UNFCCC, the UNCCD and the CBD. Both GTZ and KfW could promote technology transfer for adaptation to climate change, particularly in support of no-regret measures.

BMZ has the responsibility to facilitate the tasks of GTZ and KfW by providing clear guidance on how to consider adaptation to climate change in German ODA projects. A decision needs to be made on whether adaptation to climate change will be addressed by the development of indicators at the project level, whether the existing guidelines for environmental impact assessment will be expanded or whether long-term sustainability should become an additional criterion to be considered for each ODA project. Guidance will also be required on how to assess the risk that climate change could pose on the cost-effectiveness and other aspects of the viability of a project, as well as the extent to which a project would affect the vulnerability of communities and ecosystems to climate change.

In addition, BMZ has an important role to play in the international co-ordination of its activities, particularly in relation to the GEF and other multilateral and bilateral funding organisations. Adaptation to climate change is likely to become considerably more important under the UNFCCC in the near future. The responsibilities and complementarities of the various funding organisations need to be reaffirmed and consistent guidance must be developed.

Finally, BMZ needs to improve the understanding of the importance of climate change and the need and opportunities to adapt amongst its staff and that of GTZ and KfW. This report can be a useful first step but more will need to be done to ensure a lasting awareness. In-house capacity building is required, targeted at each part and level of the organisation and highlighting all the various aspects of adaptation to climate change. An important next step could be the organisation of a one-day conference where this report is presented and discussed with BMZ, GTZ and KfW staff as well as external experts.

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