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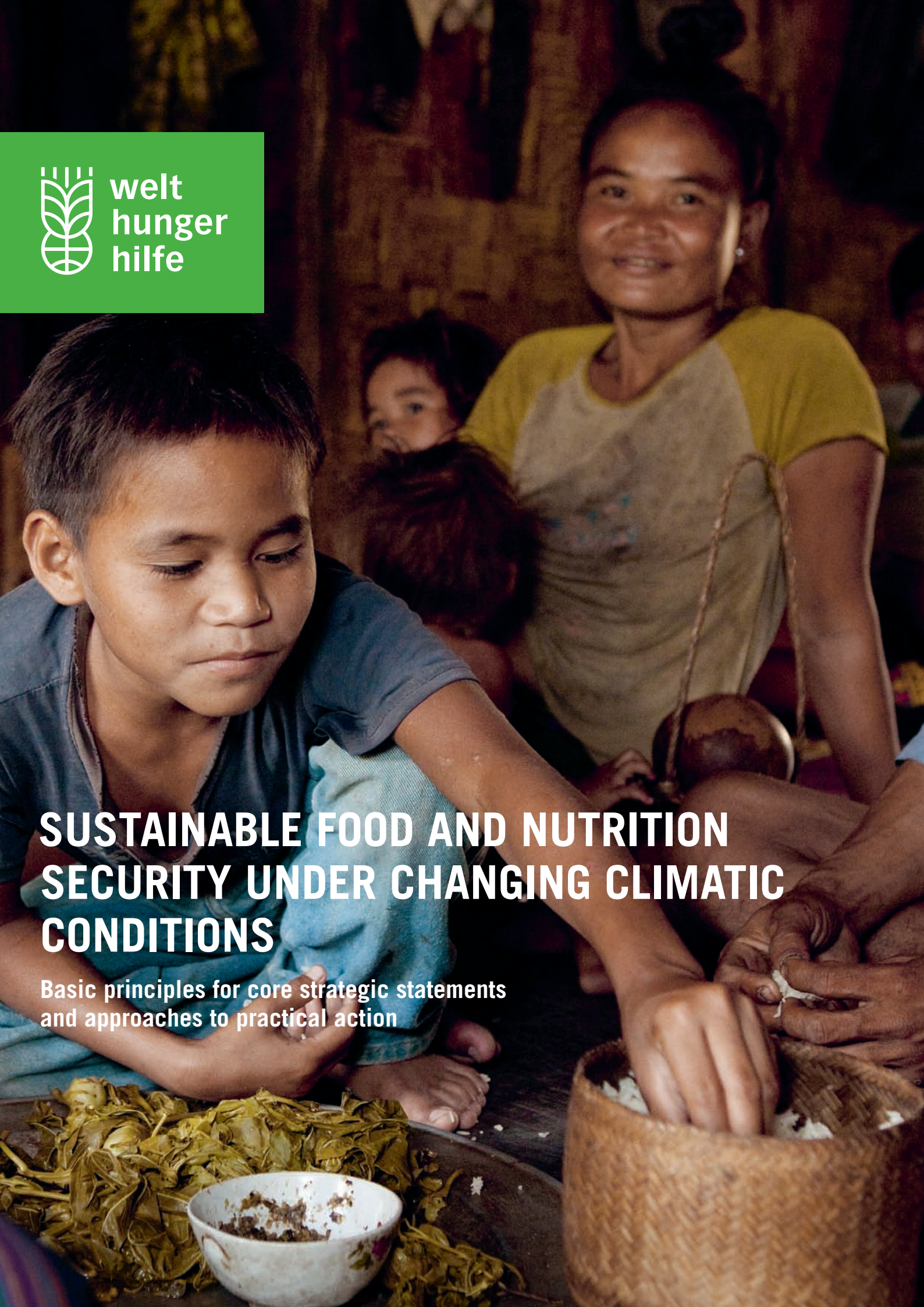

SUSTAINABLE FOOD AND NUTRITION SECURITY UNDER CHANGING CLIMATIC CONDITIONS

Basic principles for core strategic statements and approaches to practical action

IMPRINT

Published by:
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Production:
Sandra Keller
Andrea Rösler

Status:
Bonn, Mai 2011

Printed on 100% recycled paper

PREFACE

Climate change, global megatrends and their resulting negative effects pose enormous challenges for mankind in the 21st century, challenges which have to be faced. Already now, almost one billion people are suffering from hunger, while another three billion are under- or malnourished. It is estimated that the world's population will increase to approximately nine billion by 2050. The challenges of food security at a time when natural resources are shrinking due to a rapidly growing and commodity-hungry world population will have differing regional impacts and endanger already marginalised population groups. Existing structural problems and injustices between North and South are intensifying and pose an enormous existential threat to the livelihood of the poorest population groups.

Welthungerhilfe is facing up to these challenges. The present concept paper prepares the groundwork for a systematic approach towards sustainable food and nutrition security and illustrates adaptation models for Welthungerhilfe programmes and projects. As part of its sector strategy for sustainable food and nutrition security, Welthungerhilfe will be incorporating the challenges resulting from climate change as well as proposed solutions as an integral part of its project work.

The main objective must be to achieve and maintain food sovereignty for all people. This requires future-oriented, climate-friendly and sustainable systems that provides all people with sufficient access to locally available food and enables them to make independent decisions on its use. This paper provides concrete approaches for this. One key element will be the focus on strengthening civil society groups in poorer countries to enable them to develop for themselves adaptive measures to climate change and extreme weather conditions.

The four dimensions of food security have to be taken into consideration in this context – sufficient availability of and secured access to food, proper use and utilisation of food, as well as the long-term stability of supplies. This paper analyses the effects and manifestations of climate change with regards to all food and nutrition security aspects. Existing uncertainties on its effects are mentioned as well as potential strategic approaches for coping with the related challenges. Many of these approaches were developed jointly with Welthungerhilfe staff and partners in the various regions of Asia and Africa.

The study was financed with funds from the Federal Ministry for Economic Cooperation and Development (BMZ) as part of the „Building Capacities for Adjusting to Climate Change“ programme.

Bonn, November 2011
Mathias Mogge, Executive Director Programs

TABLE OF CONTENTS

SUMMARY

A. Core strategic statements

1. On the one hand, non-sustainable industrialised forms of agriculture, processing and marketing based on fossil fuels and long-distance transportation cause the release of large amounts of greenhouse gases and thus contribute significantly to climate change.
2. On the other hand, agriculture is particularly vulnerable to climate change due to its high level of dependency on weather and climate (increasing difficulty of production and production risks) – so the people who depend directly or indirectly on agriculture are also vulnerable.
3. Different regions of the world are already being or will be affected in very different ways both by food insecurity itself and by the manifestations of climate change. Inhabitants of coastal regions, for example, will have problems in particular with rising sea levels, hurricanes and floods, while inland regions will be affected above all by changing precipitation patterns (e.g. increased precipitation in eastern Africa, more frequent periods of drought in southern Africa). Other regions will suffer from serious water shortages due to glacial melting (Central Asia). In addition, framework conditions vary and possibilities of mitigation of and adaptation to climate change impacts are very unevenly distributed.
4. The impacts of climate change and the increasing frequency and intensity of extreme weather events accentuate the challenges of food and nutrition security in all its dimensions (availability, access, use and utilisation, stability) In addition, the health situation of already marginalised population groups will further deteriorate. The populations affected – particularly in Sub-Sahara Africa, in Central Asia, the coastal and delta regions of South, East and South-East Asia, the coastal regions of Africa and the islands in the Pacific and Caribbean – are those who have contributed least to the causes of climate change.
5. Climate change restricts the availability of food. Factors such as the loss of biodiversity, soil degradation, water shortages, flooding, storms, heavy rainfall, droughts, plant pests and diseases all lead to declining harvests; crop storage is also affected. Animal husbandry, fishing and forest productivity and use are also affected by climate change.
6. Access to food requires the right of access to productive resources, labour, knowledge, capital or income. The loss of resources which are essential to livelihoods, weakened capacity for labour or lack of labour, loss of income and damage to infrastructure as a result of extreme weather events makes access to food (more) difficult.
7. A number of factors affect the use and utilisation of food, such as a reduced variety of diets, reduced quality and quantity of food and water, impaired hygiene, the increase of diseases spread through water, food and vectors as well as reduced caring capacities of families.

8. Last but not least, the stability of food security, that is its reliability at any time, is also impaired by various factors. These include fluctuations in food availability caused by climate change, rising energy and food prices, increasing dependence on imports and food aid and growing risks of conflict and political instability.

9. Measures towards sustainable food and nutrition security, mitigating and adapting to climate change are cross-cutting activities which are to be integrated in all suitable programmes and activities of Welthungerhilfe and its partner organisations. In doing this, co-operation, coordination and coherence will be kept particularly in focus. The integration of nutrition aspects will be given particular importance.

B. Approaches to practical action

10. There will be no blueprints for achieving sustainable food and nutrition security under changing climatic conditions. Instead, it must be ensured that measures are designed to be appropriate to each specific context. This does not necessarily entail developing new approaches; instead, Welthungerhilfe and its partner organisations will take existing, well-proven methods, instruments and activities as their starting point, and adapt them to the particular situation.

11. Local partner organisations and communities will be involved as key actors in every planning phase for programmes and projects. Welthungerhilfe will support them in enhancing their knowledge, abilities and skills for achieving sustainable food and nutrition security, promoting in particular their ability for organisational management, the development of social capacities, setting up networks and political articulation.

12. Welthungerhilfe's programmes and projects are based on a comprehensive view of people's potential, their traditional knowledge, local experiences and practices as well as the strengths of existing systems. They also integrate modern scientific findings. Particular significance is attached to enabling and empowering the affected population to act autonomously when defining, developing and implementing mitigation and adaptation strategies.

13. Promoting gender equality, strengthening the role of women in society and paying special attention to practically supporting them are key elements for sustainable food and nutrition security in view of their diverse tasks, their greater exposure to risks and their vulnerability. Climate change will further aggravate their situation and increase the already high workload, the limited access to resources (food, water, and firewood) and their ability to provide for their families, thus increasing the risk of child malnutrition.

14. Current and future threats at specific local level and new opportunities must be identified, understood and evaluated in a participative analytical process with partner organisations and target groups. This risk assessment is the basis for the development of options for action and an adequate preparation for potential disasters.

15. In a common effort the structural, usually political, causes of vulnerability must be identified and the natural, human, social, material and financial resource base for overcoming vulnerability has to be strengthened.

16. The resilience of socio-ecosystems in the face of shocks and alterations can be enhanced by developing and improving the ability of individuals/households/communities to deal proactively with food insecurity resulting from climate change; in other words, to take the right decisions, apply effective measures, use the few chances they have and avoid maladaptations (i.e. improving the adaptive capacity).

17. Although the negative effects of climate change by far outweigh the positive one, there are some limited, not yet fully utilised potential in particular regions and for certain population groups, for example improved climate conditions for crop cultivation or the use of plant types / species which were previously unsuitable. Carbon fertilisation is another aspect.

18. A site specific and locally adapted agriculture, which is climate-sensitive, sustainable, farmer-oriented and multifunctional, alongside the sustainable use of natural resources is the best reply to the climate change induced deterioration of the food and nutrition security situation.

19. Changing course towards sustainability as outlined above would give agriculture and the entire food system considerable potential to reduce greenhouse gas emissions, improve carbon sequestration, adapt to climate change while reducing greenhouse gases and last but not least to reduce poverty and hunger. Welthungerhilfe is directing a great deal of its advocacy and networking efforts towards setting up the appropriate institutional and political framework conditions for achieving sustainable food and nutrition security and food sovereignty.

INTRODUCTION

Welthungerhilfe's primary aim, alongside the fight against poverty, is to reduce food and nutrition insecurity. In order to enable people suffering from hunger and poverty to secure access to food in the medium term, Welthungerhilfe promotes their ability to help themselves and supports the conservation of natural resources. To achieve this, Welthungerhilfe concentrates its activities on rural areas in particular, working with the affected population groups and with local partner organisations wherever possible. An integrated multi-sectoral approach is pursued, to ensure that the measures are sustainable[1].

The populations of Welthungerhilfe's partner countries are currently facing huge additional challenges to food and nutrition security. Climate change will exacerbate existing problems for the most marginalised population groups in particular. This means that Welthungerhilfe must design its activities in the medium and long term in such a way that they provide appropriate multi-dimensional answers to these new challenges and contribute to ensuring the human right to food and nutrition security for current and future generations. We must also aim to promote democratised food systems which are viable in the long term and support people in developing food sovereignty. For this reason it is necessary to develop a systematic approach to sustainable food and nutrition security under changing climatic conditions and to adapt Welthungerhilfe's programmes and projects to these challenges.

Section 1 begins by presenting the issues of food insecurity and climate change[2]: what are the existing reciprocal relationships between climate change, agriculture and food and nutrition insecurity; what are the causes of global hunger; what are the causes of drastic climate change and what impacts do changing climatic conditions have in the context of combating hunger and poverty? Section 2 then presents the selection of objectives, methods and framework conditions underlying this study: Basic Principles on "Sustainable Food and Nutrition Security under Changing Climatic Conditions".

In Part A (Sections 3, 4 and 5), the dimensions of sustainable food and nutrition security – sufficient availability and secure access to food, the use and utilisation of food in accordance with requirements and reliability – are explored and the concepts and approaches of the right to food, food and nutrition sovereignty, sustainability and strategies towards sustainable livelihoods and lifestyles explained (Section 3). Against this background, subsequent sections deal with the threats to sustainable food security in the context of climate change in view of the four dimensions of food and nutrition security (Section 4). Strategic approaches which are suitable to supporting sustainable food and nutrition security are identified and further developed, to serve as the basis for the necessary adaptation to the development co-operation programmes and projects implemented by Welthungerhilfe and its partner organisations (Section 5).

[1] cf./www.welthungerhilfe.de/yesterday-today.html; Welthungerhilfe 2004.
[2] The term "climate change" is used to cover both natural and anthropogenic climate change.

Part B builds on this (Section 6), presenting approaches to practical action towards climate sensitive (that is, climate-friendly and climate-resilient) and sustainable food and nutrition security. Welthungerhilfe focuses on the following fields of activity: risk assessment, strengthening the relevant resources in each case, reducing structural causes of vulnerability and strengthening adaptation capacities to promote resilience. In particular, measures to support small-scale farming households, an important target group for Welthungerhilfe, are outlined.

Chapter

1

FOOD INSECURITY, AGRICULTURE AND CLIMATE CHANGE

IThe following sketch of the problem outlines the causes of hunger and malnutrition as well as the causes, impacts and challenges of climate change. The mutual influences of climate change and agriculture are discussed..

1.1 Hunger and malnutrition

The bigger part of the global population who are victims of food and nutrition insecurity (75-80 %) live in rural areas in the southern hemisphere and are directly or indirectly dependent on agriculture for their livelihoods[3]. 85 % of the small-scale farmers, both male and female, cultivate less than two hectares of land. The 0.5 % of "agricultural businesses" on the other hand can cultivate over 100 hectares each; they also have a disproportionate share of agricultural income, generous subsidies and privileged access to political decision-making processes (cf. IFPRI 2011).

50 % of hungry people are small-scale farmers, in particular female farmers; 20 % are landless, 10 % practice animal husbandry, fishing or are forest dwellers. The remaining 20 % are poor urban dwellers; this number is growing considerably.

The FAO estimated in 2004 that about 450 million of the poorest people are entirely dependent on ecosystem services. Almost two thirds of the rural poor live in ecologically and agriculturally disadvantaged regions (which may be termed unfavourable sites); the remaining third who live in more favourable areas lack access to productive "resources" (Forum Umwelt & Entwicklung 2005) such as seeds, fertile land and water.

"The ultimate causes of food insecurity and malnutrition are social, economic, cultural and political." (www.ifpri.org)

Causes of the crisis 2007/2008:

- Inadequate investment in rural development and misguided trade and agricultural policies
- High input and transport costs due to rising energy prices
- Increasing subsidies for and production of biofuels
- Failed harvests and low stocks, encouraging speculation
- Population growth and changing consumption patterns.

Poverty and hunger are mutually dependent. The various forms of poverty are both the main cause and the result of hunger. Most of the structural causes are well known: marginalised and malnourished people have fewer access rights and opportunities for participation; poor governance; rural development is neglected and small-scale agriculture is looked down on as backward. It is ignored by some governments and often by development co-operation

[3] http://www.wfp.org/hunger/who-are (15.3.2010).

Chapter

1

organisations as well. Unfair global trade systems and asymmetrical power distribution also lie behind hunger and poverty. Wars, conflicts, environmental disasters and the progressive degradation of ecosystems also contribute to the situation[4]. This complex web of causes must be analysed in detail in each context if we are to be able to plan and implement appropriate programmes and projects. Focusing exclusively on increasing agricultural productionis too short-sighted in the context of sustainable food and nutrition security.

The FAO defines hunger as a calorie intake of less than approx. 1,800 kilocalories per day, the minimum requirement for most people for a healthy and productive life. Malnutrition refers to a lack of energy, proteins, vitamins and minerals.

From the physiological point of view it is not only the quantity of food but also its quality and the combination into a varied, balanced diet which are crucial. The human organism requires carbohydrates, protein, fats and micronutrients for growth, development, health and well-being. The widespread lack of adequate supplies of micronutrients is often called "hidden hunger". Over one billion people globally suffer from iron deficiency – one of the main causes of anaemia, which is held to be responsible for 20 per cent of maternal mortality, restricts children's physical and mental development and weakens adults in their work capacity. Over 20 million pregnant women living in countries in the southern hemisphere suffer from vitamin A deficiency, which causes blindness, weakens the immune system and is a contributing factor in infections and rising mortality rates: globally, one million children die from it each year. One in three children under five in the countries in the southern hemisphere suffer from growth retardation (stunting) due to chronic malnutrition; i.e. they are more often ill, their cognitive capacity is reduced, their school performance suffers accordingly and as a long-term consequence, they have fewer opportunities in their occupational outlook and their incomes are lower. Adequate feeding of children in their first 1,000 days, i.e. during pregnancy and in the first 24 months after birth, is of crucial importance for their further physical and mental development (cf. IFPRI 2011, Welthungerhilfe/IFPRI/CONCERN 2010).

Malnutrition is caused by inadequate food intake and disease. Lack of access to high-quality, safe and varied food, clean drinking water, health care and sanitation along with lack of hygiene and inadequate caring capacity and practices (child care and provision, knowledge of nutrition, food patterns, and food preparation) are all factors which influence a person's state of health. Illnesses can also increase the food requirement and reduce the body's ability to digest the food and make use of its nutrients. Nutrition depends heavily on knowledge of healthy food, of habits and rituals as well as of food taboos.

1.2 Climate change – causes, impacts, challenges

Changes in the climate are nothing unusual as such. However, the effects of industrialisation in the last 250 years and particularly in recent decades have led to clear global climate change. This is primarily anthropogenic, that is, initiated by human activity, in particular by the intensive use of fossil fuels such as coal, oil and natural gas as energy sources, for transport and in industry (carbon dioxide / CO_2). Other emissions also occur, such as

[4] On supply, regulatory, supportive and cultural functions and on the degradation of ecosystems and ecosystem services, see: Millennium Ecosystem Assessment. www.maweb.org/en/Index.aspx.

methane (CH_4) and nitrous gas (N_2O) in the course of the decomposing process on waste deposits and hydro/chlorofluorocarbons (H/CFCs) and sulphur hexafluoride (SF6) from industry, air conditioners, coolants and high-voltage power lines (cf. IAASTD 2008, IPCC 2007, Kromp-Kolb/Formeyer 2005, Latif 2007)[5]. These climate alterations are coinciding with a rapidly increased world population (dense settlement of areas, increasing demand for food) which has also become heavily dependent on infrastructures and networks.

It is necessary to distinguish between short-term variations in the weather and long-term, gradual climate change.

Non-sustainable forestry and agriculture make a significant contribution to climate change; according to the United Nations Conference on Trade and Development (UNCTAD 2011) they cause up to 32% of global GHG emissions. In a business-as-usual scenario, this proportion could increase to 40% by 2030.

- Carbon dioxide in agriculture is mainly emitted in the course of land use changes, above all through forest clearance to gain grazing and arable land. Other sources include intensive agricultural production methods and the high levels of fossil fuels used by agricultural machinery/equipment, including irrigation pumps, drying systems, in processing, packing and transport procedures and in the manufacture of synthetic chemical fertilizers and pesticides.
- Nitrous gas emissions are mainly due to the use of nitrogenous fertilizers and liquid manure, as well as to compacted earth and the decomposing of agricultural waste.
- Methane is primarily released in industrial livestock farming and in wet rice cultivation (cf. Niggli/Fließbach 2009).

Scenario calculations suggest – depending on population figures, lifestyles, economic and technological developments – rises in global temperatures of 1.1 to 6.4°C by the beginning of the next century (SRES-Szenarien 2000). Even if concentrations of all greenhouse gases and aerosols can be held to the levels of 2000, further warming of around 0.1°C annually is anticipated according to IPCC (2007).
If climate-relevant emissions are not reduced, the average surface temperature will probably rise between 2-3°C within the next 50 years.

Rising temperatures are accompanied by warming and thermal expansion of the oceans and widespread mountain glacier retreat, the melting of Arctic and Antarctic icecaps and ice sheets and snow coverage – all contributing to rising sea levels. The Intergovernmental Panel on Climate Change (IPCC) states that slope instability and soil instability in mountainous regions and other permafrost areas are probable, as are changes to snow and glacier-fed rivers, including their water quality. Precipitation patterns have altered already in the last hundred years: precipitation in eastern parts of North and South America, in northern Europe and in northern and Central Asia has increased significantly, while it has

[5] The global atmospheric concentration of the main greenhouse gases (GHG) shows a marked increase in comparison to pre-industrial (1750) values: CO_2: 280/379 ppm, CH_4: 715/1774 ppb; N_2O: 270/319 ppb (IPCC 2007, comparison of values 1750/2005). The global average temperature has risen by 0.76°C in the past 150 years. Eleven of the last 12 years (1995-2006) are among the 12 warmest years since instrumental measurement of global earth surface temperatures began in 1850.

decreased in the Sahel, the Mediterranean region, southern Africa and parts of South Asia. The frequency and intensity of extreme weather events such as hurricanes are considered likely to increase; we will also probably see an increase in periods of drought and heatwaves including forest fires, as well as extremely heavy rainfall and flooding.

Unique ecosystems, often the centres of biodiversity, are threatened – and with them the genetic potential for future food and nutrition security. An increase of the average global temperature of more than 1.5-2.5°C would probably result in considerable alterations to the structure and functions of ecosystems with negative results, e.g. in relation to their regulatory function and provision of water and food. It is considered probable that the resilience of many ecosystems will be overcome by the combination of negative effects. Biodiversity has many positive effects on the proper functioning and stability of ecosystems, so the loss of biodiversity can cause a collapse of the ecological structure. There is a growing risk of abrupt, drastic and irreversible processes in the climate system which may have devastating results. (On the tipping points, some of which are self-enhancing, see Schellnhuber 2005, Scheffer 2010; cf. IPCC 2007, WBGU 2007, MEA 2005).

It should be emphasised that not all alterations can be attributed to anthropogenic climate change. However, climate change, alongside the loss of biodiversity, is one of the greatest challenges humanity is currently facing, due to unsustainable lifestyles, especially those of the wealthy minority.
The impacts of changing climatic conditions can already be felt today. They threaten the existence of the poorest population groups, even though these are the people who have contributed least to the causes of climate change (cf. Herren 2010, Sachs 2010, Care 2010). This injustice demands particular responsibility[6] from those countries, above all the OECD, who have caused climate change with their unsustainable production and consumption patterns, especially since industrialisation began.

1.3 Climate change and agriculture – challenges in the fight against poverty and hunger

Functioning ecosystem services are not only the basis for agricultural production; they are the basis of our livelihoods. Agriculture is both one of the main causes of climate change and is particularly affected by it. Alterations to vegetation periods, precipitation and wind patterns, rising temperatures in arid zones, soil erosion, reductions or alterations in water availability, increasing spread of and vulnerability to pests and plant diseases, invasive species and the loss of agro-biodiversity all make conditions more difficult for agricultural production. The growing frequency and intensity of extreme weather events is also contributing to increasing agricultural and forestry production risks.

[6] The first step is to reduce their (our) greenhouse gas emissions, then to strengthen our ability to act and to support poorer countries. Important partners in climate protection are of course economically rapidly developing countries such as China, India and Brazil, which must also accept responsibility for the effects of their lifestyles.

Groups particularly vulnerable to climate change include small-scale, subsistence farmers, households led by women, landless agricultural workers, pastoralists, fishermen, forest dwellers and indigenous peoples as well as the urban poor, victims of crises and conflicts and coastal dwellers. This also applies to social risk groups and dependent family members such as children and old and ill people (FAO 2007).

Marginalised population groups are often exposed to weather fluctuations and climate changes without any protection, so their food and nutrition security is particularly at risk due to changing climatic conditions, especially when they are already undernourished. In addition, poor people have inadequate capacities and limited opportunities to adapt to food insecurity caused by climate change, to secure sustainable livelihoods autonomously and to develop food and nutrition sovereignty.

Challenges for combating poverty and hunger in the context of climate change (cf. IPCC 2007, FAO 2007, OECD 2009):

- loss of biodiversity and degradation of ecosystem services, leading to the destruction of the natural basis of life and production
- inadequate availability and reduced quality of water for drinking supplies and for use in agriculture and as a source of energy
- negative effects on agriculture resulting in food supply problems (harvest and animal losses)
- changes to (the productivity of) marine and freshwater ecosystems and forests
- health impacts due to undernutrition or malnutrition and diseases, reduced working strength, post-traumatic disorder, injuries and rising mortality rates
- damage to or destruction of the infrastructure or of entire settlements and problems with energy supplies
- increases to women's burden of work, which is already considerable
- limitation of human development potential and opportunities for people to plan their lives
- political instability and violent (distribution) conflicts, for example about habitable and cultivable land and clean water
- erosion of human security and uprooting of countless people; increase of migration as a strategy for life and survival.

The situation is exacerbated by the growing global population; the increasing and often competing demands for food and other agricultural and forestry products (animal feed, fuels, agrofuels and textiles), which can lead to conflicts centred on land use; rising prices for raw materials and for food and changing eating habits: more meat consumption, increasing use of processed foods, more sugar and vegetable oils (cf. Koerber et al. 2009).

Chapter

1

As will be discussed in more detail in Part A, climate change in its various manifestations in different parts of the world poses an additional threat to food and nutrition security in all its dimensions and exacerbates the food situation.

Although the negative effects of climate change by far outweigh the positives, there are some limited, not yet fully utilised potential factors in particular regions and for certain population groups, for example improved climate conditions and carbon fertilisation which increase production or the cultivation of certain plant types in agro-ecological zones which were previously unsuitable. However, making use of this potential is problematic, due to the non-linear alterations to climatic conditions which make predictions extremely difficult.

Chapter

2

OBJECTIVES, METHODS AND FRAMEWORK CONDITIONS

In Section 2, we present the objectives, the methodological procedures and framework conditions of this Study on the Basic Principles for Welthungerhilfe's core strategic statements on sustainable food and nutrition security under changing climatic conditions.

2.1 Setting the objective

The objective of this Study is to take a look at existing knowledge and experiences and to derive approaches towards climate-sensitive sustainable food and nutrition security under changing climatic conditions which will be viable for the future. These approaches are intended to give the impetus for the design of Welthungerhilfe's future programmes and projects in the face of climate change. Part A of this statement is aimed towards Welthungerhilfe's sectoral strategies for food and nutrition security. Part B includes concrete approaches to action for sustainable food and nutrition security in Welthungerhilfe's programmes and projects.

2.2 Methods and procedures

The methods on which this Study is based integrate elements from qualitative contents and documents' analysis, stake-holder workshops and discussions with experts.

The contents' and documents' analysis makes use of the following information sources:

- key Welthungerhilfe documents (reports, strategy papers and concept papers)
- scientific publications in professional magazines and journals
- strategic documents on principles, guidelines, recommendations, policies and strategies from national and international organisations and think tanks
- publications of national and international development institutions, focusing particularly on civil society organisations and institutions

The following selection criteria were applied: strategic statements, long-term statement horizon, supra-regional relevance, evidence-base.

A large number of the documents used – particularly in relation to the impacts of climate change – are based on IPCC statements.

The structure of the document and the preliminary findings were discussed at a workshop with Welthungerhilfe staff at Bonn headquarters. Two international workshops in India (New Delhi) and Ethiopia (Addis Ababa) were attended by seconded and national Welthungerhilfe staff, representatives of partner organisations, representatives of networks and scientists. The aim of these workshops was to exchange and collect information and experiences and to validate the core strategic statements and approaches to practical action.

Chapter

2

Selected aspects were covered in more depth and detail in consultations with scientists and development experts in the context of expert discussions and their written comments on the draft of the Study. It was not possible to carry out interviews with Welthungerhilfe's target groups such as small-scale farmers in this context.

Based on a review of the literature, the workshops and expert discussions, strategic approaches to action and operative recommendations were developed, taking the four pillars of food and nutrition security into account. These approaches and recommendations are intended to embody the norm for future programme and project planning.

2.3 Framework conditions and limitations

This document is a reference framework and is intended to provide a basis for the direction of Welthungerhilfe strategies, programmes and projects, without being a blueprint; the subject is not only highly complex but also characterised by huge regional differences and specific factors. Future climate developments are by no means certain, our understanding of the complex socio-ecosystem is incomplete, our data are in some cases faulty or contradictory, our models of weather developments uncertain; for all these reasons it is not possible to make precise predictions of climatic development and its impacts on food and nutrition security. Regions of hunger and malnutrition are very unevenly distributed; local manifestations and concrete impacts of climate change are, or will be, quite different in different regions of the world. Opportunities to reduce greenhouse gas emissions and adaptation capacities to changing climatic conditions are also unevenly distributed. Despite an increasing number of detailed studies, statements too closely related to one locality or too regionally specific would go beyond the scope of this paper. Therefore this Study on basic principles for core strategic statements makes general statements on climate developments and their impacts on food security in all its dimensions. These general statements are of course intended to be specified and adapted when applied in a particular context.

Both the analysis of the challenges in Part A and the options for action focus on the community and household level – in particular small-scale farming households which are an important target group for Welthungerhilfe – without losing sight of the economic and political framework conditions at national and global level. The paper also concentrates on sustainable food and nutrition security in the context of longer-term development co-operation, although the statements could also be taken to provide suggestions on how to direct emergency relief and transitional aid and hints for lobby and advocacy work.

Chapter

3

A. CORE STRATEGIC STATEMENTS

3. Sustainable food and nutrition security

In the following section, we present the dimensions of food security, the right to food, the political concept of food sovereignty, the principles of sustainability and strategies towards sustainable livelihoods.

3.1 The four dimensions of food and nutrition security

Food security has been one of the greatest global political challenges since the United Nations Conference on Food and Agriculture in Hot Springs in 1943. Welthungerhilfe has adopted the internationally recognised FAO definition of food security: food security "is achieved at national, regional and household level when all people, at all times, have physical, social[7] and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (cf. FAO 2002).

Malnutrition is one of the most threatening humanitarian, socio-economic and health issues in the world and so far one of the least regarded. During the food price crisis of 2007/2008 increasing attention was paid in international discussions to the topic of nutrition with the focus on individual food consumption and state of nutrition. "Food security therefore covers availability, access, utilization and stability issues, and – because of its focus on the attributes of individuals – also embraces their energy, protein and nutrient needs for life, activity, pregnancy, growth and long-term capabilities." (HLTF 2010). It comprises far more than just the individual requirements for carbohydrates, protein, fats, vitamins, minerals and trace elements: "Nutrition security exists when food security is combined with a sanitary environment, adequate health services, and proper care and feeding practices to ensure a healthy life for all household members." (SNC CC 2010: 9).

Whereas the concept of "food security" generally focuses on the availability of and access to food, focusing on nutrition ("nutrition security") focuses on people and views the use and utilisation of food in relation to adequate health care and social provision. Environmental conditions which are favourable to health, above all access to clean drinking water and sanitary facilities, are decisive in ensuring that the individual is in a good nutritional condition. Knowledge about healthy nutrition and the preparation of varied meals is also part of the concept, as is essential know-how concerning storage, preserving and processing of foods.

[7] Social access was not included in the FAO definition of 1996.

Chapter

3

The four dimensions of food and nutrition security[8] can be defined as follows:

- Availability means that sufficient quantities of food of adequate quality are available either through domestic production or on the markets (production, storage, food imports and food aid). The focus in this dimension is on food production, which should ideally be sustainable and diverse. However, the national or regional level is often considered in this context without paying attention to availability at the household or individual level.
- Secure access to food exists when all households and all members of a household have access to productive resources and possess enough capacity to work, knowledge, capital and income to produce sufficient food for adequate nutrition for their own consumption and/or are able to acquire, exchange or purchase it. Access is highly dependent on social, economic, political and ecological conditions.
- Use and utilisation of food according to requirements concerns the individual state of nutrition and health in relation to varied food, clean drinking water, health care, sanitary facilities as well as caring capacities and practices. The body must also be in a state to digest the food and turn it into energy, which is linked to the state of health.
- Stability refers to the reliability at all times of food and nutrition security. A differentiation is generally made between chronic insecurity and temporary insecurity; the latter may result from short external shocks or recurring shortages, for example shortly before the next harvest.

„A Food System is a set of dynamic interactions between and within biogeophysical and human environments that influence both activities and outcomes all along the food chain (production, storage, and processing, distribution, exchange, preparation and consumption.“ (FAO 2007:4)

A holistic understanding of sustainable food and nutrition security focuses on the long term and takes into account not only the ecological dimension which is often neglected and the impacts of climate change but also the social and political dimension (the right to food, power structures, access to resources etc.) all along the chain of the food system. Processing, distribution, acquisition, storage, preparation and consumption of food are just as important for food and nutrition security as the production itself. According to the FAO, food security is the result of a functioning food system in which various players with different interests[9] interact (see also 3.3).

3.2 The right to food and the political concept of food sovereignty

The consequences of climate change have profound effects on the fulfilment of human rights. Growing food insecurity, water shortages and extreme weather events impede for example the human rights to life, food, water and health as well as to adequate shelter and even entail the loss of opportunities to make self-determined life choices, particularly in the case of already disadvantaged population groups.

[8] “Food and Nutrition Security is achieved, if adequate food (quantity, quality, safety, socio-cultural acceptability) is available and accessible for and satisfactorily utilized by all individuals at all times to live a healthy and happy life.” (InWEnt 2009: 25). On the dimensions, see also FAO.

[9] Dealers in cereals, seed and agro-chemical companies, fertilizer producers, food processing companies and supermarket chains are among the powerful profiteers of the current food system and are a force against change. The power of consumers is debatable. Consumer groups demand more transparency and adequate labeling to enable consumers to make us of their “market power”.

Chapter

3

The right to food was guaranteed in 1976 in the International Covenant on economic, social and cultural Rights (Article 11) and particularly emphasised at the World Food Summit in 1996: "Everyone has the right of access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger" (Heads of States and Governments 1996).

In reality, the right to food is not fulfilled: "Every hungry or malnourished person is deprived of his/her human right to adequate e food. With an estimated 25,000 victims of starvation every day (FAO 2002) it has probably been the most massively infringed human right for decades." (Welthungerhilfe/FIAN 2009: 3)[10].

The fight against hunger is not just an ethical question; it is also a matter of obligation for each government and the international community to ensure the complete fulfillment of the right to adequate food.

A rights-based approach makes governments responsible and evaluates the influence of political decisions; for example, whether they lead to the reduction of people's dependence on external relief and support (such as development co-operation, for example) and contribute to empowering and strengthening people's self-determination. The focus on the right to food does justice to the demand to empower people and help them to help themselves. When people perceive themselves as entitled to certain rights, rather than as supplicants, they can act in a more targeted way and with more self-confidence (Welthungerhilfe /FIAN 2009: 7).

Issues related to the right to food are not adequately considered in the concept of food and nutrition security: food security can refer equally to national self-sufficiency or integration in global markets; it can focus on increasing productivity with the use of high-yield varieties in the form of large-scale monocultures or on a poverty-oriented agricultural and nutrition policy and the safeguarding of natural resources. Food security can even be confused with food safety, which is only concerned with the quality of foodstuffs (cf. EKD 2000). The right to determine their own agricultural and food/nutrition policy and the obligation not to damage the food systems of other countries or the environment is the core of the demand for food sovereignty[11]. La Via Campesina, the international movement of small-scale farmers, land workers and indigenous peoples, has formulated this demand which aims to achieve localisation and democratisation of food systems (Declaration of Nyéléni 2007; IAASTD 2009: 76). As well as aiming for justice and solidarity, La Via Campesina is concerned with seed protection and the conservation of natural resources through sustainable production methods.

The concept of food security does not examine who produces, processes, distributes, prepares and eats what, where or how.

[10] To put this into practice, voluntary guidelines on the right to food in the context of national food security were developed in 19 relevant topic areas and policy fields and unanimously accepted by 187 states at the FAO Council in 2004. Welthungerhilfe was actively involved in the process.

[11] Food sovereignty is the RIGHT of peoples, countries, and state unions to define their agricultural and food policy without the "dumping" of agricultural commodities into foreign countries. (http://viacampesina.org).

Chapter

3

3.3 Principles of sustainability, sustainable livelihoods and implementation options

Sustainable development is the long-term conservation and management of natural resources in a form which is eco-friendly, technologically suitable, economically sound and socially acceptable to satisfy the needs of present and future generations. (cf. www.fao.org/wssd/sard/index-en.htm)

What does sustainability actually mean? What are the characteristics of sustainable agriculture, a sustainable food system? The German term "Nachhaltigkeit" (sustainability) is usually considered to have originated in forestry (Hans Carl von Carlowitz, 1713) and mainly pointed to the importance of only felling as much timber as could regrow. At the start of the 20th century, the term was used in the fishing industry, to indicate the importance of not endangering fish stocks by overfishing. The target of sustainability in forestry, the fishing industry and agriculture concentrates on not exceeding the limits of the ecological stability and regenerational capacity of ecosystems, in order to maintain their functionality and productivity for the purpose of human exploitation. This reflects the dominant anthropocentric approach which reduces the environment to whatever is directly useful for humanity: as a resource, as economically useful material for production or as a repository for waste and pollutants. This concept of sustainability is restricted to the maintenance and increase of yields while minimising the damaging effects on people and environment; it gives no consideration to the idea of just distribution within the present or for future societies. A further developed, more holistic systemic understanding of the concept would recognise – beyond the enlightened self-interest – that ecosystems have their own intrinsic value and would give more space to considering political, socio-cultural and spiritual aspects. (cf. Gruber 2009, 2010).

„Further chemicalization and industrialization of agricultural production that cannot but reinforce this trend are therefore steps in the wrong direction." (UNCTAD 2011).

Although the principles of sustainable development have long been established in international rhetoric (Rio Declaration 1992)[12], the dominant forms of industrial agricultural and food systems especially within the OECD countries are non-sustainable, based on high levels of water and fossil fuel consumption, fertilisers and pesticides. These systems are associated with greenhouse gas emissions, the destruction of biodiversity and cultural diversity, water pollution, soil destruction and damage to ecosystems, all of which endangers the foundations of production and livelihoods for all humanity. Industrial livestock farming is also unacceptable due to its contribution to climate change and also for ethical reasons. Industrial agricultural production has further negative socio-cultural and economic effects, such as exploitative working conditions which endanger workers' health, the destruction of small-scale agriculture, farmers' indebtedness to and dependence on agribusinesses, reduced capacity for autonomy and self-sufficiency, increasing dependency on food imports and indebtedness at national level. (cf. Gruber 2009, 2010).

Over three billion people are malnourished: they are either undernourished or over-nourished. The current model of industrialised agricultural and food and nutrition systems has shown that it is not sustainable in future and to continue to promote it is irresponsible from several points of view, ecological, social and economic. Instead of arguing in favour of a new Green Revolution in Africa (AGRA), IFPRI (among others) is arguing for a Global Evergreen Revolution: "Based on the principles of ecology, social equity, energy efficiency, employment generation, and economic viability, this revolution will provide the technical

[12] Intergenerational justice was a topic at the first UN conference on the environment (UNCHE 1972), the principle of solidarity was presented to a wider public in the Brundtland report (1987) and was a particular focus at the UN conferences UNCED 1992 and WSSD 2002; it is the topic of the Rio+20 conference in 2012.

foundation for the universal eradication of hunger and the achievement of a food- and nutrition-secure world for all[13]."

"Climate change instils greater urgency to find more sustainable, resilient and efficient ways of producing, trading, distributing and consuming food." (SNC CC 2010: 5).

To achieve a revolution of this kind, food systems must not only become more climate sensitive; they must be made more ecological, social and economically sustainable overall. The development and strengthening of sustainable food systems has great potential[14] for the promotion of sustainable food security and can also contribute to the reduction of GHG emissions, to decreasing vulnerability and increasing resilience and to adaptation to climate change without greenhouse gas emissions – all this without continuing the destruction of the natural production and livelihood base. Last but not least, it can promote democratisation (food sovereignty).

Figure 1 shows the dimensions of food and nutrition security and the resources required for them (top left). This makes clear that no approach can be successful which mainly relies on increasing productivity and integration in global markets, without taking into account both the changing climatic conditions which are exacerbating the food situation and the political dimensions, power structures and global economic framework conditions (top right). The only system which promises success is one which fights against poverty comprehensively (satisfying the existential basic needs, access to health and educational institutions, participation in social, cultural and political life, and environmentally friendly, just economic development). It is also necessary to improve opportunities particularly for small-scale farmers for self-determined life choices and to promote sustainable food systems.

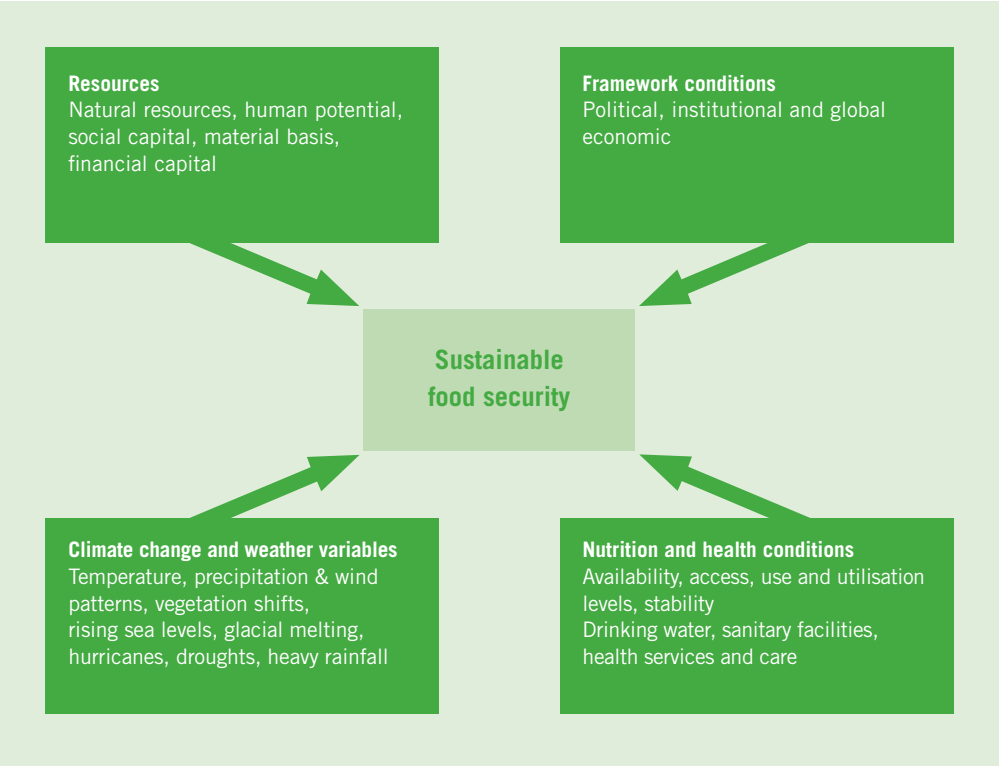
[13] www.ifpri.org/publication/uncommon-opportunities-achieving-sustainable-food-and-nutrition-security.

[14] The UN special rapporteur for the right to food, Oliver der Schutter (Report 2010) refers to the necessary transformation towards sustainable agriculture and cites the following agro-ecological advantages: high productivity (availability), the reduction of rural poverty (access), and improved nutrition (use and utilisation). Additional advantages are the potential of ecological agriculture in the context of climate change: minimised use of fossil fuels and thus lower CO_2 emissions; lower levels of methane emissions from livestock, reduced nitrous oxide emissions due to lower use of nitrogen, CO_2 sequestration due to humus increase and improved adaptation capacity to changing climatic conditions also due to water storage capacity, resilience and diversity (cf. FiB: www.fibl.org/de/themen/klima.html).

Chapter

3

Figure 1: Factors influencing food security at household and community level



Rather than seeking a "one size fits all" solution, holistic sustainable livelihood principles[15] are oriented on a local context without losing sight of the power structures and framework conditions at meso and macro level[16]. Using this approach, it is possible to work with the poorest and most disadvantaged population groups to develop strategies to secure their livelihoods and to safeguard the resources on which their livelihoods depend, their means of subsistence, their life choices and in such a way to provide food and nutrition security in a sustainable way. To achieve this, people require the following resources (assets) (cf. also 2005, 25 ff):

- Natural resources such as fertile soil, (drinking) water and biodiversity are the basis of human food, income and well-being. Access to basic natural resources and sustainable resource management are essential to food and nutrition security in all its dimensions.
- Human potential: people who have more education, knowledge, abilities and skills and who are healthy and fit to work are better in the position to make use of life choices, to provide for their own livelihoods and nutrition and to adapt to changing climatic conditions.

[15] "A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base." (DFID: Sustainable livelihoods guidance sheets, 1.1.). cf. www.eldis.org/go/topics/dossiers/livelihoods-connect/climate-change-adaptation/introduction.

[16] Livelihood strategies refers to the diverse ways, i.e. the decisions and activities, directed towards achieving (self-)determined results such as higher income, well-being, improved food security, reduced vulnerability, resilience and sustainable resource management (livelihood outcomes).

Chapter
3

- The significance of social capital is increasingly being recognised: a supportive social environment, family relationships, non-family networks and collaboration provide a safety net in times of crisis and support people in asserting political demands.
- Transport, information and communication systems, water and energy supply, sanitation and means of production such as tools and machines comprise the material basis (infrastructure) of food and nutrition security.
- Financial capital comprises income, transfer payments, savings, loans and assets which can quickly be turned into cash such as livestock.

Inadequate resources lead to greater vulnerability and reduce both resilience and adaptive capacity to changing climatic conditions in households and communities.

Chapter

4

CLIMATE CHANGE AND IMPACTS ON SUSTAINABLE FOOD AND NUTRITION SECURITY

After presenting the projected general regional impacts of climate change on food security, we will outline the threats in relation to the four pillars of sustainable food and nutrition security.

4.1 General impact in particularly affected regions

The following general regional impacts are projected for Africa, Asia, Latin America and for small islands (cf. IPCC 2007, IAASTD 2008, OECD 2009):

4.1.1 Africa

It must be assumed that average temperature increases in Africa will be higher than the average global warming. Africa is the continent most severely affected by climate change. It is particularly vulnerable due to multiple strains arising from a combination of stress factors: rapid population growth and fragile socio-ecological and political systems, while its socio-ecosystems lack adaptive capacities resulting in high costs.

- It is considered probable that agricultural yield potential, including access to food and reduction of food quality, will be severely affected. The IPCC projects serious declines in harvests by 2020; the reduction could be up to 50% in some regions for rainfed agriculture, unless appropriate adaptation measures are implemented.
- Arid and semi-arid areas are projected to expand by 5-8 per cent by 2080. Increasing water shortages for 75 to 250 million people by 2020 must be anticipated; by 2050, 350-600 million will be affected, in particular in northern and southern Africa. In East Africa, meanwhile, increased precipitation is to be expected, particularly at higher altitudes.
- Declining fish stocks are projected for bodies of water where the temperature will rise, such as the Great Lakes region in East Africa; this problem will be compounded by overfishing.
- Rising sea levels will threaten lower-lying coastal areas towards the end of the 21st century, destroying settlements, infrastructure, agricultural land and productive resources and impairing tourism. For example, in Guinea in West Africa, 130-235 km^2 of rice fields could be lost due to rising sea levels by the middle of the century. Similar effects are to be feared for coastal regions in southern Africa.
- The incidence of malaria could be reduced within the next four decades in large parts of the western Sahel zone and southern central Africa; however, at the same time the disease may spread in the higher altitude areas of Ethiopia, Kenya, Rwanda and Burundi, which have so far been spared.
- There is a danger of increasing political instability due to conflicts over the use of scarce resources and internal migration. It is projected that there will be more weak and fragile regions.

4.1.2 Asien

Predictions for Asia suggest that by 2020, 49 million more people will be at risk of hunger; by 2050, a further 132 million people could be affected (OECD 2009).

- There are huge regional differences in relation to the production of wheat, maize and rice; yields in East and Southeast Asia are projected to increase by up to 20 % in the next ten years, while in Central and South Asia, yields may decrease by around 30 %; in Bangladesh, rice and wheat production may decrease by about 8 % and 32 % respectively.
- Glacial melting affects the water supply for half a billion people in the Himalaya and Hindu Kush regions and another 250 million in China. In the short term this leads to the rivers carrying more water which can result in flooding. In the long term, there will be water shortages (as the water table sinks; rivers may even dry up).
- The availability of fresh water in Central, South, East and Southeast Asia is predicted to decline, above all in the great river catchment areas such as Changing, while demand will increase due to the growing population and rising living standards. This could have a negative impact over one billion people by 2050. The consequences would be an increase in internal migration and enhanced potential for conflict (for example, in view of scarce resources). This would also cause political instability.
- Coastal areas, in particular the densely populated delta regions in East, South and Southeast Asia, will face increased risks of flooding. Over a million people could be directly affected by rising sea levels in the Ganges-Brahmaputra-Meghna Delta in Bangladesh and in the Mekong Delta in Vietnam. Increased illness and mortality rates (diarrhoea and cholera) due to flooding and droughts are to be expected in East, South and Southeast Asia.
- Bangladesh, India and Vietnam will be particularly affected by extreme weather events.
- 24-30 % of coral reefs could be lost within the next 10-30 years.
- Climate change-induced pressure on ecosystems will be exacerbated by rapid urbanisation, industrialisation and economic development in many parts of South and Southeast Asia – in a setting where land reserves are almost entirely exhausted. Up to 50 % of Asia's biodiversity is threatened.

The Gulf of Mannar: an environment and its people under stress

The majority of the coastal population of the Gulf of Mannar in South India depend on sea¬water fish for their daily nutrition. However, today the area is recognized as one of the six most cyclone-prone areas in the world. Coastal erosion due to wave and tidal currents is another major threat. In areas like Thandirayankuppam, about 70 meters of beach have been lost in just three months. Coastal erosion is a direct outcome of climate change. India has 7500 km of coastlines. Physical preventative measures, such as tire barrages, are not sufficient to put an end to coastal erosion. However, there are some alternative measures, including bio shields and measures for management of wetlands, currently in place and functional. Due to increases in seawater temperature, coral reefs are under stress. Coupled with sea level rise, about 21 islands in the Gulf of Mannar are likely to disappear (Prasad, 2011).

4.1.3 Latin America

- A significant loss of biodiversity is projected for the tropical regions of Latin America. The cloud forests in mountainous regions are endangered if the temperature rises by 1-2°C.
- Salinisation and desertification are projected to affect 50 % of the agricultural land in Latin America (and the Caribbean, see below) by 2050, resulting in a decrease in arable land in arid areas. The situation is exacerbated by soil degradation through changes in land use in the past.
- A decline in agricultural productivity is to be expected in the case of important crops such as rice and maize (with yields decreasing by up to a third in the tropical and subtropical areas due to heat stress and arid conditions) and in animal husbandry. However, soya bean yields will increase in the temperate zones. The productivity of grazing land in temperate zones such as in Argentina and Uruguay may increase by from 1-9 %. Overall, however, the number of people affected by food insecurity is expected to increase.
- Changing precipitation patterns and the future disappearance of glaciers will result in reduced water availability for human use, for agriculture and for energy generation in the Andean region. These developments are particularly critical for countries such as Peru, Bolivia, Colombia and Ecuador.
- A large number of climate change-induced extreme events can already be observed in the Amazon Basin.
- A decrease in soil moisture linked to rising temperatures will result in the transformation of tropical rainforest into savannah in the eastern Amazon area and in central and southern Mexico, as well as the alteration of semi-arid vegetation to arid vegetation in the north-eastern Brazil and northern Mexico.
- Coastal areas will be affected by rising sea levels (flooding, declining fish stocks etc.).
- Health problems are anticipated, mainly due to heat stress and malaria, dengue fever, cholera and other insect and water-borne diseases.

4.1.4 Islands in the Caribbean and the Pacific

Climate change will have a detrimental effect on agriculture and fishing on the islands. A reduction in available water resources is predicted by the middle of the century; e.g. there will be insufficient water for people's requirements in the Caribbean and the Pacific in periods of lower rainfall. The increasing threat of flooding, storm floods, erosion and other coastal hazards will endanger the essential infrastructure, the settlements and livelihoods of the island population. Those islands in middle and upper latitudes above all must expect an increasing influx of non-native species.

4.2 Impact on the availability of adequate food

The following section outlines the general climate change-induced impacts on the availability of agricultural crops and livestock, fish and non-timber products and the effects on storage and trade.

4.2.1 Crop production

A rise in the average temperature of 1-3°C is projected to increase the productivity of agricultural crops and grazing land slightly in middle and upper latitudes, whereas in lower latitudes the opposite effect is anticipated, especially in seasonally arid and tropical areas. Consequently, productivity will decrease, resulting in a decline in food availability. Agricultural productivity will decline in seasonally arid and tropical regions if the temperature rises by as little as 1-2°C (see also IPCC 2007). If temperatures rise by more than 3°C, the global yield potential of the most important cultivated crops is likely to decrease. Over wide areas of Australia, South Asia, Latin America and southern Europe, even a small temperature increase would have a detrimental effect on conditions for agriculture. Many cultivated plants in the tropics have already reached their heat tolerance levels, so even a moderate temperature increase (1°C for wheat and maize, 2°C for rice) could cause significant reductions in yields (World Bank 2007).

Rising air temperatures and solar radiation result in higher soil temperatures. This is detrimental to the quality of tropical and subtropical soils which are fragile anyway and exacerbates soil erosion, land degradation and desertification. Changes in the water retention capacity of soils are also expected. Rising temperatures, combined with increased heat waves and extended drought periods, also affect the evapotranspiration (water evaporation from soils and plants) in agro-ecosystems, meaning that cultivated plants require more water.

According to the International Institute for Applied Systems Analysis (IIASA 2010), water will become a key variable in agricultural production – and for sustainable food and nutrition security. Whereas water availability will increase in certain regions, for example at higher latitudes and in some tropical wetlands, it will decrease in other areas.

Chapter

4

Orissa, India: rainfall variability drives farmers into suicide

Uncertain weather conditions coupled with increased frequency and severity of extreme weather events in Orissa, such as drought in 2009 and flash floods in 2010, have caused severe losses of paddy and millets yields. In just one months' time, more than 50 farmers could not withstand these losses and committed suicide. Information gathered from Orissa Government's rainfall records reveal that rainfall in coastal districts of Baleshwar, Puri and Ganjam has increased, while in the Western and Southern parts of Orissa, it has decreased drastically. The unprecedented rains in the month of December 2010 had impacted 20 districts in Orissa. Overall, rainfall days are reducing by a day in every 5 years in Orissa (Sarangi 2011, Mohapatra/Mohanty 2006).

The IPCC (2007) projects a reduction in precipitation by the end of the 21st century in the northern and southern tropics as well as a water-related shortening of the vegetation period and a corresponding shortening of the cultivation period. This will particularly affect areas used for rainfed agriculture (Fischer et al. 2002). Over 90 per cent of the agricultural production of basic foodstuffs in sub-Saharan Africa depends on rainfed agriculture (Rosegrant et al. 2002).

The prognosis for Africa is bleak (Herren 2010; IAASTD 2009, OECD 2009): by 2050, Egypt is projected to suffer a decline in rice production of up to 11 % and in soya beans of up to 28 %. Reis bis zu 11 % und von Sojabohnen um bis zu 28 % projiziert.
Based on model calculations, Walker und Schulze (2008) forecast a yield collapse of maize in the most important agricultural area of South Africa of up to 30 %. The general expectation is that areas of maize cultivation in southern Africa will be reduced to a fraction of their current size.

Soil and water quality will deteriorate further due to unsuitable agricultural practices and poor irrigation management. Very heavy rainfall is also expected to occur more frequently, which can result in damage to harvests and soil erosion and even make cultivation impossible where the soil is water-saturated. Excessive water extraction and rising sea levels can enable salt water to penetrate fertile soils and contaminate groundwater in coastal areas and river deltas. The increasing frequency and magnitude of inundations and flooding as a result of very heavy rainfall, rising sea levels and rising groundwater levels are detrimental to water quality. Storms can also damage crops and cause harvests to fail.

The particularly aggressive wind-borne black stem rust strain Ug99 is spreading from Uganda via Kenya and Ethiopia to Yemen and Iran. It poses a threat to global wheat yields (Singh et al. 2008).

The problems are compounded by other developments, including new plant diseases and pests and the loss of biodiversity; also, seeds and plants adapted to changing climatic conditions are not sufficiently available. Climate change-induced alterations to local conditions such as rising temperatures and water shortages lead in the medium term to changes in the plant population and vegetation types. The number of extinctions will also rise: migration of plant species is limited by the pace of change and by natural borders (such as mountain ranges or deserts).

Climate change threatens food and nutrition security in Asia

In many parts of Asia, the unpredictability of rainfall caused by climate change will create instability in agriculture. While in some areas the frequency of drought will increase, flooding in other areas will destroy the harvests and, in turn, exacerbate hunger and poverty. There is an expected shift in cropping regions which will push agriculture into more fragile ecological zones. Himalayan snow and glacial ice may reduce by 20 percent by 2030, accentuating both flood risk and water shortages. In particular, the Ganga-Brahmaputra delta will suffer from increasing salinity, flooding and sea level rise.

Crop models indicate that in South Asia, average crop yields in 2050 will decline from 2000 levels by about 50 percent for wheat, 17 percent for rice, and six percent for maize due to climate change. In East Asia and the Pacific, crop yields in 2050 are expected to decline from 2000 levels by up to 20 percent for rice, 13 percent for soybean, 16 percent for wheat, and four percent for maize. This decline implies negative consequences for human nutrition. The average caloric availability in Asia in 2050 is expected to be about 15 percent lower than in 2000. Cereal consumption is projected to decline by as much as 24 percent. From 2000 to 2050, the expected number of malnourished children in South Asia is expected to fall from 76 to 59 million (compared to 52 million without climate change) and in East Asia and the Pacific from 24 to 14 million (compared to 10 million without climate change).

Humans are exposed to climate change directly through changing weather patterns and indirectly through changes in water, air, food quality and quantity, ecosystems, agriculture and economies. Drought and water scarcity reduce dietary diversity and overall food consumption, leading to problems with malnutrition. The risk of flooding may be amplified by both raised sea levels and increased heavy precipitation in coastal areas. As a result, more people will be exposed to diarrhoea and other infectious diseases, lowering their bodies' capacity to utilise food effectively. Migration pushes people into urban slums and increases their vulnerability. Current studies estimate that climate change from 1970 to 2000 has caused at least 160,000 deaths and 5 million disability-adjusted life years (DALYs) due to only four factors: malaria, diarrhoea, malnutrition and flooding (McMichael, 2004) (Ramachandran 2011, IFPRI 2009).

4.2.2 Animal husbandry

The influence of climate change on animal husbandry and therefore the livelihoods of livestock farmers are highly dependent on natural resources, in particular on reliable water supplies. The availability of fodder crops is related to plant production. Reduced fodder availability and quality, for example, resulting from increases or decreases in precipitation, can lead to a reduction in livestock numbers, particularly cattle and sheep. One alternative for small-scale farmers could be to keep goats or poultry instead, depending on their location (cf. IFAD o. J).

Chapter

4

Some domestic animal breeds are less adapted to temperature fluctuations and are particularly prone to heat stress (increase or decrease of air temperature and humidity). Grazing land is very vulnerable to long dry spells, depending on the phytosociology. Long periods of drought reduce milk yields and increase mortality rates, above all for European cattle breeds which are not heat tolerant. The need for increasing amounts of water can lead to the consumption of poor quality water, resulting in increases in water-borne diseases and further losses in animal stocks (Boko et al., 2007) as well as cause water-use conflicts. A global rise in the incidence of infectious and contagious diseases among livestock is predicted, some of which may also spread to the human population. A reduction in livestock populations poses a threat to varied and balanced diets, endangering both the health of livestock farmers and their families and their "capital" (i.e. the breeding animals).

Small-scale animal husbandry with heat-tolerant sheep and goats can benefit the owners' own consumption as well as generating income (availability and access). This can also make a significant contribution to a varied diet: meat and milk from sheep and goats provide protein, vitamin A, iron and calcium in particular (see also 4.3).

Small-scale grazing-based animal husbandry releases only small amounts of methane in comparison to intensive livestock farming and tends to reduce natural emissions of nitrous gas. For this reason, it could play a key role in moving towards climate-sensitive agriculture (cf. IFAD).

Rainfall variability increases risk for Ethiopian pastoralists

The impact of climate change could be devastating in the lowlands of Ethiopia. People whose livelihoods depend on the weather and seasons will feel this impact the greatest, especially pastoralists who depend on livestock for their livelihoods. Pastoralists in the lowlands describe climate change as prolonged dry seasons and shortened rainy seasons. In comparison to the past, the onset of the rainy season has become more unpredictable. The "Kremt" rainfalls (from June to August) show decadal variability. For example, pastoralists in Afar claim that their situation has been worsening since the disastrous drought in 1984. On average, the temperature rises by about 0.37 centigrade per decade. While extent and magnitude of climate change in Ethiopia are currently uncertain, global circulation models estimate a mean temperature increase of about 1.7 to 2.1 centigrade by 2050 (Ashagrie 2011).

4.2.3 Fishery

Alterations to marine ecosystems and habitats alter (e.g. due to rising sea temperatures or an increase in large waves) affect the flora and fauna and therefore their productivity. Changes to combinations of species and a significant reduction in the diversity of fish species are predicted; above all, the most productive fishing areas in the Arctic cold water regions are potentially endangered. Alongside pollution, the fact that 85 per cent of sea fish stocks globally are already overfished, exhausted or exploited to the limit (FAO 2011) is exacerbating the situation. The weather phenomenon known as El Niño, which has existed for thousands of years and was already known to the Incas, has massive short-term effects on marine ecosystems on the west coast of South America, showing that climate variations can have huge impacts on food availability through damaging fishing and the communities who depend on it (cf. IPCC 2007). FAO estimates (2011) state that fishing and aquaculture are the livelihood base for 540 million people (those working in fishing and fish processing and their families).

Over 2.9 billion people in the world meet at least 15 per cent of their protein needs by consuming fish; in many small island states and in countries such as Bangladesh, Indonesia, Ghana and Sierra Leone, fish provides over 50 per cent of protein requirements of the population. The decline in catches has a direct negative impact on the food situation, especially in economically poor countries where adaptation capacities are also limited. Angola, Congo, Mauretania, Mali, Niger, Senegal and Sierra Leone are all particularly endangered, as well as Malawi, Mozambique, Uganda, Bangladesh, Cambodia and Pakistan (IFAD).

Deteriorating coastal areas in Bangladesh

Bangladesh is one of the most densely populated countries in the world. A temperature rise of three degrees centigrade may result in a radical one meter increase in seawater level. This is due to both melting ice and thermal expansion of water. The coastline of the Bay of Bengal extends about 700 km long. Without dams, seawater will overflow into the delta, devastating the lives of about 10 million people. Likely consequences include riverbank erosion, salinity of crop land, diminishing fresh water sources and crop failures. Food production will decline with negative effects on the nutrition and health of people living in coastal areas. As a consequence of floods, waterborne diseases are likely to increase. Bangladesh fisheries and shrimp industries will be at risk. If fishing declines, people will lose an important protein source, and poor health status will drive people deeper into poverty and food insecurity. In the long run, the deterioration of coastal ecosystems is highly likely. Expected consequences of this deterioration include decreases in foreign exchange as well as mass migrations of people fleeing from affected areas (Halder 2011, Sarwar 2005).

It is not only the marine ecosystems which are affected by climate change. Fish species and crustaceans (crabs and shrimps) which live in brackish water are particularly vulnerable to changes in the salt content of water. They and other estuarine species are facing more difficult conditions.
A number of saltwater and freshwater species are attempting to avoid the rising water temperatures in seas, lakes and rivers by migrating from their former environment to colder areas, in other words, towards the Poles. This may result in new fishing opportunities, but the situation must be carefully monitored because of the delicate balance of marine ecosystems.

Great regional variations are anticipated for freshwater fishing: depending on changes to water temperatures, wind patterns, fish populations and nutrient distribution, primary production may decrease or increase. For example O'Reilly et al. (2004) assert that climate change-induced reductions are occurring in fish catches in Lake Tanganyika on Tanzania's western border. Freshwater fishing plays an important role in Africa for the food security and livelihoods of the population; globally it plays a crucial role for around 61 million people (FAO 2011).

The aquaculture industry has grown particularly strongly in Asia, but the trend towards aquaculture can also be observed in Africa. Conventional aquaculture is linked to health risks (antibiotics, water pollution) and with the danger of outcrossing or the spread of invasive species. In some regions, climate change could benefit aquaculture (cf. IFAD.).

4.2.4 Forestry

Climate change increases the risk of forest fires, storm damage and the cross-border spread of plant pests and diseases. Biomass production is reduced and sources of wood for construction or firewood are lost. This can be indirectly detrimental to the preparation and quality of food.

Another important aspect relating to poverty reduction and food and nutrition security is the possibility of adverse climate change-induced effects on the availability of non-timber forest products such as e.g. wild fruit, seeds, nuts, fungi, honey and medicinal plants. Irregular rainfall, for example, is detrimental to the yield of wild food products. Currently, around 350 million people around the world are dependent on existing forests to maintain their livelihoods (DIE 2009).

In cooler climatic zones, the additional carbon fertilizing effect could have a positive impact on timber production. However this argument should not be overvalued (cf. IPCC 2007).

4.2.5 Storage and trade

Extreme weather events such as hurricanes, flooding and heavy rainfall do not only destroy and damage agricultural production, affecting both quantity and quality; they also impact

food storage, transport and access to markets. This extends their detrimental effect to all dimensions of food and nutrition security.

The problem is exacerbated by the fact that rural infrastructure in economically developing countries in the southern hemisphere is often very limited anyway. Small-scale farmers, particularly in sub-Sahara Africa, often have only limited marketing opportunities due to lack of information, access to markets and sales opportunities, giving them little incentive to increase production.

Increasing the trade volume of agricultural products: a solution?

It is very difficult to estimate climate change impacts on the national and continental availability of food and the consequences for global stocks, international trade and world market prices. In the tropics, climate change is expected to reduce agricultural productivity, whereas in temperate zones, productivity may benefit by an increase of up to 3 per cent in certain areas. The problem is that these developments are not linear, so their concrete effects on agricultural production are currently still incalculable. Scenarios of this kind predict increasing exports from temperate to tropical and subtropical regions.

Some observers regard increasing trade in vegetable and animal materials and products as a suitable way of balancing out the inequalities in distribution of cultivation opportunities (see 4.2.1). However, it will not be easy to compensate for climate change-induced decline in yields above all in Africa through food stocks, food aid and global trade (FAO 2008). In rural areas in particular, small-scale farming families will continue to depend heavily on agriculture as their livelihood and subsistence base. Food imports and the establishment of alternative, non-agricultural income sources can only be of limited importance for food security in endangered countries and regions, particularly in Africa, in the long term. Besides, the necessary structures and financial resources are often not available (cf. World Bank, 2007). In addition, the rising demand for food imports will increase the trade deficit which already exists in many cases (see IPCC 2007). The resulting growing dependency would also increase the vulnerability of many countries and undermine their food sovereignty. Global trade already consumes vast amounts of fossil fuels for transport, processing and packaging, thus contributing to climate change.

4.3 Impact on access to adequate food

The negative impacts of climate change are not restricted to agricultural production for the farmers' own needs and for the markets. They also affect the social and material infrastructure. Harmful effects on incomes and prices may also be observed.

4.3.1 Access rights, knowledge, labour, and capital

Famines are often caused by the fact that people lack access rights (Sen 1971 ff.). For small-scale farming families, access to food also means access rights to productive resources such as fertile land, water and seeds. They also require access to tools/machines, financial services, knowledge, information (for example about market prices), consulting services and access to markets.

Chapter

4

Climate change has detrimental effects not only on the resources available to small-scale farmers for agricultural production. The productivity of their labour is also reduced by illness or injuries which prevent them from producing food for their own consumption and for sale to generate income (see 4.3.2).
The limitation of communication and transport opportunities and access to markets also results in the restriction of opportunities to sell, buy or exchange.

4.3.2 Incomes and prices

One consequence of climate change-induced decline in agricultural yields and harvest losses is income loss for market-oriented producers – with particularly wide-ranging effects for cash crops grown for export such as cotton, coffee and tea. Loss of income has an immediate impact on spending. If families cannot produce or buy enough food, compensatory or emergency measures are applied which again may have some negative direct or indirect effects on the food and nutrition situation and health:

- Sale of livestock results in the loss of access to animal-based food sources and capital "stock".
- Job seeking by one family member which often means migration to the cities or urban areas and so loss of labour for the household.
- Abandoning the payment of school fees and pull-our of children from education.
- Savings in expenditure on health care.
- Reduction in the number of meals, the quantity and quality of food and the redistribution of the available food, often with negative consequences for women and children.

The less income a household has, the higher is the proportion of money spent on food. Many poor households already spend 50-80% of their income on food. Simultaneously declining incomes and rising food prices face these households with a barely manageable task, because an even bigger proportion of their income must be spent on food. A 25% price rise for essential basic foods, (e.g. rice in Southeast Asia) leads to a 10% reduction in real incomes in urban and peri-urban areas, resulting in a loss of spending power (cf. IRRI 2008).

Rising food prices can however also give small-scale farming businesses a chance by increasing their incomes, providing a production incentive and resulting in improvements to the nutrition situation – but only if the price rises are also reflected at local level and the farmers have the necessary resources and market access to react quickly enough to the situation (cf. ODI 2008). For people who are not involved in agriculture, access to food is above all a question of income and prices. Negative effects on food and nutrition security result particularly when food prices rise abruptly or reach an extremely high level[17].
For example, world maize and wheat prices almost doubled between June 2010 and mid-March 2011 (90% and 82%). Prices for fruit, vegetables, eggs, meat and dairy

[17] Cf. www.ifad.org/operations/food/

products have also risen significantly (IFPRI 2011). Population growth, rising incomes and increased demand for agricultural raw materials would be sufficient to cause rising food prices. It must be assumed that climate change will result in much greater price rises; for example, it is estimated that the wheat price will quadruple by 2050.

Climate change reduces the availability of cereals and increases cereal prices

According to Lobell et al., rising global temperatures in the last 30 years have resulted in a reduction of wheat harvests of approximately 5.5 percent. Consequently the wheat price has risen by six percent and consumer spending has increased by around 40 billion Euros. Maize harvests sank by 3.8 percent.
These model-based statements from Stanford and Columbia Universities are based on correlations of temperatures and yields coupled with studies of control regions where temperatures have not risen. If effective adaptation does not take place and the demand for wheat and maize continues to increase, there is a danger that declining harvests and reduced availability of wheat and maize will result (Lobell/Schlenker/Costa-Roberts 2011).

The increasing production of agro-fuels is a further problem, because it uses resources – especially land suitable for food production; it also causes further pressure on prices for agricultural raw materials and so has a detrimental effect on the availability of and access to food. If agro-fuel production increases to the extent planned, the availability of calories will decline by over eight per cent in sub-Saharan Africa. Agrofuels also put pressure on water supplies (irrigation and pollution) which can cause health problems and reduce the utilisation of food (cf. IFPRI, von Braun:http://ictsd.org/i/environment/31511/).

4.4 Impact on the use and utilisation of food

The impacts of climate change impair the diversity of the diet, the nutritional value and safety of food as well as the availability and quality of potable water; they have negative effects on hygiene, hamper caring capacities and increase health problems. All this means that direct negative effects are to be expected on the third dimension of food security, the use and utilisation of food. At the same time socio-cultural aspects thereby play an important role.

Even if a household has sufficient food available and/or adequate access to food, individual members of the household may still be disadvantaged and suffer from malnutrition and health disorders as a result of an unbalanced diet of low nutritional value. This is often the case for women and children due to their weaker position in the family and at the same time high nutritional requirements, but also for old or disabled people and people with special needs who cannot (or no longer) support themselves.

Chapter

4

4.4.1 Diversity of nutrition, nutritional value, and food security

Access to a varied, balanced diet and essential micronutrients will being impeded by the expended decline in wild plants resulting from ecological impoverishment (loss of biodiversity) on the one hand and reduced possibilities of cultivating gardens due to shortages of water or labour on the other. There is a risk that the availability of important dietary elements such as vegetables and fruit will be even more restricted in future and that this will result in an even more unbalanced diet for marginalised population groups than is already the case.

As well as restricting the supply of micronutrients, climate change also endangers food quality and safety. As conditions of agricultural production and locations change, there is a risk that food substances may alter (protein, gluten and toxin content). In addition, rising temperatures could increase the frequency of food poisoning due to food being more quickly perishable (such as aflatoxins through mould infection in peanuts and maize, post-harvest losses due to pests etc.).

4.4.2 Drinking water, hygiene, and health

Changing climatic conditions have direct and indirect effects on the health and subsequently on the nutrition condition of living creatures. More frequent incidences and new patterns of diseases are likely, affecting people, animals and plants (cf. IPCC 2007, IAASTD 2008, ABD 2009, IFPRI 2011).

Climate change can have an indirect effect on the human population through disease vectors such as mosquitoes, ticks or rodents whose ranges, populations or infectious potential depend on climatic conditions. Allergies are another factor; they are occurring more and more frequently due to changing weather conditions, an extended pollen season and the spread of pollen-producing plants.

Alterations to the climate and weather also have direct effects on the human organism. Heat waves and extreme cold can both lead to a rise in mortality rates and increases in disease, but gradual changes to average temperatures also have an effect on people's well-being. Extreme weather and its impacts, such as droughts, storms, storm surges, flooding, avalanches and mudslides can threaten the lives and health of large numbers of people. Extreme weather events and their effects increase the risks of injury and post-traumatic stress disorders such as fear or depression; they also increase the spread of water or food-borne diseases which can considerably reduce people's abilities, their health and nutritional status (food utilisation), exacerbate poverty and lead to a rise in mortality (especially child mortality). Disasters resulting from extreme weather events can have detrimental effects on health services due to the destruction of infrastructure.

Climate change will aggravate existing bottlenecks in drinking water availability and quality. Water is already a luxury in many regions. 1.3 billion people lack clean water for

drinking and cooking. Many arid and semi-arid areas such as e.g. southern Africa and north-east Brazil will suffer particularly from climate change-induced reductions in their water resources, particularly since they already face water shortages and fluctuations in precipitation. This leads to growing risks of food shortages and disease, above all in the areas which are affected by drought. These areas are expanding.

Deterioration in the drinking water supply also has negative effects on the hygienic processing and preparation of food as well as on people's sanitary situation – with negative consequences for their health. 2.6 billion people already suffer from inadequate access to sanitary facilities and waste water disposal. Pathogens spread more quickly under unhygienic conditions. Impure water will lead to a further increase in diarrhoeal diseases. These weaken the organism, compromises food utilisation and deprive the body of important nutrients – often resulting in the death of small children and already weakened people. An increase in diarrhoeal diseases and generally of infectious diseases therefore significantly impairs the ability of people to utilise food effectively.

Waste water systems may become less efficient as a consequence of climate change, e.g. due to difficulties in obtaining sufficient water or higher concentrations of harmful substances in waste water, which puts more pressure on water supplies and waste water disposal in rural areas.

Climate change increases the risks of cardiac and respiratory diseases (heat, dryness, dust). Heat waves or lower temperatures cause a rise in mortality, particularly of old people, small children, sick and the socially isolated groups. Vector-borne, water-borne and food-borne diseases affect everyone, but particularly children, pregnant and nursing mothers and older or weakened people. People suffering from immune deficiencies are more susceptible to infectious diseases and malnutrition – their work capacity is weakened still further. In southern Africa with its high prevalence of HIV/AIDS, this development is an additional burden for those concerned. Accordingly the HIV/AIDS situation is expected to be further exacerbated due to climate change.

As the ecological conditions for disease vectors change, diseases may be more quickly transmitted and widely spread and the regions potentially affected may expand. Higher temperatures will promote the spread of malaria in southern Africa and the higher altitude regions of East Africa. Malaria generally has a detrimental effect on health and compromises the physiological utilisation of food. At the same time, an organism weakened by malnutrition is more susceptible to pathogens and parasites.

4.4.3 Caring capacities and socio-cultural aspects

Climate change causes more work for women: e.g. environmental degradation and water shortages mean that even more time must be spent fetching water and collecting food, fodder and firewood. This factor as well as disease means that women's capacity to care for

themselves, their children and for old and sick family members is diminished. As a result, there is more risk of malnutrition. Both the disasters which result from extreme weather events and those that develop slowly also significantly reduce the ability of those affected to provide adequately for themselves and their families.

Cultural preferences and habits can promote or impede a varied and healthy diet (e.g. ignoring nutritious traditional foods and giving up "old-fashioned" methods of seed storage and processing, preserving and preparing food). This can play an important part e.g. in the case of environmentally-induced migration. In relation to alterations in eating habits, the local cultural values, attitudes, knowledge, views and attitudes play an important and often underestimated role. It is essential to take them into account when developing programmes and projects.

4.5 Impact on Stability

The weather fluctuations caused by climate change and the increasing frequency of extreme weather events will have a negative effect on the stability of food and nutrition security at local level, because they are incalculable and therefore no solid basis on which to plan. This means that calculations of food production (availability) and access to food are becoming more uncertain and difficult. Changes to the distribution and frequency of animal and plant diseases and pests as well as the spread of invasive species (FAO 2009) also cause problems in securing adequate food. The possible positive effects of climate change could be counteracted by extreme weather. Increasing numbers of droughts or floods – the main causes of food shortages in semi-arid and sub-humid areas in sub-Saharan Africa and parts of South Asia – mean that the regions most affected by the resulting instability are those which have the highest levels of chronic malnutrition already (cf. Schmidhuber, Tubiello 20007). Without appropriate adaptation measures, temporary uncertainty could become chronic instability.

Climate change-induced fluctuations in the availability of and access to food is only one threat to the stability of food and nutrition security and finally, of political stability as well. It is also threatened by increasing dependency (on imports, food aid or external inputs), environmentally-based migration and the worsening of socio-economic disparities. (The latter are demonstrated by the conflicts in the context of food price rises in 2007/08, some of which were violent). The danger of competition for use and distribution (e.g. of food, water and fertile land) is also increasing. This imperils internal security and the population's safety, but is also a threat to international security (cf. WBGU 2007).

Failed or weak and fragile states or regions are often faced with a high level of food insecurity. Degraded ecosystems and shortages of resources, failures in agricultural production and floods of migrants as a consequence of climate change can make the situation worse, overtaxing the society's adaptation capacity and leading to (increasing) violent confrontations. These then result in the destruction of fields, harvests, storage and transport infrastructure and markets. Lack of production incentives also add to food insecurity.

Chapter

5

STRATEGIC APPROACHES

5.1 Strategic approaches to sustainable food and nutrition security under changing climatic conditions

The current review of the possible effects of climate change on sustainable food and nutrition security can be used to derive several statements:

- Medium- and long-term changes to the climate are already taking place; they are having a negative impact on agriculture and forestry, animal husbandry and the fishery industry, and are already affecting food and nutrition security in all of its dimensions (availability, access, use and utilisation, stability).
- Climate change will very likely continue to pose a risk to food and nutrition security, particularly in areas that are already affected by hunger, since they have the least amount of resources to adapt to unexpected events. Socio-economic risks and vulnerabilities of poor and marginalised population groups in particular will continue to increase, because these groups are especially vulnerable to natural hazards, depend on natural resources for their livelihood and incomes, and have only minimal prevention, management and adaptation options.
- The respective effects and vulnerabilities induced by climate change are very specific to locations and content, as are the capacities available for adapting to climate change.

The need for action is not a matter of dispute. The formulation of adequate options for action is reaching geographic and time-related limits. While climate forecasts for moderate latitudes allow for longer-term statements, it is often impossible to derive such statements for tropical and subtropical locations due to insufficient data. Another factor is uncertainty with regard to the modelling of future climatic developments at regional and local levels, and their concrete effects on agriculture in particular. This is one of the reasons behind the low degree of precision for specific locations on the part of long-term strategies and medium- and short-term measures in respect of food insecurity caused by climate change. Strategic approaches of development co-operation aiming at sustainable food security under such variable climatic conditions must address this situation as well as possible by supporting the highest number of flexible and locally adapted solution approaches which are tested on a regular basis to determine the extent to which the assumptions which are used remain correct.

The following section first provides an outline of the international discussion on the different direction and significance of agricultural development with the aim of achieving food and nutrition security against the background of climate change. The cross-cutting issue disaster preparedness and intervention levels, emergency and transitional aid and development co-operation are also outlined. This is followed by an illustration of Welthungerhilfe strategic concerns and principles for sustainable food and nutrition security in the face of changing climatic conditions.

Chapter

5

5.2 The controversy regarding agricultural development and the significance of food and climate change

Notwithstanding its central role in food and nutrition security, the international community and national governments neglected agriculture for three decades before returning it to a prominent position on the development policy agenda. There is now at least widespread consensus regarding the key importance of agriculture and rural development in the fight against hunger and poverty, and the necessity to promote agriculture more intensively than has been done to date. In this context, small agricultural operations are also considered more important. The development community and international agricultural research is now paying more attention to supporting local innovation.

At the same time, the basic tenor of key institutions such as the World Bank, the High Level Task Force (HLTF), the Global Donor Platform on Rural Development (GDPRD), the Comprehensive Africa Agriculture Development Programme (CAADP) and the Alliance for a Green Revolution in Africa (AGRA) was initially one of „more of the same", i.e. the revitalisation of old ideas and concepts of agricultural development, with significant attention devoted to increasing agricultural productivity. The negative ecological and socio-economic effects of the failed policies of the past have not (yet) been comprehensively reflected and addressed in a credible manner (see also Forum Umwelt & Entwicklung 2008).

The IAASTD[18], in which more than 500 scientists participated over a period of four years as part of a trans-disciplinary process, represents the sole exception and demands a change in direction, as „More of the same!" was no longer deemed an option (IAASTD 2009: 6). The report also picks up on the political concept of food sovereignty.

Key statements of the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)

- Eco-system services play a key role in the survival of human beings.
- Agricultural activities must fully exploit their climate protection potential.
- Hunger must be overcome locally.
- The current AKST concepts (knowledge, science and technology in agriculture) have provided the least benefit to small-scale farmers, women and marginalised population groups. It is now important to provide them with targeted support that corresponds with their needs.
- Improved access, particularly to productive resources, markets and financial services, is essential to improving livelihoods in rural areas.
- Traditional knowledge represents a wealth of information that is required for achieving developmental and sustainability objectives.
- Participatory co-operation in generating knowledge, technological development and innovation should be supported.

[18] Information regarding the IAASTD, regional reports and a synthesis can be found at www. agassessment.org.

Chapter
5

- The ecological, health-related and social consequences of all technologies must be considered.
- Multi-layer correlations exist between agriculture, food and health; therefore production cannot only focus on quantity and price.
- The multi-functional nature of agriculture must be recognised.
- Measures to support gender equality are urgently required.

While the agricultural lobby and some governments strongly criticised the IAASTD because of its critical assessment of industrial agriculture, genetic engineering and the global agricultural trade, and ignored its recommendations[19], non-governmental organisations have largely agreed with and supported the analysis and statements outlined in the report.

The discussion surrounding the IAASTD and the future of agriculture generally is carried out against the background of two opposing schools of thought regarding agricultural development, which come to very conflicting and contrary conclusions for achieving food security. Naturally, this affects the selection of strategies for the adaptation of agricultural measures to changing climatic conditions[20].

- On the one hand, attention focuses on linear and technocratic approaches which rely on productivity increases based on technological innovations, such as the internationally controversial issue of genetic engineering. The goal is the further rationalisation of high-yield agriculture that is based on external inputs and externalises its environmental and social costs – as a way towards further reducing producer prices. Private industry is viewed as a central player. Characteristics of this technocratic approach include the commercialisation of the entire food system and a strong focus on international markets, and the integration of small-scale farmers into the latter.

- The other approach emphasises the advantages of sustainable and multifunctional agriculture that produces for local and regional markets and also pays attention to the maintenance of eco-system services. Traditional and local knowledge is recognised, and participatory research and the involvement of farmers in agricultural knowledge and technology development are emphasised. Rights-based approaches are supplemented with a demand for democratisation, localisation and the sustainable design of food systems (food sovereignty). The objective is to fight poverty and hunger, and to improve options for life choices, particularly for those who make their living from agriculture.

[19] The international agricultural industry association Croplife and Syngenta withdrew from the process shortly before its completion. The US, Canada and Australia did not sign the IAASTD, even though they acknowledged it as a „valuable and important contribution"

[20] In the author's view, this dichotomous culmination into two incompatible views of the world highlights the need for a decision – between the non-contemporary and unjustifiable „more of the same" approach, or a further development towards systemic and sustainable alternatives. Co-existence appears to be almost impossible in view of the different criteria and characteristics, also because current framework conditions seriously disadvantage sustainable approaches (see Gottwald, 2011).

Chapter

5

While the primary focus of agriculture should be on food production. Its ability to produce fodder and energy plants, medicine and natural fibre should also be an important consideration. Agriculture offers people a livelihood (workplaces and incomes) and cultural goods, fulfils a function as a living, recreational and economic space, and should in particular also provide environmental services. Therefore a multi-functional agricultural system not only produces food and other products, but also plays an important role in the economic and socio-cultural development of a community.

Climate change creates considerable challenges for agricultural and rural development. Their effects on food security, the necessity of adaptation measures and the climate protection potential of agriculture (but not so much of the entire food system) are receiving increasing attention. At this time, the focus is on the effects of short-term weather variability in connection with extreme weather events. This is not sufficient however. The FAO mentions potentially catastrophic long-term effects of climate change on agricultural production in the developing economies of the southern hemisphere from 2050 onwards and calls for measures designed to achieve a more resilient agriculture system to be implemented now (FAO, March 2011). At the same time, the negative effects of climate change are already noticeable now (see Section 4).

In the meantime, some of the insights contained in the IAASTD are being taken up by others. For example, the United Nations Conference on Trade and Development, UNCTAD (2011) calls for a transformation of agriculture and refers to the powerful interests of multinational companies in maintaining the status quo. The results of the new research programme on Climate Change, Agriculture and Food Security (CCAFS) by the Consultative Group on International Agricultural Research (CGIAR) and the Earth System Science Partnership (ESSP) are eagerly anticipated[21].

"Agricultural policies must go beyond staples and increase the availability and affordability of a diverse range of nutritious food (vegetables, fruits, animal and dairy products, small fish, under-utilized nutrient-rich indigenous foods, etc.)" (SNC CC 2010: 5)

Multinational companies already changed their focus to food some time ago, more specifically with regard to the addition of micro-nutrients such as Vitamin A to food[22] – and according to their view, it is possible to fight malnutrition largely with the use of chemical products. According to BASF, such programmes are already under way in 30 countries. The enrichment of food products can be useful in emergency situations, but is at best suited for a short-term or locally limited approach, as improved nutrition is not achieved with more rice or maize or rice/maize that has been enriched with additional vitamins and trace elements, but rather with a diet that is as varied and balanced as possible (Herren 2010: 2). To achieve sustainable food and nutrition security in the presence of changing climatic conditions, it is therefore much more meaningful in the medium and long term to promote diversified and adapted agricultural production, varied diets, drinking water supplies and hygiene practices as well as resilient and local food systems (see UNSCN 2010: 16).

[21] http://www.ccafs.cgiar.org/.

[22] For example, see the „world's leading chemical company", BASF, http://www.food-fortification.com/Home.aspx.

Governments and organisations, but also international agricultural research, failed to pay enough attention to the effects of climate change on nutrition aspects. The United Nations Standing Committee on Nutrition (UNSCN) is attempting to include these aspects in international discussions, and is calling for a revitalised „twin- track approach“ to food security, which is designed to reduce vulnerability caused by climate change, and strengthen resilience[23]: In a further developed form, Track One contains the up-scaling of direct food-specific interventions and safety nets. Track Two consists of a broader, multi-sectoral and food-and-nutrition-sensitive approach with sustainable, climate-resilient agriculture and rural development, health and social security systems and community-based approaches and risk management (see UNSCN). In this context, attention is to be focused on the particularly vulnerable target groups of women and small children.

5.3 Intervention levels

A distinction can be made along the respective geographic activity level, hence between approaches and measures for sustainable food and nutrition security at the household and local level (micro-level), regional and national level (meso level) and the trans- and international level (macro level).

Humanitarian organisations and development co-operation organisations, along with Welthungerhilfe, address a number of very different issues that are manifested on a variety of intervention levels: development-oriented emergency aid and transitional aid, as well as long-term development co-operation. The experience that there is a gap between the respective intervention levels led to the creation of the approach of linking emergency aid, rehabilitation and development aid (Linking Relief, Rehabilitation and Development, LRRD), also because the individual phases often co-exist in practice. Welthungerhilfe is active at all aforementioned levels and provides „integrated aid“. In this context, the organisation views disaster prevention or risk reduction as a cross-cutting task.

In connection with climate change, a distinction is made between mitigation and adaptation. Many negative effects can be prevented, reduced or delayed with climate protection measures - for example, in line with climate-friendly food systems: reduction in greenhouse emissions and improved carbon sequestration particularly for soils and forests.

For a long time, the climate discussions in the context of the climate framework conventions (UNFCCC) focused on reducing greenhouse gases and pushed issues of adapting to the negative effects of climate change into the background. This view was justified with damage scenarios. The fourth progress report of the IPCC (2007) has highlighted that extensive adaptation measures are needed to address the de facto or expected effects of the warming process that can no longer be prevented, and which are due to earlier emissions[24]. At the Conference of the Parties of 2010 in Cancun/Mexico (COP 16), adaptation was recognised for the first time as equivalent to mitigation, a work programme for adaptation was approved and reference was also made to the connection between nutrition and food security (see FCCC 2011/3).

[23] At the international conference Financing for Development 2002, the FAO, IFAD and WFP agreed to a „twin-track approach“ for the fight against hunger and poverty, the revitalisation of which is also demanded by IFPRI, the FAO and the UN High Level Task Force on the Global Food Security Crisis. www.fao.org/docrep/006/j0563e/j0563e00.htm.

[24] However, the longer emissions reductions and the relevant investments are delayed, the more difficult it will be to achieve a lower stability level - and increase the risk of serious climate effects in the process. In addition, as climate changes increase, opportunities for successful adaptation are reduced, along with an increase in associated costs (IPCC 2007: 23, 35).

Chapter

5

Mitigation and adaptation initially require the preparation and dissemination of knowledge, the personnel-related and institutional development of capacities, climate-sensitive infrastructure development including spatial and land use planning, affordable and adapted technologies and cultivation methods as well as the relevant financing mechanisms. Coherence and synergies must be maintained, so measures designed to reduce emissions do not undermine food security and the right to food. The fact that this implies target conflicts, for example in the context of the long-term intensification of agricultural production, cannot be denied. Maladaptation refers to interventions and adaptation strategies that increase the vulnerability of certain population groups, sectors and systems with respect to food insecurity (e.g. monocultures, high-yield varieties, high-performance varieties that are susceptible to disease, agro-fuels) by further increasing the vulnerability of the community and socio-ecosystem to the effects of climate change, or further driving forward climate change instead of contributing to its reduction. In the process, it is important to think in terms of „risk spaces“: positive measures for one population group are quite conceivable in integrated contexts (e.g. flood protection by rivers), which however increase the risk for groups that live further downstream. Therefore mitigation and adaptation cannot be viewed separately from each other. Where possible, adaptation should also always imply mitigation measures, and therefore fulfil a double function. Mitigation and adaptation measures are important to all intervention levels of humanitarian organisations and organisations concerned with development co-operation.

5.3.1 Disaster preparedness or risk reduction: a cross-cutting issue

Disaster preparedness refers to targeted preparedness activities designed to reduce the risks of natural hazards and man-made disasters. In the context of this Study: “Sustainable Food and Nutrition Security under Changing Climatic Conditions”, it refers to disasters induced by climate change, and the medium- to long-term preparedness for the potential occurrence of extreme weather events and their consequences. Therefore it concerns anticipatory action. In the context of sustainable food and nutrition security, it refers to food- and gender-sensitive risk assessment, prevention (particularly through climate-sensitive infrastructure investments and educational measures especially for women and children) and preparedness for potential disasters (e.g. participatory preparation of emergency plans, regular training of target population, development of and equipment for emergency teams and supply capacities) and social protection measures.

Past experience has shown that the benefits of disaster preparedness by far outweigh the costs[25]. As part of the international decade for the reduction of natural disasters (IDNDR, 1990-1999), disaster preparedness has gained in international stature and has been recognised as a component of sustainable development. During the most recent Conferences of the signatory governments held as part of the climate framework convention, disaster preparedness was highlighted as a central instrument for adapting to climate change. The IPCC plans to submit a „Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation“ at the end of 2011.

[25] For more information on the EU strategy for supporting disaster preparedness in developing countries, please see http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0084:FIN:DE:HTML.

Hyogo Framework for Action 2005 – 2015

Five prioritised action fields of disaster preparedness:

1. Institutionally strengthened disaster preparedness,
2. Identification, valuation and monitoring of risks and strengthening of early warning capacities
3. Creation of a culture of security and resistance
4. Reduction of important risk factors
5. Preparedness for disasters.

The ecological effects of disasters are serious and frequently irreparable. In addition to technological, infrastructure and spatial planning, as well as educational approaches, it is particularly important that the susceptibility to disasters and the vulnerability of a community are reduced: The fight against poverty in the wider sense can have a significant impact in reducing the number of dead and injured as a result of disasters as well as the effects on food and nutrition security. A better understanding and a more responsible management of ecosystems helps to reduce the effects of a disaster on the one hand (e.g. mangrove forests as protection from storm surges and as habitat, trees as wind and erosion protection, adapted shoreline management to protect against flooding), and to maintain natural habitats on the other hand.

It must be noted that extreme natural events per se do not necessarily have to lead to a disaster. Rather, disasters are caused by a combination of natural hazards, a lack of preparedness and the vulnerability of socio-ecosystems.

The strengthening of communities plays a particularly important role. Capacities for minimising risks and preparing for disasters, and for managing, adapting and strengthening resilience must be developed based on traditional and local knowledge and through the use of „modern“ scientific insights and adapted technologies. Not least there is also a requirement to appeal to responsible government leaders in line with advocacy work, and address issues of power, ownership and income, with the goal of achieving preparedness for food insecurity as a result of disasters induced by climate change, and to reduce the structural causes of vulnerability.

5.3.2 Development-oriented emergency aid

Emergency aid refers to the provision of immediate short-term and survival aid to quickly reduce the suffering of victims of natural disasters or violent conflicts.

Climate change has increased the number of people affected by disasters caused by weather extremes, including droughts, hurricanes, storm surges, heavy rainfall and as a result of floods or landslides. Disasters destroy development successes achieved to date, and often exceed the capacities of the affected community and government. Reconstruction ties up personnel and financial resources. Direct humanitarian aid tends to work in a top-down manner (even if the population is integrated into the setting). It is designed for short-term action and is directed by the principles of impartiality, independence and neutrality. Welthungerhilfe implements visible and quickly-acting aid measures, such as

supplies of food and drinking water, medication and health services, the containment of epidemics and the distribution of sanitary products, household items, blankets and the provision of shelter (for information regarding the significance of health care and healthy environmental conditions to food and nutrition security, see 3.1). However, emergency aid activities cannot stabilise the livelihoods of the affected population.

„Do no harm" is an important basic rule for avoiding the potential negative effects of humanitarian intervention.

Therefore Welthungerhilfe focuses on development-oriented emergency aid: it implements measures that go beyond initial emergency aid – measures that reduce susceptibility to future disasters, support the (existing) self-help capacities of people and communities and form the foundation for sustainable development (see LRRD). It will be important to further develop the conceptual framework conditions for emergency aid so that they result in the stabilisation of livelihoods and a reduction in the risk for the affected population, which forms the basis for longer-term co-operation.

Welthungerhilfe has signed the code of conduct of the Red Cross (Code of Conduct 2007) and has adopted the Sphere Standards of emergency aid for people in distress. A new handbook has just been published (2011), which now takes into account the effects of climate change[26]. The regional procurement (short transport routes) of climate-sensitive, where possible – relief items and temporary shelters is an important factor in preventing dependencies, strengthening regional economic cycles, creating work and incomes, and also in view of reducing climate change.

Food insecurity and diseases frequently accompany disasters. The image of food aid[27] has been tarnished as a result of significant weaknesses in the past. Criticism is and has been primarily directed at the use of surpluses e.g. in Europe and US, but also how food aid often benefits the urban population and elites and hastens the rural exodus. Food aid can make local production more difficult, displace traditional food and change consumer habits. It can destroy local markets, increase the dependency on humanitarian aid and promote a recipient mentality. 2003 marks a turning point in international food aid. Welthungerhilfe clearly understands: Food aid must lead to sustainable self-sufficiency according to the principle of help towards self-help[28].

5.3.3 Transitional aid (rehabilitation)

It is important that reconstruction after a disaster is used as an opportunity for improvements: „build back better". Reconstruction not only aims to replace what has been lost, but also to improve the livelihoods and living conditions of people and compensate for socio-economic disadvantages. The last item is particularly noteworthy; also because marginalised population groups are particularly affected by disasters. Ecologically-compatible and

[26] See www.sphereproject.org/
[27] In addition to food distribution, vouchers or tokens may also be distributed, or people may be involved in reconstruction efforts in line with „Food for Work" or „Cash for Work" measures.
[28] See Welthungerhilfe: Emergency aid orientation framework.

participatory reconstruction or development-oriented rehabilitation following disasters (and military conflicts) are designed to establish the conditions for climate-sensitive as well as sustainable food and nutrition security oriented development.

Reconstruction and rehabilitation must be organised on as decentralised a basis as possible, and must be in the hands of the affected parties, whereby the inclusion of women must be given particular consideration, to ensure that reconstruction corresponds with local requirements and that self-responsibility and the self-help capacities of people can be strengthened. Rehabilitation includes the repair and reconstruction of shelter and sanitary facilities, the repair of utility, water and waste water systems, roads and bridges, as well as the reconstruction of community facilities such as schools, health stations, but also markets and warehouses. It includes the preparation of fields and consultancy regarding the sustainable management of the latter. Lost seed and other agricultural inputs, farm animals, fishing boats and nets are replaced. Savings and loan schemes are introduced so that people can continue with their work. Food-sensitive educational measures for health care and hygiene are used for a better use and utilisation of food. And last but not least, psycho-social support is also required to help people overcome traumatic events[29]. Such measures serve as a bridge between emergency aid and long-term development co-operation.

5.3.4 Development co-operation

Development co-operation aims to achieve long-term changes in terms of a sustainable improvement of living situations, incomes and life choices – including developing capacities as well as financial, technical and personnel support. In this context, the integration of social and gender equality, ecological responsibility and economic efficiency is of particular importance. Development co-operation uses instruments that allow for medium- and long-term adaptation to climate change, whereby mitigation potentials must also be noted.

In the context of changing climatic conditions, it is important to analyse which measures can be used to minimise risks and reduce the vulnerability of human beings, and how the adaptation capacities of humans can be improved and the resilience of socio-ecosystems can be strengthened. The main objective is to „do the needful better“, hence not necessarily do something else, but design „classic“ measures – here related to food and nutrition security – so that intended successes can be not only achieved but also secured under changing climatic conditions (risk reduction as a prerequisite for sustainability). In addition, it is also important to scrutinise the effect of development co-operation-interventions on climate change-induced risks to people‘s livelihoods (see The Development Fund 2008).

The necessity of long-term climate change adaptation measures and their effectiveness are generally not in dispute. At the same time, there has been a tendency towards a decline in the importance and financing of long-term project and programme support by the national and international donor community in favour of short-term disaster aid – often at the expense of forgotten, insidious disasters. For the purpose of being able to respond to

[29] Since this does not constitute a focus area for Welthungerhilfe, it co-operates with other organisations.

climate change-induced food insecurities in a proactive, meaningful and long-term manner, given the present structural conditions, the issue receives particularly attention within the framework of Welthungerhilfe programmes and projects. Even though transitional aid only features a limited project period of one to two years, it can nevertheless establish the basic building blocks for long-term climate change adaptation. A continuation of activities crucially depends on the co-operation with the respective partner organisations and local and national governments, and their support in the establishment of local administration structures and institutional capacities. Supporting the adaptation capacities of people and socio-ecosystems takes time – hence long-term interventions of development co-operation. Welthungerhilfe also advocates this position as part of its policy work and lobbying activities. Thematic interfaces and coherence must receive special attention.

5.4 Concerns and principles

Welthungerhilfe emphasizes outcome and impact-oriented co-operation to improve people's living conditions and advocates structural changes from the local to the global level (representing the interests of its target groups)[30]. Welthungerhilfe aims to work towards implementing the right to food and sustainable food security, considering nutrition in particular, and to support food sovereignty.

In this sense, agriculture that is compatible with its location[31], climate-sensitive, sustainable, farm-oriented and multifunctional, alongside the sustainable use of natural resources are accorded special attention particularly in view of changing climatic conditions, since it is likely the best way to minimise the food insecurities associated with climate change.

Welthungerhilfe agrees with the general statements of the IAASTD. It supports the required transformation of agriculture in the developing countries of the southern hemisphere into an ecologically adapted, economically sound and socially compatible direction. Sustainable, ecological agricultural practices that maintain natural production principles and livelihoods are supported for a long-term food security process. Dependencies on expensive and external inputs are avoided and people receive support with reducing existing dependencies. Those target groups that are directly or indirectly dependent on agriculture and the use of natural resources play a key role in this regard. The focus on ecological, economic and social sustainability is extended to the entire food system.

Of particular importance is an improved understanding of food aspects and patterns and the documentation and dissemination of traditional knowledge and skills – for example, with regard to the use of local food plants, improved conservation and storage of food products, improved hygiene and health care and cooking practices. (Agricultural) advisory services must be directed accordingly – also by Welthungerhilfe's partners. Already in the past Welthungerhilfe has been supporting target groups to take responsibility for their own actions and supports participation at all levels. The strategic concern of strengthening target groups as independent actors applies as a working principle at all intervention

[30] Cf. Concept papers and orientation frameworks of Welthungerhilfe: www.welthungerhilfe.de
[31] Cf. also Welthungerhilfe In Brief No. 19: Farming against poverty and hunger

levels. Welthungerhilfe programmes and projects must be based on a comprehensive understanding of people's potential, their traditional knowledge and local experience, as well as the strengths of existing systems, whereby the integrated use of formal, non-formal and informal knowledge also plays an important role. Civil society, local partner organisations and communities are involved in each phase as key actors, and receive support with developing their knowledge, abilities and skills through advisory services, training, organisational development, funding and contributions in kind. The strengthening and empowerment of the target groups as independent actors for the definition, further development and implementation of mitigation and adaptation strategies plays a particularly important role, also because they are frequently most aware of their adaptation requirements and opportunities („community-based approach"). Adaptation must take place at the local level. Finally, the challenge for Welthungerhilfe, its partner organisations and the affected parties will be to prepare for climatic developments that are now largely unknown and to be able to influence the political framework conditions.
Lack of gender equality is one of the main reasons behind food insecurity. Welthungerhilfe already recognises the special role of women in the context of food security. In their role as agricultural producers, seed managers, animal breeders, plant collectors, herb specialists, resource managers and providers for their families, women are particularly affected by climate change (higher risk exposure and vulnerability), also because their access to productive resources, community goods and services as well as opportunities for political involvement are usually limited. Their already large workload is further increased by resource shortages caused by climate change (food, water, firewood), which in turn negatively impacts their ability to provide for their families, in particular smaller children, and increases the risk of malnutrition (see WHI 2009, DIE 2009, IAASTD 2008).

Therefore it is of particular importance that the education and health of women is improved, that they receive assistance with regard to their living and work conditions, and that their role in society is strengthened. In particular, this is about access to social services, secure access to and control over land, water and seed, as well as access to information and advice, to financial services and markets, and not least to political decision-making processes. Support for the development of women's capacities as potential agents of a sustainable transformation of food systems, an recognitiont of their knowledge, their experience and skills, as well as support for the organisation and network formation for women is an important factor in the fight against poverty and sustainable food security, particularly also for children (see eldis, IAASTD 2008, GDPRD 2010).

Due to the geographic and time-related complexity and the correlation between climate change, the degradation of natural livelihood resources and food security, Welthungerhilfe avoids where possible isolated projects without connections to the relevant national, regional and community programmes, adaptation and development plans (e.g. NAPAs, PRSPs). Rather, the respective measures for mitigation and adaptation to climate change, and sustainable food and nutrition security (as a cross-cutting task) are integrated

into the relevant programmes and activities, with a particular focus on coherence (see LRRD). Together with its partner organisations, Welthungerhilfe identifies, analyses and disseminates good practices, particularly at the household and community level, and thus supports South-South learning.

As part of its activities to strengthen sustainable food and nutrition security under changing climatic conditions, Welthungerhilfe relies on close co-operation and exchange with its partner organisations, pays attention to coordination and coherence with other government and non-governmental organisations and institutions, and maintains strategic co-operative relationships with scientific and political networks at the local, regional, national and global level, for example as part of its involvement in national poverty reduction and adaptation strategies, local development plans, with the preparation of the World Hunger Index in co-operation with IFPRI or Alliance 2015 for achieving the millennium development goals.

Any approach towards sustainable food and nutrition security under changing climatic conditions must be based on a holistic concept and a context-specific understanding of food systems. It should not only address the symptoms of climate change and food insecurity but also the underlying causes. Because of the many different and structural causes of food insecurity, it is therefore important to think beyond increasing agricultural production and productivity. Particularly effective approaches include a combination of ecological, social and cultural as well as economic aspects, without losing sight of the political framework conditions. Comprehensive answers that address the structural causes behind the discrimination and marginalisation of the vulnerable rural population are needed (see Bals et al. 2007). This requires lobbying, network and advocacy work at all socio-political levels in order to develop joint positions and political influence.

The goal of food and nutrition security under changing climatic conditions should be adopted as a cross-cutting task in all Welthungerhilfe's strategic and operating units. Approaches for sustainable food and nutrition security are being pursued along all three outlined intervention levels (emergency aid, development-oriented transitional aid and long-term development co-operation) along with disaster preparedness; they must also

- be based on an assessment of risks and include provisions for the case of a disaster,
- target the structural causes on which vulnerability is based, and strengthen the resource base of people and communities to reduce vulnerability,
- enhance people's adaptive capacity for more resilience, and always exploit climate protection potentials as part of this process. The relevant measures are introduced in Part B which follows.

In this sense, it is less about the development and application of new approaches but rather about building on existing, well-proven approaches, and the existing strengths and competencies of Welthungerhilfe and its partner organisations. Similarly, it is also important

to ensure an adequate and explicit consideration of the four dimensions of sustainable food and nutrition security, in particular food and the special challenges resulting from changing climatic conditions:

- promoting sustainable resource management to maintain natural ecosystems and agricultural production foundations,
- promoting climate-sensitive, ecological and diversified agricultural production that is appropriate for the location in order to achieve varied and healthy diets (at the household and community level), to maintain natural production bases and livelihood resources, and to secure work and incomes,
- improving hygiene and nutritional education, access to clean drinking water and waste water disposal, as well as strengthening basic health and nutritional counselling particularly for risk groups,
- promoting social capacities, strengthening communities and networks of the partner organisations, in order to promote development from the bottom up (ownership as strategy element).

Chapter

6

B. APPROACHES TO PRACTICAL ACTION

Based on the discussion and strategic approaches in Part A, Part B introduces practice-oriented approaches to action, instruments and concrete measures for sustainable food and nutrition security under changing climatic conditions. They are discussed in relation to the following three areas: risk assessment, strengthening of the resource base to reduce the causes of vulnerability, and increasing the adaptive capacity for more resilience. Each discussion starts with a definition of the objective, followed by an introduction of the corresponding instruments and measures, taking into account food and nutrition security dimensions. The partial overlapping of measures between the respective areas of activity cannot be avoided due to the complex interrelationships, particularly if they are based on more holistic approaches. When combined, they can make an important contribution towards sustainable food security.

In this context, it must be noted that not only are the ecological and socio-economic effects of climate change on food and nutrition security in the different regions very context-specific, but that the leeway for action and response opportunities by people and households can differ widely – depending on the availability of human potential and social capacities as well as material, financial and ecological resources. The important topic of general – favourable or unfavourable – political and institutional framework conditions is also discussed.

A checklist for sustainable and climate-sensitive food and nutrition security with guiding questions for the planning of new projects and programmes forms the end of Part B.

6. Measures and instruments for achieving sustainable food and nutrition security in the face of changing climatic conditions[32]

Planning for new Welthungerhilfe country and regional programmes and relevant projects and the subsequent adaptation of already existing projects – should include a consideration of climate-sensitive and sustainable food security in all of its dimensions, particularly taking into account food (and nutrition) as a cross-cutting issue. It is important to ensure that measures are climate-friendly, i.e. are not associated with any or only minimal greenhouse gas emissions, and that the sustainability of humanitarian aid and development co-operation projects can be ensured even under changing climatic conditions (see also the method for climate proofing, Welthungerhilfe 2011). In general, this requires a context-specific and risk-sensitive mix of instruments and measures that targets all aspects of climate-induced food insecurity.

The options for action available to the Welthungerhilfe target groups for managing and adapting to climate-induced food insecurity can be classified as follows:

[32] Redundancies with Part A are intentional, so that Part B may also be read on its own.

- Maintenance and strengthening / intensification of existing strategies and successful practices,
- Enlargement of existing strategies and practices while at the same time strengthening new and better adapted strategies,
- Diversification of strategies and practices for the purpose of spreading risks and reducing vulnerability,
- Reduction of strategies and practices (concentration on a few).

Another adaptation strategy may include temporary, partial or full migration[33]. The respective strategies and practices may be pursued in a reactive or proactive manner.

A distinction can be made between coping and adaptation measures. While reactive coping strategies target short-term survival after a disaster and during the course of a crisis, and frequently degrade the resource base as a result of a lack of alternatives, adaptation is a continuous and planned process that targets alternatives for securing livelihoods and utilises resources in a sustainable manner[34].
A related distinction is made between autonomous and planned adaptation strategies: autonomous adaptation as a reaction to noticeable climate changes is based on current experience, existing knowledge and technology; it must be promoted in a systematic manner. At the same time, due to the growing challenges but also because of structural barriers, this approach often does not suffice to warrant food and nutrition security in view of a situation that is being exacerbated due to climate change. It is also the reason why there is a need for planned adaptation and the corresponding institutional capacities and favourable political framework conditions (see IPCC, 2007). Adaptation in this sense must be viewed and planned in terms of risk spaces. Otherwise there is a danger that improvements in one space lead to increased risks elsewhere.

During the drought of 2009, poorer households in central Kenya were forced to implement drastic coping measures. Emergency sales of cattle and goats were common, as was temporary migration to friends and family living in regions that were less affected by the drought.

Frequently, the best adaptation options are not completely new solutions but rather innovative modifications to proven practice. This approach focuses on the study, evaluation and systematic integration of traditional knowledge systems, local experience, skills and practices, but also uses relevant „modern“ scientific insights and adapted technologies. Rather than introducing new and foreign practices, it is recommended that, for example, traditional cultivation systems or traditional animal husbandry, which have been frequently discredited as backward but are of great importance to food and nutrition security, are improved in a sustainable manner (see The Development Fund 2008)

It must be noted that all interventions should be based on the specific challenges and vulnerabilities, local capacities and opportunities, since the failure to understand local livelihoods and integrate communities runs the risk that these measures are not only not useful but may even contribute to increased vulnerability. The risk of maladaptation can be prevented with a systematic evaluation of climate change induced risks (see 6.1), causes

[33] In this vein, mobility is sometimes that most important adaptation strategy for changing climatic conditions for pastoralists.
[34] See www.careclimatechange.org.

of vulnerability (see 6.2) and possible subsequent effects of development interventions (see OECD 2009). Similarly, another form of maladaptation is neglecting to use the few new opportunities to secure food which result from climate change. Therefore it is also important to determine potentially positive climate change effects on local food security.

A checklist for identifying maladaptation contains the following questions (see. Barnett/O'Neil 2010):

1. Does the activity disproportionately increase greenhouse gas emissions?
2. Does the measure lead to a disproportionate increase in the vulnerability of especially vulnerable population groups?
3. Are the ecological, social or economic costs of the activity high as compared to the alternatives (opportunity costs)?
4. Does the activity reduce the incentive for independent adaptation or increase dependence on third parties?
5. Does the activity define development paths at the expense of the flexibility required in view of future adaptation requirements, for example through expensive infrastructure investments?

Following an evaluation (risk assessment, vulnerability, adaptation capacity), Welthungerhilfe prioritises those activities that are reasonable and can be implemented in view of the target groups, and which make a meaningful contribution to reducing poverty and hunger and sustainable development. A selection is made using the criteria and principles for sustainability.

Principles for sustainable projects:

- ecologically compatible, climate-sensitive and appropriate to the location,
- socially just, socio-culturally embedded, technically adapted,
- effective and
- efficient (cost-benefit relationships),
- organisationally, economically and politically feasible
- coherent (with existing measures and other actors).

Strengthening the self-help capacity, innovative power and resistance of people and local communities is an important Welthungerhilfe objective. In this sense self-organisation and the development of social capacities, network formation and work are playing an increasingly important role, so that communities and partner organisations are able to advocate changed

[35] So ist für Pastoralisten Mobilität mitunter die wichtigste Anpassungsstrategie an sich verändernde klimatische Bedingungen.
[36] Vgl. http://www.careclimatechange.org.

political, institutional and economic framework conditions in the direction of food sovereignty at the local, national and also global level. Welthungerhilfe is also increasingly committed to sustainable and climate-sensitive food and nutrition security as part of its networking, lobbying and advocacy work, and maintains strategic alliances with other non-governmental and governmental organisations and the scientific community.

6.1 Risk assessment, early warning capacities, and disaster preparedness

The objective of risk assessments and precautionary measures is to support communities and households in identifying, evaluating and minimising current and future risks related to food insecurity induced by climate change, and to be adequately prepared for potential hazards, hence to act in a forward-looking manner instead of simply reacting to events.

The corresponding awareness-raising and development of capacities is designed to help target groups, local partner organisations and Welthungerhilfe staff identify and evaluate risks related to climate change, and to be able to prepare for extreme weather events and the consequences of long-term climate change in view of food security.

Risks such as weather-related insecurity, pests and diseases, and also price fluctuations are nothing new for the agricultural activities. However, there is now an increasing probability that the industry will be affected by direct physical impacts that accompany climate change, such as rising sea levels, floods or increasing extreme weather events such as droughts, heavy rainfall and hurricanes. Factors such as increases in temperature, changing rainfall patterns, soil erosion, the melting of glaciers and rising sea levels all lead to water supply problems, animal deaths, harvest and income losses as well as the destruction of settlements and work materials. Such developments put at risk livelihoods, health and food security, and millions of lives in the worst case scenario.

6.1.1 Risk assessment

Not least because risks are perceived and evaluated so differently, it is important that communities and partner organisations are integrated into the risk assessment process, whereby food aspects (food and nutrition risk assessment) must be given special consideration. Where possible, a joint analysis process involving the local partner organisations and target groups should identify those population groups that are most at risk with respect to food insecurity, and collect the relevant information in order to identify, understand and evaluate the local-specific, current and future risks as well as new opportunities. Not only does this represent an important sensitivity and awareness-raising measure, but the success of this measure also depends on the systematic integration of the affected people with their traditional knowledge, abilities and skills as the main actors for the (further) development and implementation of measures.

Chapter

6

With respect to the participatory analysis process, the following methods are suitable: charting of hazards for identifying climate change-related risks to infrastructure and natural resources, seasonal calendars for recording recurring climate-related stress periods as well as trend analysis of extreme events to estimate climate trends and their effects on the availability of food (see Practical Action).

The information gathering and collocation process must include embedding local knowledge and experience, but also researching scientific documents for the respective region and observation of political and strategic approaches (cf. Tearfund 2009, Welthungerhilfe 2011: Climate proofing).

Table 1 below illustrates an example of what a joint risk assessment may look like. The left column shows how climate change has already manifested itself and which effects are expected in terms of habitats: e.g. higher temperatures, changes in rainfall patterns, more frequent and more intense extreme weather events or rising sea levels. The centre column identifies the populations that are particularly affected by the respective effects: Small-scale farmers, particularly small-scale farming households led by women, pastoralists, landless agricultural workers, fishermen and women, people living in forests, indigenous as well as other marginalised and particularly vulnerable population groups such as children and women, as well as the old and infirm. The right column describes, in as much detail as possible, the risk of being affected by food insecurity in relation to the dimensions of food and nutrition security (availability, access and use and utilisation), whereby it is particularly important to note the mutual correlation of the food and health situation.

Table 1: Risk assessment

Manifestation of climate change	Affected regions and people	Risk description and assessment
Rise in temperature, heat waves, droughts, soil erosion, desertification, less and less reliable rainfall, water shortages, forest fires	Arid/semiarid regions, farmers, pastoralists, fishing families, forest dwellers (in all cases both women and men)	■ Lack of available food: decrease in fish catches, animal deaths, reduction/loss of harvest, damages to forests, higher incidence of pests and plant diseases, storage losses ■ Lack of access: production losses, income losses ■ Negative impacts on the use & utilisation of food: lower food and drinking water quality, deteriorated hygiene and care opportunities, higher susceptibility to disease, dropping out of school
Increase in rainfall amounts, more intense rainfall, floods, landslides	People in coastal regions and river delta regions	■ Lives at risk, higher risk of injury ■ Lack of availability: destruction of fields and stocks ■ Lack of access: negative impacts on infrastructure (see below) ■ Negative impacts on use: lower water quality and availability, health problems
Glacial melting, landslides	People in mountainous regions and valleys fed with melt water	■ Decreasing water availability and quality ■ Water and energy supply problems ■ Internal migration ■ Increased conflict potential
Floods, hurricanes, rising sea levels	People in coastal and river areas, in regions at risk of storms	■ Lives at risk due to weather extremes ■ Lack of availability: Loss of fertile land, animals and inputs, damages to forests, soil and water degradation through salinisation or industrial poisons as a result of flooding, water shortages ■ Lack of access: limited self-sufficiency opportunities and destruction of roads, transport means, warehouses and markets, higher costs, resettlement, loss of social networks, dependencies, limited educational opportunities ■ Negative impacts on use & utilisation: destruction of shelter and food preparation options, sanitary and health facilities, spread of disease

Risk may be categorised according to the probability of occurrence (very likely, likely, occasionally) and the potential severity of impact (negligible, moderate, serious, critical, catastrophic)[35]; measures to be implemented can be prioritised by classifying them as high, medium and low risk, as well as with respect to the capacity to manage the risk and implement the corresponding adaptation measures (=adaptive capacity, see 6.3) (see FAO 2010).

6.1.2 Identifying options for action

Sri Lanka: Adapting to climate change

In Sri Lanka, the rapid change of rainfall and drought patterns has become a major cause of uncertainty in agriculture. Risks in agriculture are grouped into three main groups: production risks (climatic conditions, pests and diseases), price risks (trade and market issue) and consumption risks (changing consumer preferences, major switches in consumer demand like the margarine versus butter issue, etc.). Farmers try and minimize these risks through measures like insurances or the adaptation of cropping patterns. For example, farmers in Kadiragoda, Hambantota used to grow paddy since generations. Paddy farming had been practised in both "Yala" and "Maha" seasons of the year. Since a decade, however, the paddy is not being cultivated due to shortage of water during the seasons. Farmers in these dry zones are already looking for other crops to plant other than paddy. It is mainly the well resourced farmers who are able to change crop varieties and investigate alternative markets. These farmers have switched to grow drought resistant varieties of vegetables that grow under harsh climatic conditions using organic fertilizer. Drought tolerant varieties of vegetables like Thibbatu, Batu and Brinjals and cereals have enabled them to make up for lost productivity. These new drought resistant vegetables thrive better under changing conditions. Additionally, areas experiencing intense temperature change have switched to a more livestock intensive practice, where that livestock can feed on drought tolerant grasses that would grow under the changed conditions (Tennakoon 2011).

There are several ways of handling risks, and measures in this regard can be classified as follows (see Tearfund 2009: CEDRA, OECD 2009, IPCC 2007):

a) Carry the risk

If the costs of adaptation measures are high compared to the expected damages, the decision is more likely to favour carrying such a risk. At the same time, it is also possible that risks are underestimated due to a lack of awareness.

Particularly disadvantaged groups are often left with little choice but to shoulder the risk due to a lack of resources.

[35] The distinction between „sudden-onset" and „slow-onset" effects must also be taken into account.

b) Share the risk

Traditional solidarity within communities, social safety networks and insurance systems can be used to distribute risk within a particular community.

Insurance for changes in the climate

International climate insurance mechanisms for the poor are practical if they increase farmers' economic protection against drought, floods and other extreme weather events. These are of particular importance if they offer incentives for adapting to long-term climate change in addition to reducing the vulnerability caused by variable weather events.

Initial experience with micro-insurance systems against drought damage incurred by subsistence farmers is currently being gathered in Malawi, where an insurance system provides farmers with access to better seed, enabling them to generate higher yields. A consideration of seasonal rainfall forecasts (possible due to their strong correlation with the El Nino-Southern Oscillation) during the calculation of the insurance policy was used as a control instrument for improved variety selection (see Suarez/Linnerooth-Bayer 2010).

c) Avoid risk

For example, if an agricultural activity can no longer be continued or its location is extremely risky, it is recommended that either its use (e.g. growing other crops) or the location is changed

d) Limit risk

It may also be sufficient or possible to limit the risk of climate-induced food insecurity caused by, for example, hurricanes and floods by measures such as the reinforcement of slopes, the establishment of buffer zones, storm and flood protection, in particular also the protection of natural barriers such as mangroves and the corresponding construction methods, land use and regional planning and the maintenance of (agro) biodiversity and a diversification of livelihoods.

Nine agronomic principles (Das 2011)

1. Mixed cropping of plants with different root depth and structure, resulting in optimal utilization of water and nutrients and higher resilience against environmental stress.
2. Multi-storey agro-forestry extend growing season and reduce soil erosion, while enhancing carbon sequestration.
3. Use of locally adapted plants, animals etc. reduce the need for high external inputs (water, synthetic feed, petrochemical by products etc.)

4. Irrigation using surface water and shallow level ground water and mechanical lifting devices (rainwater harvesting)
5. Biological soil inputs, which enhance capacity of soil to store water, carbon and nutrients reducing need for synthetic chemicals / soil nutrients.
6. Soil and moisture conservation steps that improve stress tolerance, reduce soil erosion and siltation of water bodies
7. Diversifying production system, source of income (enhances biodiversity)
8. Use of bioreactors such as biogas digester, anaerobic composting, small ponds etc. (reduces methane emission)
9. Use of renewable energy resources for irrigation, crop drying, threshing etc. (reduce need for petrochemicals).

In exceptional cases, governments will have no other choice but to resettle people living in high-risk zones into areas that are less prone to risk. Incentives for self-determined migration are much more compatible on a socio-cultural level.

e) Early warning and disaster preparedness

The development of reliable local information and early warning systems has been receiving increasing attention (e.g. weather stations, weather forecasts and climate information, early warning systems for hurricanes or floods, monitoring of food situation).

Moving forward in climate change affected areas of Nepal

In Nepal, climate change has forced non-governmental organisations (NGOs) to adapt their development projects and programmes. While some measures simply strengthen ongoing approaches – such as the conservation of land, forest and water resources, the diversification of livelihood opportunities (including the use of non-timber forest products) and capacity building and training of communities – there are also new and climate change specific measures being taken. For example, the NGO FORWARD invests in disaster risk reduction measures such as early warning systems, rescue bridges, dykes and emergency shelters. In collaboration with research partners, drought tolerant short duration rice varieties (Barkhe 2014, Barkhe 1027, PR 101) are being tested. In order to replace rice fallow, mungbeans are being introduced in rice-wheat systems. In addition, short duration maize varieties help farmers to overcome dry spells (Gurung, 2011; Khanal/Harris/Lakpa/Sherpa/Joshi 2004).

6.2 Reducing vulnerability by strengthening the resource base

The objective is to support communities, households and agricultural production systems in identifying and fight the -frequently political -causes behind their vulnerability to climate-induced food insecurity. They include all socio-cultural, economic and institutional barriers that prevent people from developing and having access to resources („assets“).

The vulnerability of people and socio-ecosystems is greatly dependent on

- the natural resource base (changes to ecosystems, degraded ecosystem services and biophysical stress factors such as temperature, water, wind),
- human potential and socio-cultural factors (such as education, health, age, gender, ethnicity, care, eating habits),
- socio-economic aspects (income opportunities, ownership situations, dependencies, access to productive resources, social and material infrastructure, disaster preparedness) as well as
- political determinants (power structures, poor governance, weak institutions and access rights)

It is also occasionally exacerbated by a lack of natural, individual, social, material and financial resources, all of which play a key part in livelihoods and the range of life choices (see IPCC 2007, ADB 2009).

The consequences of climate change negatively impact the resources of people, households and communities. If there are fewer and poorer-quality resources and access rights for people, they also become more vulnerable to food insecurity caused by climate change. Communities and households that have more resources find it easier to handle insecurities, shocks or changes – whether of natural or man-made origin. Therefore it is of vital importance that the people's resource base is strengthened and diversified, that they are empowered and that efforts are undertaken to work towards favourable institutional and political framework conditions that reduce vulnerability (see 6.5). The reduction in the causes of vulnerability must continue to receive special attention as part of development-oriented transitional aid and longterm development co-operation.

6.2.1 Vulnerability assessment

To understand and subsequently reduce the complex and context-specific ecological, sociocultural, economic, institutional and political causes of vulnerability, such causes must first be identified and evaluated by way of a joint assessment undertaken by Welthungerhilfe, its partner organisations and target groups[36]. This also results in indicators for the corresponding measures (see 6.2.2).

Key questions in this regard are as follows:

- What are the effects of climate change on the livelihoods and food and nutrition security of people (current and future), and which population groups are particularly vulnerable? In this context, it is important to note that socio-ecosystems change over time, for example with respect to population growth, urbanisation, incomes, food patterns, technologies and institutions. (This is a part of the preceding risk assessment 6.1.)
- What are the ecological, socio-economic, socio-cultural and political causes of special vulnerability?

[36] E.G. with the participatory Vulnerability Assessment method CRiSTAL (Community-based Risk Screening Tool-Adaptation and Livelihoods): www.cristaltool.org; see also Füssel, H.M / Klein, R.J.T. 2005.

- What influence do the persons affected exert on these factors?
- Does the target group have access to the key resources required for their livelihood: productive and usable resources, adequate inputs,, infrastructure and financial services, agricultural and non-agricultural income opportunities, savings, social capacities and opportunities for political participation?
- How are these resources negatively affected by climate change?
- What strengths – local knowledge systems, management strategies and practices, social capacities – can be built on (see also 6.3.)?
- How can the involvement of women with their special needs and capacities and that of other marginalised population groups be ensured?

6.2.2 Options for action: strengthening the resource base and reducing the causes of vulnerability

In Tables 2 to 5 below (based on the four dimensions of food and nutrition security), the left column lists the resources of which a lack leads to vulnerability, and the right column outlines options for action to reduce vulnerability. The table does not purport to be complete but can rather be used for orientation purposes regarding the context-specific design.

Table 2: Availability of food

Resource basis	Options for action
Material and financial basis: Lack or loss of productive resources as part of earlier weather extremes, external land acquisitions, lack of storage options **Ecosystem services:** Conversion of natural landscapes, vulnerability to heat, water stress, storms, floods, disease and pest, dependency on rainfall (rain-fed agriculture), additional stress: agrochemicals; changes in land use, deforestation, overgrazing and population pressures **Human potential:** Lack of knowledge or lack of access to information, lack of or weak ability to work (migration, disease) **Political Framework** Lack of political support	■ Development/strengthening of adequate, local and networked educational, information, consultancy facilities and early warning systems ■ Respect for traditional knowledge and local practices ■ Networking of information sources on climate forecasts and early warnings (e.g. FAO re: expected negative impacts on agricultural production) ■ Promoting better understanding of ecosystem functions and services, and effects of climate change ■ Increase and protection of biodiversity ■ Promotion of community-based, sustainable resource management (pastures, forests and non-timber products, fishery and aquaculture) ■ Reforestation/Forestation measures (soil protection, mitigation) ■ Incentives for diversification and sustainable and climate-sensitive production methods: - Ecological agriculture (see FIBL 2007) - Improved land management[37] - Optimisation of irrigation management[38] - Adapted varieties[39] - Integration of land cultivation and animal husbandry Combination of animal husbandry and fishing, Agro-forestry, ■ Prevention of harvest and post-harvest losses ■ Development of seed banks and decentralised food warehouses

[37] Increasing humus levels: crop rotation, intercropping; plough-less or reduced soil cultivation; use of organic fertilizer and compost; avoiding the practice of burning crop residue; better control of wildfires; construction of plant pits and stone rows

[38] Improvement of techniques for extracting and storing water, preparation of water and water protection, and for water use (water collection tanks, terraces, support system management, water protection areas and reforestation, desalination, expanded use of rainwater, efficient irrigation)

[39] Improved, more robust, better adapted heat-, drought-, salt- and flood-resistant varieties; adaptation of seeding periods; biological, integrated pest and disease control; animal, feed and fertilizer management (mitigation and water protection); collection of wild fruits, medicinal plants and non-timber products

Table 3: Access to food

Resource basis	Options for action
Material and financial basis: Dependency on agriculture, little or no income and lack of income alternatives, indebtedness and lack of access to credit, lack of access and weak or destroyed infrastructure (e.g. disrupted transport routes) **Human potential:** Health problems and poor education, lack of self-confidence, lack of political voice **Social capacities:** Lack of social security systems, no or little participation in decisionmaking processes **Political framework:** Local power structures, discrimination of certain population groups, particularly women, conflicts regarding access and use, lack of conflict solution mechanisms	■ Promoting equal and safe access and control over productive resources, such as seed, land, water, animals, fishing grounds, forests and technologies, not least through corresponding advocacy work ■ Supporting diversified livelihoods/agricultural and non-agricultural activities and income options reducing landcity migration due to seasonal factors ■ Climate-sensitive, gender- and food-sensitive improvement of social and material infrastructure ■ Promoting equal access to health, education, information, work, transportation options, local markets, credit and other adapted financial services ■ Social safety systems and transfer services ■ Promoting school and household gardens ■ Empowering women and other marginalised groups ■ Promoting the self-organisation of groups, networks, agricultural co-operatives and joint marketing ■ Promoting social cohesiveness in community and supra-regional co-operation and information exchange

Table 4: Use and utilisation of food

Resource basis	Options for action
Material and financial basis: Lack of or inadequate drinking water supplies or lack of access to sanitary facilities, lack of educational and health institutions, **Human potential:** Lack of awareness and information, bad health conditions, **Social capacities:** Socio-cultural barriers, Food taboos, restricted access **Political framework:** Discrimination and marginalisation of certain population groups, especially women, ethnic minorities, disabled and elderly people	■ Improving drinking water supplies, waste water disposal and sanitary facilities, adequate shelter ■ Information regarding hygiene measures, health risks and precautionary measures ■ Promoting health centres and educational institutions ■ Promoting diverse and healthy diets through corresponding educational and consultancy measures with regard to preparation, food conservation, storage management, preparation and supplies particularly also in view of nutrient losses ■ Improving preventative and therapeutic health measures, particularly for risk groups (infants, small children, pregnant and lactating women, adolescent girls, older and handicapped people) ■ In emergency cases and cases of chronic crises: enrichment of food products

Table 5: Stability

Resource basis	Options for action
Material and financial basis: Destruction caused by climate change **Institutional, political & economic framework:** Poor governance, weak institutions, low and fluctuating world market prices, conflicts over access and use of productive resources	■ Diversified, climate-sensitive, sustainable agricultural production systems/land use ■ Storage management (seed and cereals, food conservation, management of supply inventories) ■ Climate-sensitive construction methods/infrastructure ■ Developing and promoting adequate information systems ■ Investing in participatory research for sustainability ■ Promoting responsible government management, particularly through advocacy work ■ Reducing in social disparities and promotion of conflict solution mechanisms ■ Supporting the development of institutional capacities and NGOs that enable equal access opportunities, rights to ownership and use ■ Advocacy work for changed global economic framework conditions

Social protection measures can also be used to reduce vulnerability, in addition to the livelihood principles that focus on strengthening people's capacities and self-determined life choices. They serve to protect vulnerable households and actually represent a task that should be taken on by governments, even though they are increasingly assumed by non-government organisations. The focus is on material and financial resources; newer approaches also include the political dimension. In this context, the different definitions of social security range from narrowly defined social safety nets to approaches that target the redistribution of income and resources and strengthening the rights of discriminated population groups. Instruments include social services (care of the old, child day care), social transfer services (food, money), insurance, pensions, fee exemptions as well as the fight against discrimination, secure access to common goods and strengthening human rights (see ODI 2010). The approach selected will influence the respective programming and implementation of the measures. It is important that all measures are planned and implemented in consideration of existing risks, since they may otherwise contribute towards increasing such risks and thus counteract what has been intended.

6.3 Increasing the capacity for resilience and adaptive capacity

The objective of strengthening adaptive capacity and resilience is to develop and improve the abilities of communities and households, enabling them to handle climate change-induced food insecurity in a proactive manner. Adaptive capacity refers to the ability to make the correct decisions in view of uncertain future climatic developments, and to implement effective measures to prevent and mitigate food insecurities, and furthermore to identify the few opportunities resulting from climate change and to prevent maladaptation.

Chapter

6

Adaptive capacity results from the experience, knowledge and innovative power of actors to transfer their abilities and skills into concrete practices and adapt their actions to changing framework conditions. In this context, adaptive capacity depends on the respective resources and the institutional and political framework conditions.

Improved adaptive capacities lead to increased resilience, which in turn reduces vulnerability to food insecurity. Resilience refers to the capacity and ability of a socio-ecosystem to constructively manage disruptions and changes and still maintain the same or similar function, structure, identity and feedback and thus continue to develop. This applies equally to ecosystems and societal systems (and their economic sub-systems) which are also very interconnected, which is why we also refer to them as socio-ecosystems[40] (see also Scheffer 2010). Resilience is a key factor in maintaining options for future development (cf. Resiliance Alliance, iied 2009).

The following list of the key elements of a high adaptive capacity by ACCRA clearly highlights the close relationship with a reduction in vulnerability (see 6.2).

The Africa Climate Change Resilience Alliance (ACCRA) outlines the following key elements of high adaptive capacity:

- Availability of key resources, that allows the system to react to changes as best as possible,
- An institutional environment that allows for fair access and rights to key resources,
- Collection, analysis and dissemination of knowledge and information to promote adaptive capacities,
- A favourable environment for innovation and experiments and the opportunity to try out niche solutions in order to develop new opportunities,
- Flexible, forward-looking planning and decision-making processes and governance structures (ODI 2010; http://community.eldis.org/accra/).

Finally, measures designed to strengthen adaptive capacity and resistance aim towards improved innovative power, particularly for small-scale farming households and communities. Measures can be categorised as follows:

a) Information, training and continuing education of local actors (development of capacities),

b) Promotion of social capacities, co-operation and network formation (formation of social capital),

c) Advocacy work for beneficial political framework conditions that enable access to key resources (see 6.2) and promote innovation

[40] Social-ecological systems (Fikret Berkes/Carl Folke 1998).

6.3.1 Information, training and capacity development

The procurement, evaluation and dissemination of information, training and continuing education, agricultural advisory services and corresponding formation of awareness/sensitivity training for vulnerable population, particularly in view of hygiene measures and health care, is very important at all intervention levels and for all dimensions of sustainable food security. Content quality and target group-appropriate preparation are of decisive importance in this context. Subsequently, attention must be directed at gender, food, and climate-sensitive advisory services based on the training and continuing education of agricultural advisors with the corresponding competencies.

Respect for (and associated strengthening of), systematic research and assessment of traditional knowledge, local experience and practices are of fundamental importance, particularly in relation to

- adapted varieties, local breeds and varieties, particularly under-utilised/minor crops (see Jarvis et al. 2008),
- cultivation and harvest methods,
- food conservation and storage management,
- cooking and health practices[41].

The most promising strategies, practices and interventions – e.g. success stories of social transformation processes, for example how negative habits and socio-cultural barriers and other obstacles can be overcome – must be documented, collected, promoted and disseminated with tributes in a manner appropriate to the target group, and further developed specific to the context and with the use of „modern“ scientific insights and adapted technologies.

Hence the first question concerns which food products are produced and how, which food products are purchased and how they are processed, prepared and distributed/consumed within a household. Also in view of nutritional content, improved seed and plants with a stronger focus on little used local plants (e.g. Bambara groundnut, pigeon pea and ensete in Africa) and the genetic potential of animals are becoming increasingly important. In addition, the focus is on reducing post-harvest losses (right time to harvest, transport, storage, conservation and preparation, used in fresh state). Sun-dried fruits and vegetables rich in beta carotene, including mangoes, squash, oranges and sweet potatoes, can store Vitamin A for up to six months, for example.

[41] Promising approaches in this area include „participatory“ videos or experimental learning through group-dynamic / didactic games (www.worldresourcesreport.org).

Chapter

6

Why minor crops matter

In India, there are number of native crops which can tolerate stress. For example, rice has a number of varieties, which can tolerate drought-water stagnation-salinity. Several minor millet varieties, oil seeds and pulses are more productive under climate stress compared to mainstream varieties. Strategic tuber crops, such as elephant yam, tapioca, which can be stored under the soil if not harvested. They supply households with carbohydrate during and after stress periods. There are number of edible weeds, fruits, unknown leafy vegetables which the minority communities use to collect from the commons to meet their nutritional need. Mixed cropping with locally suitable cover crops, minor millets, oil seeds, pulses, leafy vegetables to improve soil health, retains moisture in the soil, expand the farming season, reduce dependency on single crop, hence reduces vulnerability (Das 2011).

Traditional management and adaptation strategies used to handle shocks and long-term changes are essential but not (or no longer) sufficient. Accordingly, research plays a central role in this regard, more specifically research in the form of participatory research with farmers and communities rather than research about affected populations. Therefore another important measure consists of farmers experimenting with alternative cultivation methods and improved seed. Joint learning processes, such as „farmer field schools“, not only serve to disseminate the best practices but also promote the empowerment of farmers (see De Schutter 2010; see 6.3.2). Action research (particularly with the inclusion of interdisciplinary climate change adaptation research) can be used to (further) develop and test local adaptation measures (see Geoghegan 2010). Participatory research needs are also noted in view of the socio-cultural aspects of sustainable food and nutrition security (development and strengthening of knowledge, awareness and the corresponding food practices).

Coping with climate change in the coastal areas of Bangladesh

People living in the coastal areas of Bangladesh are not necessarily aware of the devastating effects of a possible rise in sea level. In order to overcome this, the non-governmental organisation ANANDO, with the support of Welthungerhilfe, encourages the formation of eco-groups comprised of local farmers for local communal survival. Adaptation to saline resistant crop varieties, such as rice seeds from the Bangladesh Rice Research Institute, helps people to overcome low to moderate levels of salinity. Special attention is given the Sunderbands and their protection, the world largest mangrove forests of the world. In addition, hydroponic cultivation (used to grow crops in mineral solutions without soil) is being tested as an alternative to conventional soil based cultivation. Those who are aware of the possible sea level rise use tin or wooden semi-pucca housing instead of cementing works (which are easily decayed by salinity). Semi-pucca houses have fixed

walls made up of pucca material, the roof are constructed out of material other than iron sheets. In these areas, the construction of new water tanks (assisted by non-governmental organizations) for harvesting rain as drinking water is also of high priority. Furthermore, when necessary, people are supported to create their own alternative livelihoods using rickshaws, human-powered transport (Halder 2011).

6.3.2 Promoting social capacities, co-operation and network-building

The dissemination of innovative approaches requires a systematic approach. In this context, it is also important that obstacles to the dissemination of innovative and sustainable approaches are identified and overcome – for example, by establishing the relevant partnerships and networks and promoting institutional capacities. The development of such information and knowledge management systems supports South-South learning, for example through learning and information networks connected via the internet, analogous to institutions such as InfoNet[42]. An example of a global platform for exchanging experiences is the „Adaptation Learning Mechanism“ (ALM), which was set up by the development programme of the United Nations (UNDP)[43].

In addition, it is also important to promote the social capacities (formation of social capital) for the networking, self-organisation and mobilisation of local actors, e.g. through social learning, strengthening of communication between all relevant actor groups, mediation etc. Not least, this is also about strengthening and developing leadership capacities at the local level to strengthen the political co-determination and decision-making capacities and autonomy of communities.

Moreover, multi stakeholder partnerships and innovation processes to adapt to climate change-induced food insecurities must be promoted in a targeted manner, particularly co-operation between practice, research[44] and private sector, for example, through the promotion of climate-sensitive forms of ecological, small-scale agriculture and sustainable food systems.

Living Farms' plea for sustainable agriculture

Living Farm, a partner organisation of Welthungerhilfe in Orissa (India), believes in the positive effects of sustainable agriculture. The use and promotion of locally available resources based on the local knowledge of farmers takes center stage in this respect. At the same time, this also requires the corresponding framework conditions to ensure the right of farmers to soil, water and biodiversity. The production of basic food stuffs must be given priority over the cultivation of crops for national and export markets. Community-oriented seed breeding and propagation along with seed banks must be established to maintain crop diversity (Sarangi 2011).

[42] See also www.infonet-biovision.org/
[43] www.adaptationlearning.net
[44] E.G. with research institutions and initiatives that document and analyse local innovations, such as PROLINNOVA: www.prolinnova.net/

6.3.3 Advocacy for favourable political framework conditions

Advocacy work for supportive policies and adequate institutional framework conditions both for access to key resources (see 6.2, 6.4) and for experiments and local innovations (see Dietz 2006) also plays a central role in improving adaptive capacities.

The promotion of corresponding institutional capacities includes, for example, the systematic promotion of variety diversity, the localisation and realignment of plant and animal breeding programmes to focus on resilience, the promotion of adequate advisory services, weather forecasts, early warning and insurance systems, as well as the corresponding adaptation of agriculture policy.

6.4 Favourable and obstructive framework conditions

Ecological factors, human and socio-cultural aspects, along with the socio-economic and political context, make up the framework conditions that either promote or hinder the reduction of risks and vulnerability as well as the strengthening of adaptive capacities. The section concludes with a list of relevant starting points (no claim to completeness). This is where advocacy work is required from the local to global level in order to encourage politicians to set the course accordingly.

a) Ecological factors

Hindrances to sustainable food an nutrition security in view of changing climatic conditions include in particular the limitation and deterioration of the natural resource base and the degradation of ecosystems and their outputs. The progressive destruction of the production basis (fertile soils, water quality and quantity, biodiversity) is also a particular consequence of industrial food systems.

On the other hand, changing course towards sustainable and climate-sensitive food systems would lead to increased protection of ecosystems, promotion of biodiversity and sustainable resource management, and would take advantage of the potential to reduce greenhouse gases as well as the agro-ecological opportunities caused by climate change. In addition, it is important to utilise potential climate-induced opportunities through modified longer growth periods and access to new varieties.

b) Human and socio-cultural aspects

The lack of respect for traditional knowledge systems, a lack of understanding and awareness, insufficient information and advice, and competing priorities and requirements all have a negative effect. Other challenges to sustainable food security include the breaking up of existing production and consumption patterns and rapid population growth and its effects.

On the other hand, there are opportunities in improved food and health conditions, the development and strengthening of individual capacities, more self-confidence, options for life choices and quality of life as well as improving social capacities, more co-operation

and social cohesiveness and the empowerment and social mobilisation of those affected to overcome the structural causes of food insecurity.

c) Socio-economic and political context / power structures

Good governance and the rule of law are key political prerequisites to ensure that people and societies can better manage shocks caused by climate change and adapt to long-term changes. Frequently, powerful private business interests and the corresponding lobbying activities are behind poor governance and inadequate economic policies (prices, marketing, taxes, tariffs, subsidies, foreign exchange).

Advocacy work for integrated and coherent long-term oriented policies for sustainable food and nutrition security comprises the following focus areas:

- Protection and sustainable use of the natural resources,
- Comprehensive fight against poverty, commitment to human rights (e.g. anchoring the right to food in the constitution) and against unreasonable working conditions and slavery, support for social network building and democratisation processes,
- Commitment to involving civil society in the development and implementation of national climate protection adaptation strategies (NAPA) and programmes to reduce emissions (REDD+) as well as development programmes,
- Access/Communication of information related to scientific findings/forecasts for the target group and translation of technical issues into concrete measures,
- Promotion of gender equality,
- Support for the development of community-based climate protection and adaptation strategies, including disaster preparedness,
- Commitment to the development and expansion of social safety systems,
- Promotion of rule of law, human rights and effective, efficient, participatory, transparent and responsible governance,
- Support for the development of institutional capacities and effective, efficient institutions enabling equal access opportunities as well as rights to ownership and use,
- Investments in climate-sensitive, sustainable rural development and respective infrastructure (education, health, water and energy supplies, information and communication systems, storage management, transport and market opportunities, credit/financial services),
- Commitment to land reforms and corresponding land use planning in order to promote fairer distribution of fertile land and its sustainable use,
- Improve access rights by small-scale farmers to productive resources such as land, water, seed and adequate technology as well as improved social and material infrastructure, diversification of livelihoods,
- Incentives for the sustainable production of diversified foodstuffs and overall promotion of sustainable, localised and democratic food systems,

Chapter

6

- Investments in participatory and sustainable research on agriculture and nutrition incorporating traditional knowledge systems,
- Respective training, capacity building and advisory services (production, processing, conservation, storage, preparation),
- Lobbying for a transparent and fair global trade system,
- And last but not least, advocacy against waste of food and in favour of changing German‘s food consumption patterns in the sense of food ecology: regional and seasonal, ecologically produced and fairly traded, tasteful and easily digestible, mainly vegetarian, preferably minimally processed food that has not been packaged (or packaged with environmentally-compatible materials) – and preferably freshly prepared and consumed in communion.

Chapter 7

CHECKLIST FOR PLANNING NEW PROJECTS AND ADAPTING PROJECTS AND PROGRAMMES

Future Welthungerhilfe projects aim to further increase the consideration of the objective of sustainable food and nutrition security under changing climatic conditions. This checklist assists in reviewing new project ideas for their relevance in this regard. It is of a general nature and can be used for all intervention levels outlined in Part A.

Programme and project environment

☐	The target group-specific food situation of the people in the project area including their specific cultural characteristics has been recorded in a participatory manner, and secondary data regarding food trends is known.
☐	Data on weather developments and expected climate trends (type, frequency, intensity) has been gathered; in particular, climate change-induced hazard scenarios are known.
☐	Possible effects of climate change on the availability, access and use of food have been assessed.
☐	Current effects of climate change on the food security of various target groups have been described and are available.
☐	Already implemented measures for the adaptation to climate change by network partners and public institutions in the project area are known.

Programme and project development

☐	Experience of the target groups and partner organisations with climate change-induced food insecurity has been taken into account as part of programme and project development.
☐	Concerns by the target groups and partner organisations with regard to adaptation strategies related to climate change induced food insecurity have been included.
☐	The relevant political framework conditions, national adaptation strategies (NAPAs), regional programmes and institutions that are key to climate change adaptation, and their positions, have been taken into account as part of programme and project development.
☐	Populations (target groups) that are particularly vulnerable to and at risk of food insecurity caused by climate change have been identified and are playing a vital role in programme and project development.

Programme and project direction

☐	Programme and project aims and specifications take into account the objective of sustainable food and nutrition security under changing climatic conditions.
☐	Particular attention has been paid to the importance of food and eating habits and needs of the target groups.
☐	Gender equality is taken into account in the entire project as an important cross-cutting topic.
☐	The basic principle of sustainability (ecological compatibility, social fairness, effectiveness and efficiency) has been considered throughout.
☐	The mitigation potential of possible measures has been taken into account and maladaptation can be excluded.
☐	Political and strategic aspects regarding the right to food and food sovereignty have been taken into account and are included in the project design.

Reducing risk and vulnerability, increasing adaptive capacity

☐	Information regarding existing disaster preparedness efforts in the project region has been obtained and anchored in the project design.
☐	Potential measures to reduce the risk of climate change-induced food insecurity forms a part of project design.
☐	The structural causes of climate change-related vulnerability and the resulting food insecurity of target groups have been compiled.
☐	Potential measures to reduce the structural causes of climate change-induced food insecurity have been examined.
☐	National strategies to adapt to climate change have been taken into account.
☐	Local management and adaptation strategies by the target groups with regard to climate change have been collected tested for their relevance to the project and included and strengthened where applicable.

Networking

☐	Contact to local and regional research institutions with expertise in climate change adaptation and food security have been established.
☐	Co-operation and strategic alliances with non-governmental institutions for climate change adaptation and food security have been entered into.
☐	Co-operation and strategic alliances with public institutions for climate change adaptation and food security have been clarified.

Coherence

☐	Measures of upstream or potentially downstream intervention levels have been compiled, interfaces between the areas have been created (e.g. between transitional aid and long-term development co-operation).
☐	Efforts have been made to ensure the coherence of measures between the intervention levels and the respective actors.

Personnel, budget

☐	Measures for the professional development of project staff regarding climate change and sustainable food security have been defined.
☐	Provisions for the use of external expertise in climate change and sustainable food security have been anchored in the project budget.

TERMINOLOGY/GLOSSARY

The definitions listed below are mainly based on the IPCC and UNISDR and FAO glossaries.

Adaptation

Initiatives and measures designed to reduce the vulnerability of natural and human systems (socio-ecosystems, see below) with respect to actual or expected effects from climate change.

Adaptive capacity

The totality of capacities, resources and institutions of a country/region, and the capacities of communities, households and individuals to implement effective adaptive measures.

Climate change

Climate change refers to any – natural or anthropogenic – change to the climate over time (decades or longer). The term climate change refers to changes in the climate that can be directly or indirectly traced back to human influence.

Climate sensitivity

Climate sensitivity refers to both climate-friendly in view of greenhouse emission, as well as climate-resilient (Resilience, see below).

Disaster

A serious disruption of the functioning of a community that results in far-reaching human, material, economic and ecological losses and damages which exceeds the capacity of the affected community to overcome the effects of the disaster on its own.

Disaster preparedness

Systematic and conceptual framework or package of measures implemented prior to a natural disaster, with the objective of limiting or preventing negative effects on the community or the environment. Disaster preparedness includes preventative and preparatory measures for the case of a disaster.

Ecosystem services

Ecosystems fulfil a supply function (food, water, wood, fibre, genetic resources), a regulatory function (e.g. climate, water, disease, waste removal, pest regulation and pollination), a supporting function (biological diversity, provision of habitat, soil fertility ...) and a cultural function (recreational value, cognitive and spiritual experience, aesthetic value, knowledge, social relationships). The well-being of humans is dependent on these ecosystem services.

Food security
Food security comprises the following four dimensions: availability, access, use and utilisation, stability.

Nutrition Security
A household has achieved nutrition security when it has secure access to food coupled with a sanitary environment, adequate health services, and knowledgeable care to ensure a healthy life for all household members.

Food sovereignty
The right to self-determination with regard to agricultural and food policies, and the obligation not to damage the food systems of other countries and the environment in the process; this is at the core of the political demand for food sovereignty aimed at democratic, localised and sustainable food systems (see La Via Campensina).

Food system
A food system includes not only seed and agricultural production but also the processing, distribution or procurement, storage, preparation and consumption of food products.
In contrast, the term industrial food system refers to the power relationships and beneficiaries, especially grain merchants, seed¬ companies, agrochemical companies, fertilizer producers, food processors and supermarket chains.

Hunger
The FAO defines hunger as a calorie intake of less than 1800 kcal per day, which is the average minimum requirement for most people for a healthy and productive life. The exact requirement is determined by a person's age, body size, activity level and physiological conditions such as illness, infection, pregnancy and lactation.

Industrial agriculture
An agricultural production form (corporate or family-owned) that is characterised by a high degree of specialisation and technology, and the extensive use of capital; it is also based on fossil fuels and external inputs and is targeted towards mass production.

Malnutrition
A broad term for a range of conditions that hinder good health, caused by inadequate or unbalanced food intake or from poor absorption of food consumed. It refers to both undernutrition (food deprivation) and overnutrition (excessive food intake in relation to energy requirements).

Mitigation
In connection with climate change, mitigation refers to the implementation of policies to reduce greenhouse emissions and strengthen carbon sinks (climate protection strategies).

Resilience
The ability of a socio-ecosystem to manage disruptions, stress and changes in a constructive manner and at the same time maintain the same or a similar basic structure and functions along with the capacity for self-organisation and adaptation, and to develop further in the process.

Risk
Risk refers to the risk of damage to people, things and nature as a result of undesired events.

Socio-ecosystem
Since societal systems (and their economic sub-systems) and ecosystems are highly interconnected, we also use the term socio-ecosystem.

Sustainability
Growth is sustainable if it is ecologically compatible, technologically adapted, economically feasible and socially acceptable in order to satisfy the requirements of current and future generations. In terms of a more holistic and system-related understanding, and beyond the level of enlightened self-interest, sustainability refers to the acceptance of the intrinsic value of the ecosystem and a stronger consideration of political, socio-cultural and spiritual aspects.

Vulnerability
Vulnerability describes the degree to which a system is susceptible to the negative effects of climate change and is not able to manage these effects. Vulnerability is strongly linked with socio-economic and institutional framework conditions.

Weather extremes
Events that rarely occur at a specific location and during a specific season. Single extreme events cannot be simply and directly attributed to anthropogenic climate change, since there is always some possibility that this event may have occurred naturally.

ABBREVIATIONS

AGRA	Alliance for a Green Revolution in Africa
AKST	Agricultural knowledge, science and technology
BMZ	Bundesministerium für wirtschaftliche Entwicklung und Zusammenarbeit (Federal Ministry for Economic Cooperation and Development)
CAADP	Comprehensive Africa Agriculture Development Programme
CCAFS	Climate Change, Agriculture and Food Security
CDR	Centre for Development Research
CGIAR	Consultative Group on International Agricultural Research
CO_2	Carbon dioxide
COP	Conference of the parties
CH_4	Methane
ESSP	Earth System Science Partnership
FiBI	Forschungsinstitut für biologischen Landbau (Research Institute of Organic Agriculture)
GDPRD	Global Donor Platform on Rural Development
FAO	Food and Agriculture Organisation of the United Nations
FIAN	Food First Informations- und Aktions-Netzwerk (Food First Information and Action Network)
H/CFC	Hydro/Chlorofluorocarbons
HLTF	High Level Task Force
IFAD	International Fund for Agricultural Development
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development
IEZ	Interdisziplinäres Forschungsinstitut für Entwicklungszusammenarbeit (Interdisciplinary Research Institute for Development Co-operation)
IIASA	International Institute for Applied Systems Analysis
IDNDR	International Decade for Natural Disaster Reduction
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IFPRI	International Food Policy Research Institute
LLRD	Linking Relief, Rehabilitation and Development
N_2O	Nitrous gas
MEA	Millennium Ecosystem Assessment
OECD	Organisation for Economic Co-operation and Development
PRSP	Poverty Reduction Strategy Papers
GHG	Greenhouse gases
UNCHE	United Nations Conference on the Human Environment
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention to Combat Climate Change
UNCTAD	United Nations Conference on Trade and Development
UNISDR	UN International Strategy for Disaster Reduction
SNC	United Nations Standing Committee on Nutrition
WBGU	Wissenschaftlicher Beirat der Bundesregierung Globale Umwelt-veränderungen (German Advisory Council on Global Change)
WFP	United Nations World Food Programme
WSSD	World Summit on Sustainable Development

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Working papers: www.welthungerhilfe.de

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IFAD: www.ifad.org

IAASTD: www.agassessment.org; www.weltagrarbericht.de

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