Module

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CONCEPTUAL BASES

In recent years concept papers have been produced throughout the world on everything related to „climate change". The most comprehensive and most important for Welthungerhilfe up to now is the Policy Guidance on Integrating Climate Change into Development Co-operation published by the OECD in 2009.[7] This policy guidance is based on the 4th Synthesis Report of the Intergovernmental Panel on Climate Change (IPCC) from 2007.[8]

The climate proofing is based on the definitions used and interrelationships presented by the IPCC and in the OECD Policy Guidance. The following first of all explains the composition of the climate risk on which the risk assessment (Step 1) is based (A.1). This is followed by considerations for adaptation to climate change (A.2). Finally, under A.3 the most important definitions are compiled in a glossary.

A.1 Composition of the climate risk

The risk of people, infrastructure and natural resources suffering damage and losses due to the effects of climate change is composed of three different components. These are used for determining the sub-steps of the risk assessment:

Effects of climate change:

The effects of climate change present a danger to many developing countries and their inhabitants. This is the starting point for climate proofing. Typical hazards which are expected in connection with climate change are, for instance less and more irregular precipitation as well as more frequent and severe weather extremes such as aridity, hurricanes/tornadoes/storms or heavy precipitation with floods and landslides. Also, the rise in sea levels can increase the danger of flooding and salinisation of drinking water. The increase in global temperatures is causing glaciers to melt and can hence initially cause flooding and then later water shortages. Higher temperatures also facilitate the spread of diseases such as malaria, dengue fever and cholera. With regard to the effects a differentiation can be made between events which occur rapidly (rapid onset, above all extreme weather events) and slowly occurring, long-term changes (slow onset, for instance change of precipitation patterns, increase in sea levels or an increasing spread of diseases in the wake of the increase in temperature).
In analysing hazards for a certain country or a specific region one can examine the critical situations that have already been experienced (e.g. water shortages in agriculture, diseases, floods) and use these to determine their future development on the basis of climate forecasts. Here, however it must be taken into consideration, that in future new hazards can also occur which were previously unknown in the region **(→ Modul B).**
Even if the climate proofing primarily focuses on risks which climate change poses for Welthungerhilfe's programme countries, it should not be forgotten that in individual cases climate change can also provide opportunities if, for instance, increased precipitation improve conditions for agriculture in arid regions. Frequently opportunities and risks are closely related:

[7] OECD (2009) Integrating Climate Change Adaptation into Development Co-operation. Policy Guidance. Paris.
[8] IPCC (2007) Climate Change 2007: Synthesis Report. Summary Report. An assessment of the Intergovernmental Panel on Climate Change. Geneva.

for instance, melting waters of glaciers, which temporarily provide improved water supplies for inhabitants but can also lead to flood hazards and shortage of water in the medium-term.

In order to be able to better assess the hazard and later the risk, it is necessary not only to record the type of hazard (for instance hurricane, cyclones, rise in sea levels, melting of glaciers) but also the probability and the expected frequency (for instance future dry periods) and the forecast extent of the hazard (for instance rise in sea levels) has to be taken into consideration.

Affected population groups and assets:

Not all population groups, infrastructures and natural resources are affected to the same extent by the impacts of climate change. On the one hand the geographical location is decisive: coastal areas and islands are for instance particularly subject to hazards related to the rise in sea levels. Water, plants, animals and people in glacial regions are presumably particularly affected by the effects of melting glaciers **(→ Module B).**

On the other hand it depends on specific characteristics and living conditions, whether and to what extent people or anything else suffers from the effects of climate change. For instance children, old and sick people are regarded as particularly vulnerable because of their physical situation, as well as poor people and households run by women – amongst other things because of their social disadvantage – and small-scale farmers who depend on subsistence farming because their livelihoods are strongly influenced by the climate. In the same way flora and fauna as well as infrastructure have certain characteristics which make them particularly more or less vulnerable to weather-related extreme events or long-term climate changes.

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A compilation of the affected population groups and assets in a specific case helps to limit further steps of climate proofing to the most important aspects and to recognise at an early stage whether adaptation to climate change will be very important or less significant for the planned project. A quantitative factor (for instance the number of affected people) can be an important factor here.

Sensitivity factors and strengths:

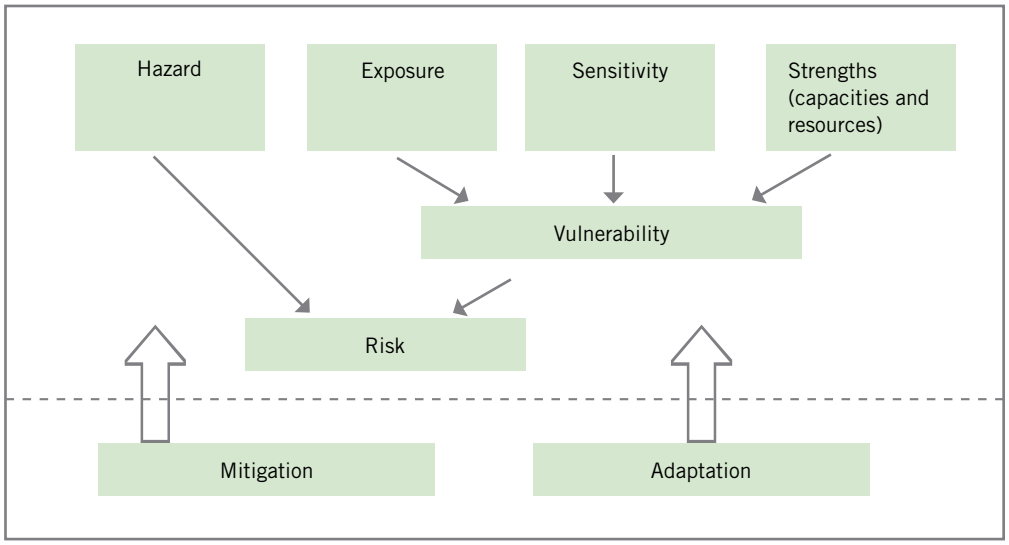
The investigation of the sensitivity of endangered population groups and assets is closely related to the first two analyses. Here it has to be determined what makes their sensitivity to the effects of climate change so special. There is a long list of possible factors: some are directly related to the climate changes, respectively weather-related events – for instance lack of access to weather information, lack of early warning and disaster management, dependency of natural resources as a basis for livelihood on climatic conditions. However, in developing countries climate change in particular presents a hazard because structural development problems today already make people, infrastructure and the natural environment vulnerable to shocks (natural events, financial crises, etc.). Where poverty, food insecurity, lack of health care, lack of access to information and loans, degradation of natural resources, lack of spatial planning and construction standards, amongst other things, weakens the basic resistance of society, climate changes can constitute an additional stress factor and can have disastrous effects. The concepts of resistance to disturbances (resilience), the ability to cope with hazardous situations (copying capacities) and the ability to adapt to changes (adaptive capacity) are closely related to the term sensitivity and in consequence vulnerability (see glossary) **(→ Modul B).**

The analysis of the sensitivity factors is designed to recognise the complex interrelations in order to identify the most important starting points for reducing vulnerability through implementing adaptation measures: What interventions can be used to achieve the biggest possible effect? Here it is also necessary to not just focus on weaknesses but also to recognise capacities which can be useful in adaptation. This can be, for instance, the good self-organisation of a group or a local institution which can help the adaptation.

Risk:

Hazard, sensitivity and strengths can be used for determining the risk facing affected population groups and assets that they will suffer damage or losses due to climate change. The consequences which climate change will have for the individual groups and assets are loss of life, houses and harvest, diseases, destruction of infrastructure, as well as loss of biodiversity of flora and fauna and many other things. This description of the risk should go beyond the direct impacts and also examine indirect consequences, such as loss of income due to diseases or destroyed infrastructure as well as increased migration.

In assessing the risk it is helpful to take into account the extent and probability of the expected effects of climate change in the same way as taking into consideration the number and vulnerability level of the affected people, infrastructure and resources.



A.2 Adaptation to climate change

Mitigation measures are being used to try to limit climate change and its effects. This also limits possible hazards and consequently the climate risks. On the other hand adaptation measures are used to try and reduce the vulnerability of people, infrastructure and natural resources in the face of the hazards. This also reduces the risk.

There is a great range of possible adaptation measures, which usually adopt the approach of reducing sensitivity and/or improve capacities and resources. According to the OECD Policy Guidance, these can be divided into seven categories (see OECD pages 50-51):

- Share losses (risk transfer): This describes all measures which ensure that damage is not solely borne by those affected but instead by a larger community (for instance government reconstruction, insurances, traditional solidarity groups).
- Limit the threat: This applies to measures which reduce the effects of climate-related events. This applies, for instance, to preventing landslides through technical protection measures for stabilising slopes.
- Prevention: The majority of adaptation measures are aimed at adaptation to changed climatic conditions and, for instance, people using more efficient irrigation or improved water storage to reduce the impacts of droughts on their own lives.
- Change use of natural resources and soil, if the previous use is no longer possible or is unsafe. Then, for instance, more resistant seed can be used for arable farming and market gardening, the cultivation system can be changed or land which is no longer used for agriculture can be afforested.

- Change location: Cultivation areas can be relocated to use more fertile land. Individual families or whole villages can be resettled, for instance to make them safe from floods or landslides. Relocation can be one of the most effective measures, but it is frequently avoided because it is generally difficult to implement (land rights issues, resistance of the respective population, etc.) and involves high costs.
- Research, for instance for improved information on climate or the development of more resistant seeds.
- Encourage behavioural change, for instance through measures for raising awareness or school education.

Similar to the analysis of sensitivity factors a differentiation is made between measures which are directly related to climate change (for instance improved weather forecast, early warning and disaster reduction, drought-resistant production resources, etc., rain water storage) and those which contribute indirectly to adaptation through improving structural basic conditions (for instance education, spatial planning and fighting poverty). With the latter modifications to the content can considerably increase the sustainability of the measure and its contribution to adaptation to climate change. Some examples: in educational projects environmental and climate-related issues can be included in the syllabus, if required resistance to hurricanes/cyclones can be increased when building schools; in spatial planning the conditions of the natural environment should be taken into consideration – for instance flooding scenarios; in promoting local economic development lines of business can become more or less important with regard to climate change.

Another interesting consideration regarding adaptation to climate change differentiates between measures

- which are directly aimed at implementing change and those,
- which primarily focus on society‘s ability to adapt (adaptive capacity).

With regard to the help for self-help in the long term the second category is the more important and should be also taken into consideration in all packages of measures right from the outset.

Throughout the world measures and experiences regarding adaptation to climate change are currently being compiled. This is also leading to considerations on the difficulties and limits of adaptation. In addition to the OECD Policy Guidance, which deals very comprehensibly with the different options for action, attention should also focus on two new documents: PIK, Misereor amongst others (2010) Global aber gerecht (Global but fair) describes in detail approaches for adaptation and mitigation. Birkmann, J. (2011): First and Second Order Adaptation to Natural Hazards and Extreme Events in the Context of Climate Change) examines obstacles and limits to adaptation.

A.3 Glossary

The following overview is based on the glossary of the 4th Synthesis Report of the Intergovernmental Panel on Climate Change (IPCC) from 2007 (pages 86-99): www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_appendix.pdf

It has been complemented by definitions marked with asterisks from two sources:

- R. Dikau/ J. Weichselgartner (2005) Der unruhige Planet. Der Mensch und die Naturgewalten.
- Glossary of the International Strategy for Disaster Reduction UNISDR: http://unisdr.org/eng/terminology/UNISDR-Terminology-English.pdf.

Adaptation

Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc.

Adaptive capacity

The whole of capabilities, resources and institutions of a country or region to implement effective adaptation measures.

Coping capacity*

The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.

Anthropogenic emissions

Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities, including the burning of fossil fuels, deforestation, land-use changes, livestock, fertilisation, etc.

Arid region

A land region of low rainfall, where low is widely accepted to be <250 mm precipitation per year.

Carbon dioxide (CO_2)

A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning biomass and of land use changes and industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured.

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Climate

Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization.

The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. In various parts of this report different averaging periods, such as a period of 20 years, are also used.

Climate change

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

Climate model

A numerical representation of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. The climate system can be represented by models of varying complexity, that is, for any one component or combination of components a spectrum or hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parametrisations are involved. Coupled Atmosphere-Ocean General Circulation Models (AOGCMs) provide a representation of the climate system that is near the most comprehensive end of the spectrum currently available. Climate models are applied as a research tool to study and simulate the climate, and for operational purposes, including monthly, seasonal and inter-annual climate predictions.

Climate prediction or forecast

A climate prediction or climate forecast is the result of an attempt to produce an estimate of the actual evolution of the climate in the future, for example, at seasonal, inter-annual or long-term time scales. Since the future evolution of the climate system may be highly sensitive to initial conditions, such predictions are usually probabilistic in nature. See also Climate projection and Climate scenario.

Climate projection

A projection of the response of the climate system to emission or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasise that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realised and are therefore subject to substantial uncertainty.

Climate scenario

A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models.

Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as about the observed current climate. A climate change scenario is the difference between a climate scenario and the current climate.

Climate sensitivity

In IPCC reports, equilibrium climate sensitivity refers to the equilibrium change in the annual mean global surface temperature following a doubling of the atmospheric equivalent carbon dioxide concentration. Due to computational constraints, the equilibrium climate sensitivity in a climate model is usually estimated by running an atmospheric general circulation model coupled to a mixed-layer ocean model, because equilibrium climate sensitivity is largely determined by atmospheric processes. Efficient models can be run to equilibrium with a dynamic ocean. The transient climate response is the change in the global surface temperature, averaged over a 20-year period, centred at the time of atmospheric carbon dioxide doubling, that is, at year 70 in a 1%/yr compound carbon dioxide increase experiment with a global coupled climate model. It is a measure of the strength and rapidity of the surface temperature response to greenhouse gas forcing.

Climate shift

An abrupt shift or jump in mean values signalling a change in climate regime (see Patterns of climate variability). Most widely used in conjunction with the 1976/1977 climate shift that seems to correspond to a change in El Niño-Southern Oscillation behaviour.

Climate system

The climate system is the highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the land surface and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations and anthropogenic forcings such as the changing composition of the atmosphere and land-use change.

Climate variability

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). See also Climate change.

Disaster*

A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

Disaster risk reduction*

The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Extreme weather event

An event that is rare at a particular place and time of year. Definitions of "rare" vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of the observed probability density function. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. Single extreme events cannot be simply and directly attributed to anthropogenic climate change, as there is always a finite chance the event in question might have occurred naturally. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).

Hazard*

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Impacts of climate change

The impacts of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts:

- Potential impacts: all impacts that may occur given a projected change in climate, without considering adaptation.
- Residual impacts: the impacts of climate change that would occur after adaptation.

Methane (CH_4)
Methane is one of the six greenhouse gases to be mitigated under the Kyoto Protocol and is the major component of natural gas and associated with all hydrocarbon fuels, animal husbandry and agriculture. Coal-bed methane is the gas found in coal seams.

Mitigation
Technological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to climate change, mitigation means implementing policies to reduce greenhouse gas emissions and remove a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol from the atmosphere (sinks).
Note that in disaster risk reduction policy (see ISDR) "mitigation" is defined differently, being the term used for "the lessening or limitation of the adverse impacts of hazards and related disasters" where the impacts cannot be prevented fully. (e.g. dams, stabilizing slopes).

Resilience
The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.

Risk*
The combination of the probability of an event and its negative consequences.
Comment: This definition closely follows the definition of the ISO/IEC Guide 73. The word "risk" has two distinctive connotations: in popular usage the emphasis is usually placed on the concept of chance or possibility, such as in "the risk of an accident"; whereas in technical settings the emphasis is usually placed on the consequences, in terms of "potential losses" for some particular cause, place and period. It can be noted that people do not necessarily share the same perceptions of the significance and underlying causes of different risks.

Sea level change/sea level rise
Sea level can change, both globally and locally, due to (i) changes in the shape of the ocean basins, (ii) changes in the total mass of water and (iii) changes in water density. Factors leading to sea level rise under global warming include both increases in the total mass of water from the melting of land-based snow and ice, and changes in water density from an increase in ocean water temperatures and salinity changes. Relative sea level rise occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence.

Sensitivity

Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate variability or climate change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise). This concept of sensitivity is not to be confused with climate sensitivity, which is defined separately above.

United Nations Framework Convention on Climate Change (UNFCCC)

The Convention was adopted on 9 May 1992 in New York and signed at the 1992 Earth Summit in Rio de Janeiro by more than 150 countries and the European Union. Its ultimate objective is the "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". It contains commitments for all Parties. Under the Convention, Parties included in Annex I (all OECD member countries in the year 1990 and countries with economies in transition) aim to return greenhouse gas emissions not controlled by the Montreal Protocol to 1990 levels by the year 2000. The Convention entered in force in March 1994. See Kyoto Protocol.

Vulnerability

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.