

# The impacts of climate change on food security and health in Southern Africa

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## **Abstract**

*Climate change will have a great impact on Southern Africa according to the IPCC. Two closely related topics, food security and health will be affected by the changes in many ways. Difficulties in transporting food through carbon regulations in air-freight, changing conditions for growing food crops and negative impacts on fishery might occur and will very possible lead to an increase in malnutrition in the region. Changes of the climate will also have an effect on the way illnesses are transmitted and cause a number of extreme weather events which can have an extremely damaging consequence on human living. Two main efforts are being work on in terms of dealing with these concerns. At the international, regional and national levels, adaptation and mitigation action is being planned and implemented. Activities at each level are discussed and I argue this in this paper that currently the most efficient way of dealing with the existing and future burdens of climate change impacts are activities at a national level, and enhanced effort has to be made to improve regional and international collaboration in addressing these issues.*

*Keywords: climate change, food security, health, Southern Africa*

## **1. Introduction**

Human beings are dependent on the environment they live in. Even though it seems that humans in this century, all over the world, are more connected to technology than to the natural environments that surround them, this picture fails when it comes to climate change. Through discussion around climate change and its impacts, the quality of life of poor people is increasingly taken into consideration. Poor people have always been very dependent on weather and environmental conditions; only the wealthy minority of the world population has the

privilege to prevent rain, cold or droughts from disturbing their daily life.

The Intergovernmental Panel on Climate Change (IPCC) called Africa 'one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity' (IPCC WGII 2007: 10). Similarly, Peter Lukey, Chief Director of the South African Department of Environmental Affairs and Tourism (DEAT), states that 'Africa has become the worst-off victim of worldwide climate change' (Engineering News Online 2008). Africa seems to be in such a poor position because the majority of the population on the continent are dependent on the weather for activities such as agriculture or fishing. The degree of dependence is too great for the available capacity to deal with consequences of changing climate, thus causing the IPCC and the DEAT Director to be alarmed.

With a change in the climate, agricultural production, prices and infrastructure will change, limiting the amount and quality of food produced. Again linked to the situation around nutrition in a family, a country or the world is the state of health. With inappropriate or too little food health conditions of people are getting worse. Supplementary climate changes like increasing temperature, floods or droughts are threatening human physical and psychological circumstances. And the link is also the other way around: 'Poor people are likely to have less access to healthy, nutritious food, which results in a poor health status and lower labour productivity. These two factors then contribute to perpetuating the vicious cycle of poverty and malnutrition' (FAO 2005).

The two approaches currently adopted by the international community to deal with issues around the impacts of climate change are adaptation and mitigation strategies. How adapting to changing situations or mitigating greenhouse gas emissions, or even a combination of both strategies, at national, regional and an international level may be relevant to food security and human health, which will be

shown in this paper.

I argue that currently the most efficient ways of dealing with existing and future burdens of climate change impacts are activities at the national level, and that enhanced effort has to be made to improve regional and international collaboration in addressing these issues.

I provide a general introduction to climate change impacts on Sub-Saharan Africa, followed by a discussion around the consequences of these changes on food security and health in Southern Africa. Adaptation and mitigation, the two current strategies adopted to deal with the present and future situation, are introduced in section four. Following the idea that these strategies are possible to develop and implement at various levels; national, regional and international actions are examined. Currently, implemented projects and policies are considered in order to clarify how relevant action on which level can ease the burden of the impacts of climate change on food security and health in Southern Africa.

## **2. Climate change in Southern Africa**

The IPCC report from 2007 defines Africa as 'one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity' (IPCC WGII 2007: 10). Water and water related issues are expected to be the most challenging threats to the continent. Water stress is going to influence between 75 and 250 million people's lives by 2020 and change the conditions for agricultural production drastically. In combination with increasing temperatures 'the area suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas, are expected to decrease' (IPCC WGII 2007: 10). Unsure rainfall and longer dry periods are going to put extra stress on farming production. Coastal areas are in danger from floods and sea-level rise by 2080, and changing conditions in the ocean are going to impact on fisheries and the people close to the sea (IPCC WGII 2007: 10). 'Exposure to climatic hazards and vulnerability to climate change varies enormously between regions and sectors in Africa' (Downing *et al* 1997: 21).

South Africa, for instance, is going to become generally drier and warmer through climate change. Significant impacts are expected in 'some sectors, particularly agriculture, water resources, biodiversity and human health' and 'these potential impacts will undoubtedly have detrimental effects on South Africa's priority issues (i.e. poverty alleviation, employment, housing, access to and provision of services, food security, potable water, HIV/AIDS, etc.)' (Lim 2004: 6).

This paper focuses on the Southern African region as a whole, including Namibia, Botswana,

Zimbabwe, Mozambique, Lesotho, Swaziland and South Africa.

## **3. Impact of climate change on food security and health in Southern Africa**

Two of the most important issues impacted on by climate change described above in Southern Africa are food security and human health. Both have a direct and essential impact on human existence. Food security concerns the available amount of food for a certain purpose. This could be to feed a family or an individual, or to feed a nation, or even the amount of food needed to feed the whole world population. Additional to the simple quantity of required food, food security also includes concerns issues like the transport of food to people and storage issues. The quality of food is emphasized in the term food safety (anonymous interview with participant of World Economic Forum in Cape Town on SABC 2, 5. June 2008, 2pm). The divide between food security and safety is not going to be followed throughout this paper, but is mentioned for reasons of completion.

The United Nations Organization for Food and Agriculture (FAO) define the four most crucial factors for a household's food security as: 'food availability, access to food, stability of supply and accessibility, and the degree to which food is nutritious and safe and can therefore be utilized' (FAO 2005:1). Food availability is expected to be heavily impacted as climate change may transform 'the area suitable for agriculture, the length of growing seasons and yield potential' (IPCC WGII 2007:10). The access to food and stability of supply are closely linked to the conditions of the infrastructure. This includes roads, railways, cargo transfer and the possibility to transport food over long distances by plane. Roads and railways might suffer under increasing weather stress and air transport might be regulated due to greenhouse gas reduction affords.

The safety of food comes back to the quality of the available food. IPCC expects 'agricultural production, including access to food, in many African countries and regions ... to be severely compromised by climate variability and change' (IPCC WGII 2007: 10). The FOA sees the 1.1 billion hectares of land which is already only arable under heavy endeavours expanded by 50-90 million hectares as the result of climate change (FAO 2005:2). The production of 'yields from rain-fed agriculture could be reduced by up to 50% by 2020' (IPCC WGII 2007:10) and it's a consequence spreading hunger very quickly. Main sources of nutrition for people in Africa like beans, wheat, potatoes and rice are in danger of being difficult to produce in future.

Another important factor is rivers and coastal zones. It is still uncertain if increasing temperature will increase or hinder fish production, but clearly it

will change something (IPCC 2001: 10). Many countries in Africa are food-insecure and a large portion of the population rely on subsistence farming where 'farmers both consume their product and sell it in local markets' (Brown & Funk 2008: 580). As a result 'large-scale hunger can ensue, even when there is sufficient food in the market that has been imported from elsewhere' as these farmers cannot earn enough from their own crop sales to buy the imported food (Brown & Funk 2008: 580). Current protests about the increasing food prices all over the world give an idea what this could mean for people and political stability of the effected countries. Brown and Funk (2008:581) see by now 'up to half of all malnutrition ... driven by non-food factors'. Taking all the influencing factors of food security into consideration the question which has to be asked and answered is: 'Where is the food, how is it grown and how traded?' (anonymous interview with participant of World Economic Forum in Cape Town on SABC 2, 5. June 2008, 2pm). Possible approaches to answer these questions and act appropriately are discussed in the next sections.

'The relative importance of climate change for food security differs between regions' (Gregory *et al.* 2005: 2139). This is also the case for the impacts of climate change on human health. An almost continent-wide problem is going to be the impact of food insecurity on the health of people. Malnutrition is likely to increase (IPCC WGII 2007:10, Brown & Funk, 2008: 580). According to the World Health Organization, the estimated global number of people who are currently undernourished is 800 million, with close to half of these living in Africa' (Patz *et al.* 2005:311). Authors like McMichael estimate the increase of underfed people by 5-10% (McMichael *et al.* 2006: 863).

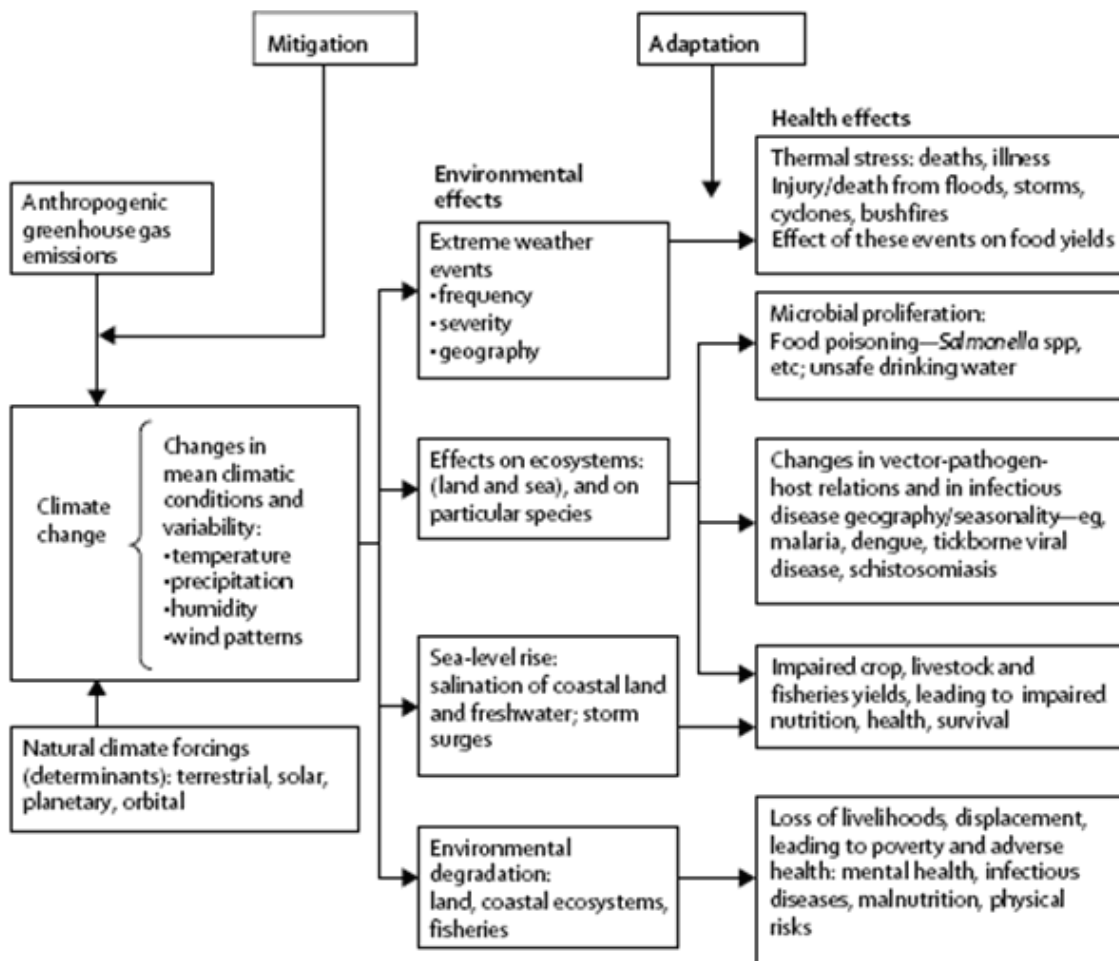
Another threat is the possible increase of vector-borne diseases in some areas. In regions like the east African highlands 'the potential incidence, seasonal transmission, and geographic range of various vector-borne diseases' are expected to rise (McMichael *et al.* 2006: 862). These diseases include Malaria, Dengue fever, Yellow fever, various types of viral Encephalitis, Schistosomiasis, Leishmaniasis, Lyme disease, and Onchocerciasis. Even though the IPCC report speaks about uncertainty in terms of the 'the decrease or increase of the range and transmission potential of malaria in Africa' (IPCC WGII 2007:9), McMichael *et al.* (2006: 865) reviewed a number of studies 'that have modelled seasonal changes in transmission [and] researchers estimate a substantial extension - such as a 16-28% increase in person-months of exposure to malaria in Africa by 2100'. However, 'due to varying quality of long-term disease data across sites in Africa, and in part due to the difficulty in adequately controlling for demographic and biological (drug resistance) data'

(Patz *et al.* 2005:311), there is no strong discourse obvious in the literature at the moment. The same applies to HIV and AIDS. The effect of climate change on this virus is little studied and assumptions are very vague. Brown and Funk (2008: 581) see the virus to be likely to 'become more severe and widespread with warming temperatures', but there is also no evidence in the literature about this matter.

A positive influence is generally understandable in very cold regions, where the number of people who die through cold waves might become less. Alternately, in warm regions like Africa even more people will die due to heat stress (McMichael *et al.* 2006: 863). All in all, these kinds of big scale events are going to have a growing power over people's lives, particularly over people who live in areas very vulnerable to climate change such as coastal zones, places where storms are to be expected and regions at risk of droughts or floods. 'Over 96% of disaster-related deaths in recent years have taken place in developing countries' (African Development Bank *et al.* 2003:X). Further health concerns exist due to spread of disease as the result of migration caused by climate change impacts (McMichael *et al.* 2006: 860-62, Patz *et al.* 2005: 311-15, IPCC WGII 2007: 9-13).

In conclusion it can be said that the link between climate and health is most noticeable in cases where extreme weather events like heat waves, floods, storms, fires, or infectious diseases are the crucial factor. 'Other important climatic risks to health, from changes in regional food yields, disruption of fisheries, loss of livelihoods, and population displacement (because of sea-level rise, water shortages, etc) are less easy to study than these factors and their causal processes and effects are less easily quantified' (McMichael *et al.* 2006: 860).

Food security and Health are closely related issues, as food for instance, has a direct impact on human health and the physical conditions of humans has a strong influence on their ability to work and earn money. Figure 1 shows the main pathways by which climate change affects the health of human beings, including the consequences of food scarcity. The left side of the diagram demonstrates the concept of climate change and the middle section shows the main changes in the environment as the result of climate change. The right side points out the effects on health, most of which are negative, but some have also positive consequences. Two types of interventions are mentioned in the diagram. One is mitigation, which tackles climate change at the stage where it is caused and so works at the root of the problem. The second type is adaptation, which starts at a much later point and deals with the symptoms of the previous emitted amounts of greenhouse gases (which might not have been able to prevent through



**Figure 1: Schematic summary of the main pathways by which climate change affects population health**

Source: McMichael et al. (2006: 860)

mitigation or have been there before the intervention started). Other areas of focus adopted by the international community to try to ease the burden of the impacts of climate change are technology transfer and research (IPCC WGII 2007:20). Ideally these are combined with adaptation and mitigation action. To differentiate between these strategies is in some cases neither possible nor necessary. Most of the adaptation and mitigation programmes that are going to be discussed contain elements of technology transfer and research. How adaptation and mitigation are applied and to what extent they are relevant for food security and health are examined in the following section.

#### 4. Adaptation and mitigation action to ease burdens

The current and future impacts climate change has and will have on Southern Africa are creating a great need for people to change behaviour to be able to survive in the new conditions. Areas where so-called adaptation is appropriate are, for example, disaster management (floods, droughts, storms etc), food security, water resource management,

land degradation (erosion, desertification), biodiversity loss, natural resource management, health (HIV/AIDS, malaria etc), migration, rural livelihoods, poverty alleviation and coastal zone management. This paper takes a closer look at food security and health and discusses the possible adaptation and mitigation strategies that can be adopted.

Many definitions for adaptation and mitigation are available in the literature. The most common and probably deeply discussed one is the definition used in the IPCC report which says that adaptation refers to changes in 'processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate' (IPCC WGII 2001:1). It involves actions to reduce the vulnerability of regions and communities to climate change (IPCC WGII 2001:1). Adaptation can be spontaneous or planned action done by governments or civil society, but 'institutional and economic parameters determine the vulnerability and adaptive capacity of societies' (Hug et al. 2003:17).

In the international climate change negotiations

decisions were made which were 'initiated to develop the adaptive capacity of poor people and the poorer countries (...) to cope with the impacts of climate change' (Hug *et al.* 2003: 18). The required capacity includes financial, human and knowledge resources. Research about how to adapt to what, when and where has only started recently and there are still very few people working in the field. Financial support is supposed to come from the so-called developed countries. 'As adaptation activities can be capital-intensive and the benefits highly localized and immediate, the real challenge will be the development of secure, adequate and predictable funding to meet priorities, as well as equitable frameworks to access this funding' (Winkler 2004:362).

For instance, the cost of adaptation to expected sea-level rise in low-lying coastal areas with large populations is estimated to be at least 5-10% of GDP (IPCC WGII 2007:10). Considering these numbers, it becomes clear that the costs cannot be carried by national budgets alone. Adaptation is not an issue which can be dealt with in isolation. Strategies like the Millennium Development Goals and the Poverty Reduction Strategy Papers have to be able to be combined with adaptation action to get the greatest benefits and not hinder the success of other efforts (Hug *et al.* 2003:18). The IPCC supports this idea strongly with the advice to 'include (...) adaptation measures in land-use planning and infrastructure design and include (...) measures to reduce vulnerability in existing disaster risk reduction strategies' (IPCC WGII 2007:20). Generally the adaptive capacity in Africa is low due to low GDP per capita, widespread poverty, inequitable land distribution, and low education levels (African Development Bank *et al.* 2003:3). In addition, climate change impacts in Africa affect many people. With a high number of people depending on rain-fed agriculture and over 25% of the population living in coastal areas, adaptation is necessary and might depend to a large extent 'on the degree of civil order, political openness, and sound economic management' (African Development Bank *et al.* 2003:3).

It is obvious that strategies like mitigation are an international task. Carbon emission regulations have to be thought through on a global level, mitigation action does not have a significant local effect on food security. It might improve air-quality locally, but as long as in other places in the world people keep or even increase emissions into the atmosphere, a positive impact on global warming will not be possible. It should also be noted that 'even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades, which makes adaptation essential' (IPCC WGII 2007:20). A combination of both strategies or 'adaptation options that also address climate

change mitigation' (Nganga 2006:7) are the most effective approaches. The United Nations Framework Convention on Climate Change creates the basis for future work and in the following - national, regional and international programmes will be stressed.

#### **4.1 National strategies**

At a national level, adaptation could take place at different levels in society: national, sub-national (for instance, provincial), and local, depending on country's situation and sub-national circumstances (Niang\_Diop & Bosch: 186). To start with the lowest level where adaptation can happen, every individual is adapting to changes in the environment. This action might happen unconsciously, but it is from an evolutionary science perspective as part of life on earth. Individual adaptation has limitations however, once financial or energy resources sources are emptied. The next step is then to look at communities at a whole. Possible actions addressing food stress could be a change in used crop, investment in new irrigation systems, better soil conservation and livestock management. Safe water drinking technologies and new water use strategies could have a positive impact on the health of the community (Sharma 2002). It is also possible that whole communities move away from areas with high risk of extreme weather events.

As the biggest potential for fast and flexible adaptation is currently seen in community structures, the South African climate change NGO SouthSouthNorth (SSN) developed the SSN Adaptation project Protocol for Community Based Adaptation (SSNAPP). 'This tool is designed to assist project developers to identify, select, design, fund raise, implement and monitor and evaluate community based adaptation to climate change interventions in response to local climate change impacts in developing countries where all levels of stakeholders are engaged at each step in the process' (SouthSouthNorth a:2).

However, strategies and policies are usually the responsibility of governments at a national level, while measures can be taken at a more local level (individuals, enterprises, households, communities, etc.) (Niang-Diop & Bosch: 186). Large scale strategies and policies have to be made by governments, due to reasons of financial capacity, human resources and authority in the implementation. The international community agreed on procedures which are supposed to help the countries with adaptation. Firstly, there is the National Communication (NC). All countries which ratified the Kyoto Protocol are committed to communicate to the Conference of the Parties (Article 12, paragraph 5 and Article 4.3). Countries have the chance to apply for financial support at the United Nations and will also get some advice on how to write the

NC. In most of the cases the government department which deals with environmental issues is responsible for the report. Ideally, a country defines an agency that is then in charge to research the present and future impacts of climate change on the country and defines special concerns in terms of vulnerability, adaptation and mitigation. Next to money, technical support can be asked for from the United Nations Environmental Programme (UNEP), United Nations Development Programme (UNDP), UNFCCC and also from ministries, universities, non-governmental organizations (NGOs) and public and private firms (Mwakasonda 2008).

The UNDP unit is responsible for the NC's developed an Adaptation Policy Framework (APF). This APF includes a User's Guidebook and technical papers. The main incentive of creating an APF was 'to assist and provide guidance to developing countries in identifying, prioritizing, and shaping potential adaptation options into a coherent strategy that is consistent with their sustainable development and other national priorities' (UNDP & GEF 2003:iv).

The National Communications harbour the greatest potential for Non-Annex-I states to get international attention, funding, and capacity building programmes running in their countries. An example of adaptation action of this kind is the research project developed by the Medical Research Council and the University of Kwa-Zulu-Natal. The study looks at 'the link between climate variables and the distribution of malaria and schistosomiasis' (Lim 2004:13). In South Africa research into agriculture and climate change has also been initiated at the Universities of Stellenbosch, Kwa-Zulu-Natal and Pretoria, the South African Weather Service and other Institutions. In 2004 two adaptation projects addressing farming concerns, the CLOUD project in Limpopo and awareness workshops for the Department of Agriculture, were implemented (Lim 2004:12).

In the paper 'Poverty and Climate Change', in which a large number of international organizations were involved in writing it, advice is given to developing countries which are willing to work on their national adaptation performance (African Development Bank et al. 2003). Firstly, it is advised that work on the National Adaptation Programme of Action, which is similar to the APF process, is strengthened. In doing this countries should further ensure that:

- They involve the relevant stakeholders from the most vulnerable sectors of the economy and regions of the country.
- They also need to ensure that high-level policy makers are aware of the importance of the issue.
- The general public is made more aware

about the issues.

- Special focus is given to the most vulnerable regions and populations within each country.
- All relevant institutions within the government as well as civil society need to be made aware of the problem and their respective roles in dealing with it.
- The focus is on building long-term national adaptive capacity.
- Adaptation to climate change is effectively mainstreamed into national and sectoral development. (Hug et al. 2003: 36).

It can be said that until present the most effective adaptation activities are done by individuals and communities even though their work is mostly undocumented and not recognised as work under the term adaptation. National programmes are starting slowly and, as shown by the South African example, still have a long way to go to make a real difference. In South Africa, only a few projects have been implemented so far, and this was the first of the sub-Saharan countries to submit the NC.

As none of the countries in Southern Africa are Annex-I states, mitigation action in terms of fulfilling emission targets do not have to be taken into consideration. South Africa is once again in the unique position in Southern Africa of facing emission targets in the next 10-15 years. The National Climate Change Response Strategy talks about 'the mining and energy sectors ... [as] particularly vulnerable to climate change mitigation measures' (RSA 2004:5). However, through the Clean Development Mechanism (CDM), carbon reduction activities are made possible for Non-Annex-I countries (Kyoto, Article 12). Emissions reduced in the developing country can be sold through international carbon trade certificates to developed countries and help these countries to reach their targets. Even though CDM projects are contributing in a positive way to global mitigation affords, they are not reducing the global emissions and can only be as good as the emission targets of the Annex-I states (Michaelowa et al. 2004, Ellis et al. 2004).

The link between mitigation and food security at a national level is based solely on the contribution of greenhouse gas emissions to global climate change. The impacts of emissions on health are different, however, as indoor and outdoor air pollution are major contributors to respiratory health diseases and local reductions of emission can have a big impact on the health conditions of people (WHO 2005). A South African example is the Kuyasa CDM project. In this project, solar-water-heaters, ceilings and fluorescent bulbs are installed in houses in the low-income settlement of Kuyasa in Khayelitsha. Through the installations, the project hopes to

cause a change in behaviour and initiate a switch over from polluting cooking methods like paraffin or wood to electricity (Tyler 2007). This would be expected to have a positive effect on the respiratory health of the dwellers and according to the theory of suppressed demand also reduce greenhouse gas emissions. Adaptation and mitigation are thus combined in this CDM project.

#### **4.2 Regional strategies**

National borders usually define areas where different thinking, planning and activities take place, 'however adaptation strategies, policies and measures must also be considered at the sub-regional and regional levels (e.g. when they are related to shared resources, as is the case with international rivers)' (Niang-Diop & Bosch: 185). This leads the Southern African Development Community (SADC) to get together and identify areas of priority for environmental policies. 'These priority areas target environmental and developmental concerns in the region which require immediate attention and call for both national and collective regional action' (Lim 2004:13). In reaction to these findings the SADC Food, Agriculture and Natural Resources, SADC Protocol on Shared Watercourse Systems and the SADC Forest Protocol have been developed. In addition to these actions within the SADC community, the New Economic Plan for African Development (NEPAD) and the Millennium Development Goals are mentioned as frameworks for regional collaboration (Lim 2004:13).

Border crossing issues like food security and health are probably most effectively addressed at this scale. Improved cross-border transport systems, such as roads and railways, might enhance collaboration in tackling issues such as supply and accessibility of food (IPCC WGII 2001: 10). SADC or NEPAD may also strengthen their position in international negotiations about agricultural subsidies if the countries collaborate and speak with one voice. In the African context, there is little discussion about mitigation activities except for CDM projects.

Regional actions are similar to national ones in that they are still in early stages. Even though the potential to work together on adaptation strategies, and at a later stage also on mitigation strategies, is high due to similar social-economic backgrounds and geographically related burdens, only assumptions can be made about the impact collective actions will have once actually implemented.

#### **4.3 International strategies**

At the international scale, the Global Environmental Facility (GEF) is unquestionably the main player in the climate change adaptation scene. Aside from running surveys, assessments and initial pilot projects, this monetary organization from the United Nations, manages two funds. The Least Developed

Countries Fund (LDCF) and the Special Climate Change Fund (SCCF) are both designed to support concrete adaptation projects in developing countries (GEF website 11 June 2008). Some examples of endeavours around food security are the rather non-concrete research project like the 'Climate Change Adaptation and Mitigation and Food Security Concerns', but there are also projects on the ground like the 'Reversing Land Degradation in Zhomba through Integrated Catchment Management Programme' in Zimbabwe.

Another United Nations organization which is working on adaptation issues is the Food and Agriculture Organization (FAO). They have developed, among other things, the Global Agro-Ecological Zones methodology, which 'can provide a detailed understanding of the sensitivity of agricultural crops and regional land-use systems to climate change' (unknown author 2002:10). Analyses with this methodology have shown that 'on average, industrialized countries stand to make substantial gains in production potential, while developing countries are expected to lose' (FAO 2005).

The FAO will also further monitor the relationship between climate change and food security and can be counted as one of the big international players in this field. There are many more international organizations working in the field of adaptation in Southern Africa, the World Bank, International Development Research Centre, the Institute for Sustainable Development and Oxfam being but a few. Oxfam, for instance, recently developed an Adaptation Financing Index, which 'gives an indication of what fairness in adaptation requires'. The USA, EU and Japan are identified as the three main entities responsible for climate change and they should, according to the Index, be contributing 40%, 30% and 10% to the adaptation costs (Oxfam 2007).

Oxfam also gives some recommendations on how to divide adaptation work at the different scales. For the international sphere the requests are to 'contribute(...) to the international learning networks on adaptation' (Oxfam 2007) and to improve regional collaboration in shielding cross border ecosystems and monitoring and forecasting of climate change (Oxfam 2007). Similarly, crucial is the role of the international players in areas like systematic observation, technology transfer and capacity building. As 'the inadequacy of systematic observations network which is necessary for climate characterization' is seen as one of the main barriers 'to effective vulnerability and adaptation assessment in Africa' (Nganga 2006:12), this is an area where international cooperation can be pivotal. The two other barriers Prof. Nganga identifies in his presentation for the UNFCCC are 'inadequate technological capacity to implement adaptation projects' and technical capacity. Once again these issues are seen

as challenges for action at the international level. The 'Poverty and Climate Change' paper delivers a list of recommendations for further steps towards collaboration in adaptation on the international level (African Development Bank *et al.* 2003). In addition to the issues mentioned earlier are an improvement of the international negotiating capacity amongst the developing countries and measures to 'become more effective at sharing the results of their work on adaptation amongst themselves' (Hug *et al.* 2003: 37).

Apparently the adaptation work at the international level is comprehensive and definitely required. Pilot-projects showing what adaptation could look like, and policy advice may help governments to make decisions. However, since developing countries are still struggling to include climate change concerns into their policies and legislation, more effort has to be put into raising the responsiveness of governments and other people in power.

Mitigation action essentially happens at the international level. The national states are negotiating and deciding how the international climate regime should work. For now, there is no specific relation between global greenhouse gases reduction efforts and food security or health other than the general link between emissions and climate change. Local impacts of mitigation on health have been covered in earlier sections already.

It is obvious that there is a lot happening at the international level, and to cover all the activities is too large a task for this paper. International activity means international attention and that brings funding and projects with it, a crucial factor for further work on every level.

## 5. Conclusion

Food security and health are two crucial issues of climate change not specific to, but particularly dramatic for Southern Africa. The present state of health and nutrition is already a cause for major concern and this will not improve if adaptation and mitigation activities are not taken seriously. Action needs to be taken to improve the situation people in these countries are living in currently, and to prevent conditions from becoming even worse in the coming years.

I argue in this paper that currently the most efficient way of dealing with the existing and future burdens of climate change impacts are activities at national level, and enhanced effort has to be made to improve regional and international collaboration in addressing these issues. International and regional cooperation has started and in some cases already delivering good results, but national governments still carry heavy responsibilities that they are not properly prepared for. Financial, human and knowledge resources are lacking, to the point that some countries are not even able to participate

through basic measures like producing a National Communication.

It would be great if institutions and government departments placed more effort into adaptation strategy research. With this work it would be possible to compare and define good practice examples on the national level, which in turn might help international players to place better focussed incentives to improve food security and human health in a changing climate.

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