

Global Environmental Problems as a Risk to Security



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Abbreviations

AGeoBw	Amt für Geoinformationswesen der Bundeswehr (Bundeswehr Geoinformation Office, now: Bundeswehr Geoinformation Centre)
CDM	Clean Development Mechanism
EC	European Council
EU	European Union
FAO	Food and Agricultural Organisation of the United Nations
FAO-STAT	FAO statistics
GTZ	Gesellschaft für Technische Zusammenarbeit mbH
HLPE	High Level Panel of Experts on Food Security and Nutrition, Committee on World Food Security, FAO
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
NATO	North Atlantic Treaty Organisation
PG	Palestinian Hydrology Group for Water and Environmental Resource Development
REN21	Renewable Energy Policy Network for the 21 st Century
UN	United Nations
UNCCD	United Nations Convention for Combating Desertification
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund
USA	United States of America
USDA-NRCS	United States Department of Agriculture – Natural Resource Conservation Service Soils
WBGU	Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (German Advisory Council on Global Change)
WFP	World Food Programme

1. Introduction

This study analyses the impact of climate change and desertification¹ on human security. According to current scientific findings, these global environmental problems affect human security most. First, their impact will be described on the global scale. Subsequently, a closer look will be taken on regions where these environmental problems are expected to have the most significant impact on human security.

Climate change is caused by anthropogenic greenhouse gas emissions into the atmosphere. Its most significant impacts are an increase in the global average temperature, a redistribution of precipitation on a large scale, and a rise in sea level. Desertification is caused by human-induced exploitation of the soils in arid areas as well as by erosion caused by wind and water. This results in land degradation and eventually the disappearance of natural vegetation. Even before desertification occurs, land degradation itself may significantly compromise human security.

Climate change was the first global environmental problem to be addressed as a serious risk to security in international scientific and political discussions. In 2007, the German Advisory Council on Global Change (Wissenschaftlicher Beirat der Bundesregierung für Globale Umweltveränderungen – WBGU) submitted the first comprehensive analysis of the impacts of climate change on security². That same year, a summary of this expert report was presented to the Heads of State or Government attending the G8 summit meeting in Germany. This sparked a lively international debate regarding security-related impacts of climate change. In 2007, the United Nations (UN) Security Council, then under British Presidency, had extended an invitation for discussing this issue. Four years later, a second debate was held under the German Presidency. Upon publication of the WBGU expert report, the European Union (EU) also addressed this matter.

In spring 2008, the European Council in cooperation with the European Commission submitted a pertinent report including recommendations³. A key recommendation was to study the security-related impacts of climate change in all regions of the world. Since then, several research teams have started working on that subject⁴.

In June 2009, the UN General Assembly adopted a resolution expressing deep concerns about the potential impact of climate change on security⁵.

In November 2010, NATO included climate change into its new Strategic Concept as one factor that will have a significant impact on future security in its area of interest⁶.

¹ All technical terms are explained in the glossary at the end of this study.

² WBGU (2008)

³ EC (2008)

⁴ Cf. Warner et al. (2009), Maas & Tänzler 2009, United Nations University (2012 and 2013)

⁵ UN (2009)

In July 2011, the EC recommended adopting a renewed and strengthened European Union (EU) climate diplomacy that also covers the impacts of climate change on international security⁷.

In March 2014, the 5th Assessment Report of the IPCC also outlined the impacts of climate change on human security⁸.

At the political level, the impact of desertification on international security was first addressed by the Secretariat of the United Nations Convention for Combating Desertification (UNCCD) in 2009⁹. But in many studies on the impacts of climate change that do not explicitly address desertification as an independent global environmental problem, the impact of desertification is nevertheless highlighted. The UNCCD distinguishes between these two global environmental problems due to their different root causes.

The central assumption of this study is that the impacts of the global environmental problems affect the human basic requirements for food and water both at regional and global level, thus increasing the conflict potential, at least in certain regions.

The study will start by explaining the impacts of climate change which can increase the conflict potential (Chapter 2), focussing on the water and land resources as well as on food production and pointing out their interrelations. It will become apparent that a decrease in food production as a consequence of climate change has a huge potential for intensifying conflicts. Chapter 3 will then outline the fact that desertification may intensify conflicts, especially in arid regions. Chapter 4 will discuss the conflict constellations arising from the respective conflict-related impacts of the global environmental problems described in chapters 2 and 3. Chapter 5 will assess how these problems are interlinked with population growth and rising living standards as well as land grab¹⁰, especially in poor developing countries. Special attention will be given to biofuels. Chapter 6 will focus on the regions where the global environmental problems covered by this study are most likely to intensify conflicts in future, and will analyse triggering factors. As a conclusion, Chapter 7 will provide a geopolitical assessment and present options for policies and measures.

2. Conflict-relevant impacts of climate change

The impacts of climate change with the greatest potential for intensifying conflicts are those affecting food and water availability, which are vitally important goods (cf. Chapter 1). Therefore, a decrease of water resources does not only result in reduced

⁶ NATO (2010), Art. 15

⁷ EC (2011) in cooperation with the European External Action Service (2011)

⁸ IPCC (2014a), p. 20f.

⁹ Brauch & Spring (2009)

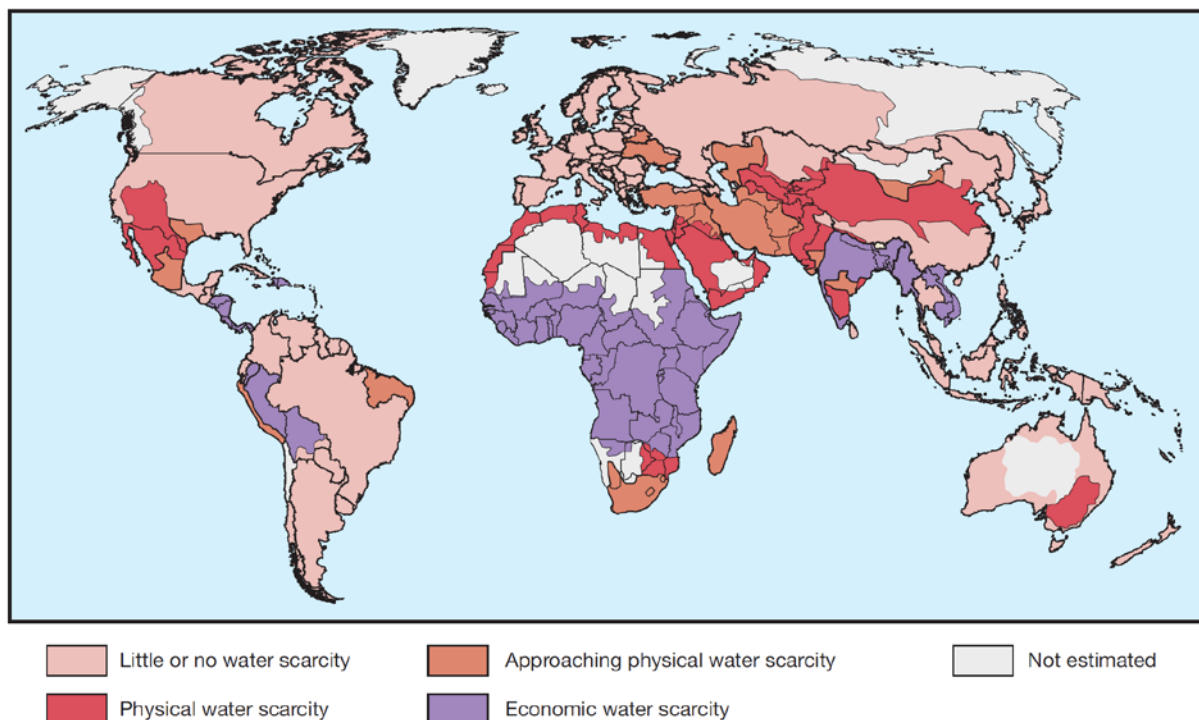
¹⁰ Foreign acquisitions in agricultural land

water availability but directly reduces agricultural production which is also affected by the rising sea level and by desertification, both leading to a loss of agricultural land. In addition, agricultural production is threatened by land degradation.

2.1 Impact on water resources

40% of the global renewable freshwater resources are already used by mankind¹¹. The consumption increases by about 10% per decade¹², with agriculture as the biggest consumer (70%)¹³. About 1.1 billion people already suffer from physical water scarcity, i.e. they live in regions where the demand for renewable freshwater is higher than the supply, and another 500 million people are approaching physical water scarcity. Another 1.6 billion people suffer from economic water scarcity, i.e. they live in regions where there is actually enough renewable freshwater, but people do not have the means for accessing it sufficiently (cf. Fig. 1).

Figure 1: Areas of 'physical' and 'economic' water scarcity¹⁴



Climate change reduces water availability in arid regions due to decreasing precipitation, while rising temperatures increase evaporation. Figure 2 illustrates the changes in total precipitation projected for this century. It shows that precipitation will mostly increase at higher latitudes and in many areas of the inner tropics, whilst a decrease is projected in the subtropics. Also, climate change leads to the melting of

¹¹ Renewable freshwater resources comprise rivers, lakes, groundwater, and soil moisture

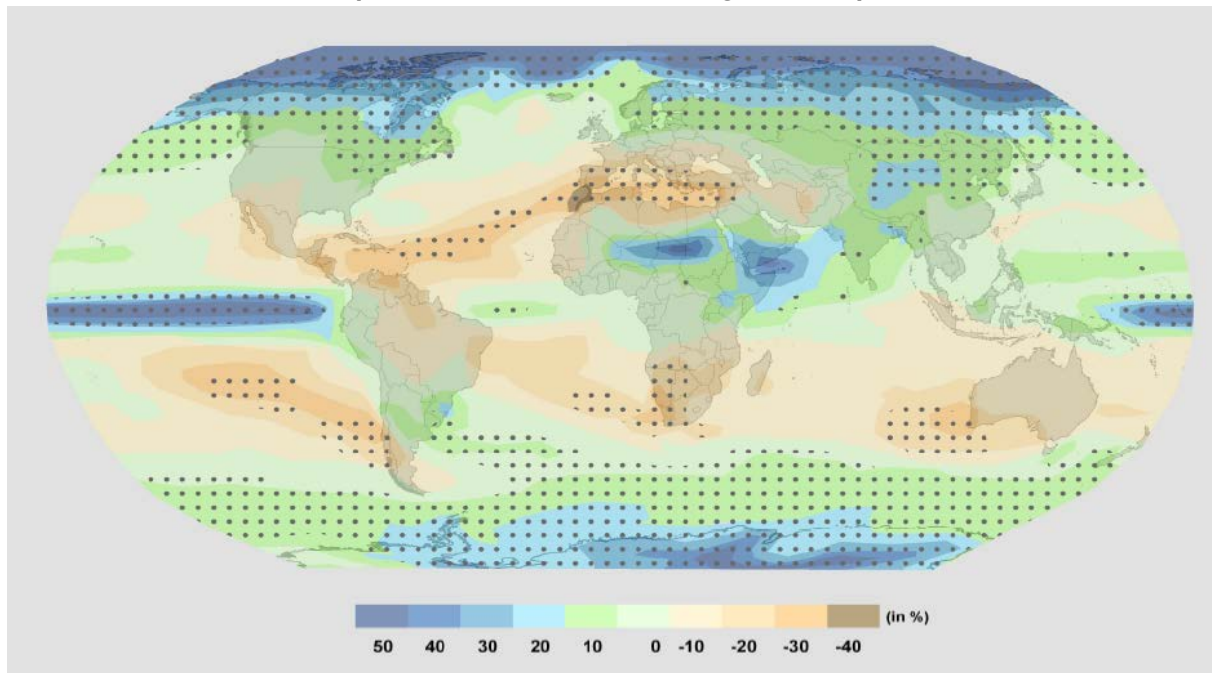
¹² WBGU (2008), p. 83

¹³ UNESCO (2012), p. 18

¹⁴ Source: International Water Management Institute (2007), p. 11, from WBGU (2008), p. 81

the mountain glaciers. As soon as their size falls below a critical level, the glaciers will supply the rivers with less melt water. In a few decades, these rivers, first of all those that are supplied with melt water from the glaciers in the Himalayas and Andes, will consequently carry less water in the dry season. Often there will not be sufficient water then for a second harvest, for example along the Indus River in Pakistan or the Ganges River in India.

Figure 2: Projections of the changes in total precipitation in the 21st century¹⁵
(in % of the current climatological mean)



About one fifth of the world's population lives in the catchment areas of the rivers fed from glacier water from the Himalayas and the Andes. This underscores the significance of glacial retreat, at least for the time horizon until the end of this century.

2.2 Impact on land resources¹⁶

Climate change reduces the availability of agricultural areas primarily due to the rising sea level. The rising sea level also leads to the loss of land on the coasts and to the intrusion of salt water into freshwater reservoirs near the coast. For this century, the sea level is projected to rise by roughly one metre¹⁷, which could result in the flooding of about 1.0% of the arable land worldwide.

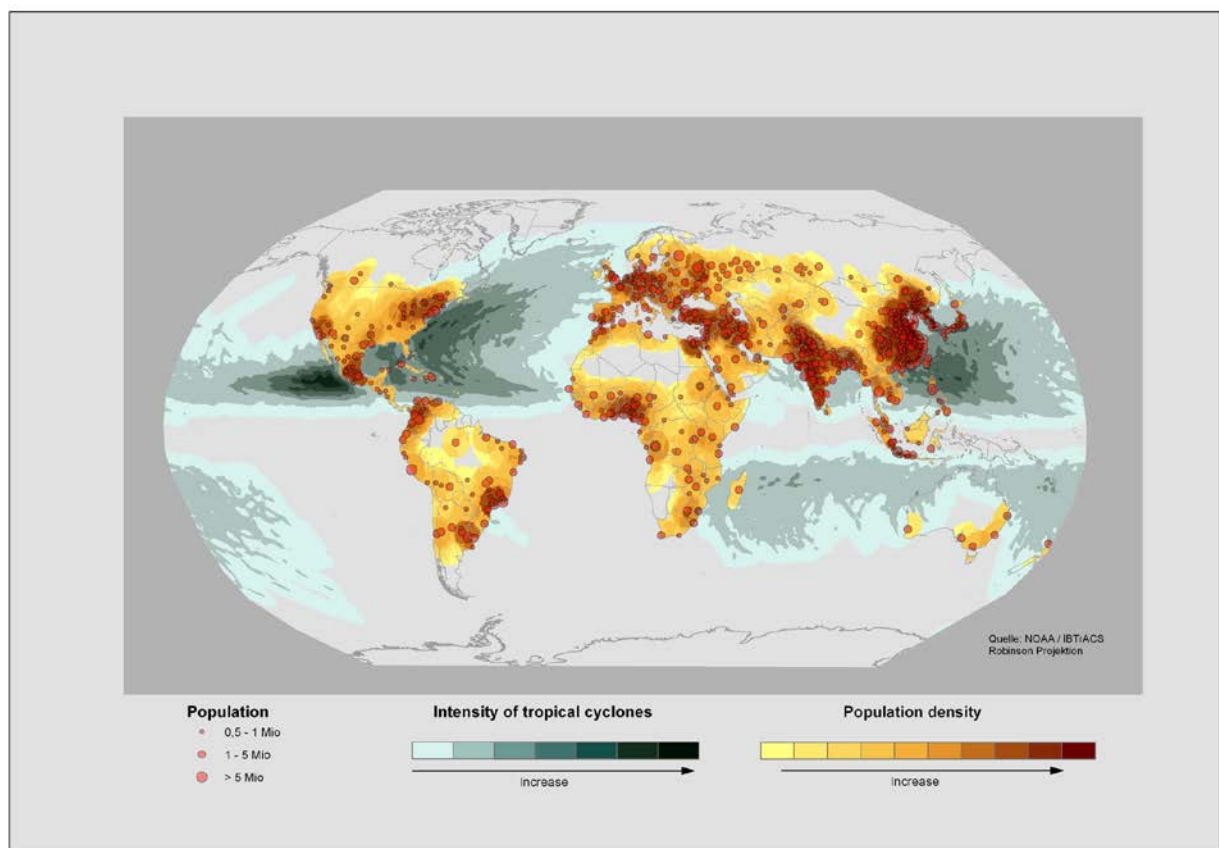
¹⁵ According to IPCC (2013). For this graphic, the means of the 39 models used for the report were calculated. The dots indicate areas where the signal is significant, i.e. the standard deviation is at least twice as high as the 20 year variability until the end of this century, and in more than 90% of the models used, the trend points to the same direction.

¹⁶ Cf. AGeoBw (2010), S. 16-18

¹⁷ IPCC (2013), S. 21

Due to climate change, it is also expected that tropical cyclones will intensify¹⁸, causing increasingly high flood waves. During typhoon Haiyan, which devastated parts of the Philippines in November 2013, some regions are reported to have been struck by a flood wave of five metres in height that, similar to a tsunami, destroyed almost anything caught in it. Tropical cyclones constitute a risk for the population, in particular, in regions where they hit flat, densely populated coastal areas. Vulnerable regions are principally the coasts of Southeast Asia (Southeast China and the Philippines), the Bay of Bengal and the Caribbean as illustrated in Figure 3. That figure shows the intensity of tropical cyclones as well as the population density and the location of urban agglomerations.

Figure 3: Tropical cyclone threat to urban agglomerations¹⁹



2.3 Impact on food production

Currently about 1 billion people suffer from hunger²⁰, and the demand for food is projected to further increase by about 50% by 2030²¹. The availability of further

¹⁸ IPCC (2013), p. 5

¹⁹ Source: WBGU (2008), S. 112

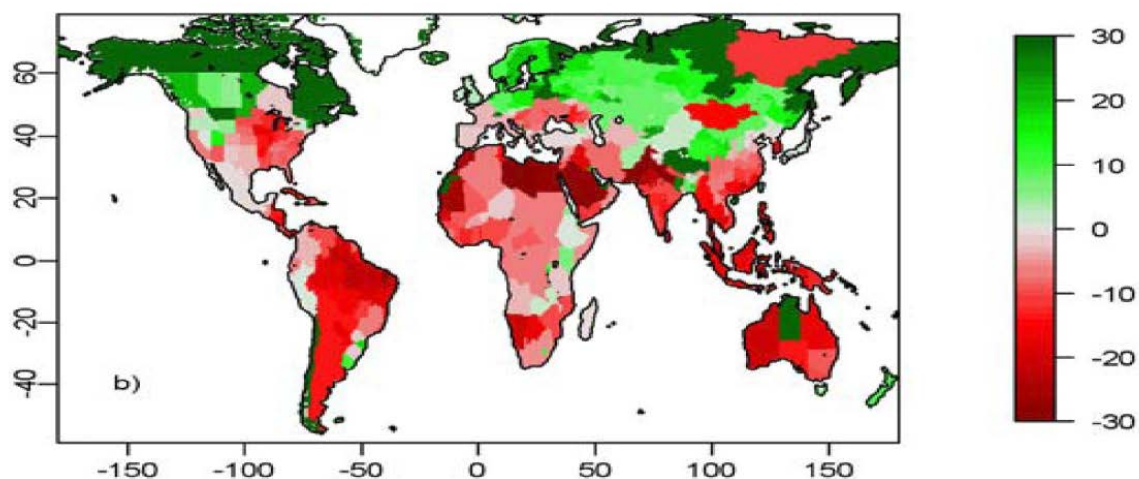
²⁰ According to: Internationale Food Policy Research Institute (2013), p. 5.

²¹ UNESCO (2013), p. 46

agricultural areas is limited. It can't be extended by more than 13% in total if agriculture is practised sustainably²².

Primarily in the tropical and subtropical as well as temperate zones, climate change will lead to a decrease in agricultural yields as long as agriculture does not adapt to climate change²³. These projected changes in agricultural yields are essentially the result of shifts in water availability and temperatures. Thus, agricultural yields at higher latitudes benefit from increasing temperatures, a prolonged vegetation period, and more precipitation. At lower latitudes, however, increasing temperatures generally decrease agricultural yields. If precipitation is declining too, agricultural yields will further diminish due to less water availability. Fig. 4 shows first model results of the projected changes in agricultural yields. These results are, however, still rather uncertain and can therefore only be interpreted as a qualitative baseline. Furthermore, the area available for agricultural purposes is reduced as already described in Chapter 2.1.

Figure 4: Projected changes in agricultural yields 2000 – 2050 ²⁴



3. Conflict relevant impacts of desertification²⁵

Those forms of land use that contribute most to land degradation and may eventually lead to desertification are overexploitation of the soil in agriculture, deforestation, and non-sustainable forms of irrigation that lead to the salinization of soils. Furthermore, population growth increases the demand for food. As a result, the regeneration time for soils after a drought is too short if agriculture and pasture farming are not practised in a sustainable way. After all, they degrade during each drought period. In the past, the vegetation covering these soils could regenerate once precipitation has

²² According to: WBGU (2009), p. 67

²³ IPCC (2014a), p. 17f.

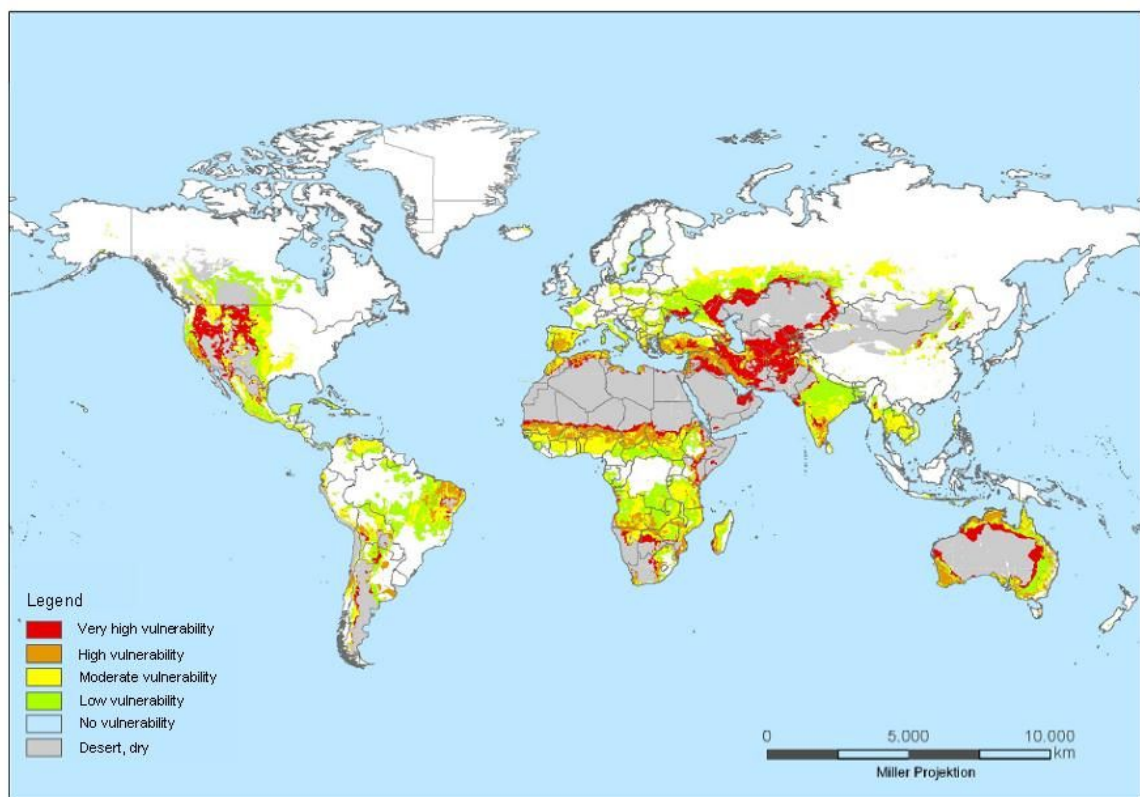
²⁴ According to Müller et al. (2009)

²⁵ The most important information and figures originate from UNCCD (2012)

reached its mean again, and people have adapted to variations in precipitation. Nowadays, regeneration becomes more and more difficult due to the growing population, and eventually becomes impossible if the methods used for the cultivation of land are not sustainable. Land degradation and desertification are additionally increased by wind and water-induced soil erosion.

Fig. 5 shows the only global analysis existing so far regarding the vulnerability to desertification. It reveals that the margin areas of deserts are the areas most vulnerable to desertification.

Figure 5: Vulnerability of the soils to desertification²⁶



The UN estimates that 12 million hectares²⁷ of agricultural land are lost world-wide each year due to desertification. This corresponds to about 0.6% of the agricultural land per year and is about 50 times more than the amount of land lost due to the rise of the sea level caused by climate change (see above). 24% of the global land area has degrading soils. About 1.5 billion people live in this area which contains about 20% of the global agricultural land²⁸. These estimates are seemingly outdated, and there is no scientific proof of their accuracy. The first scientifically relevant analysis

²⁶ According to USDA-NRCS (1998)

²⁷ Brauch & Spring (2009), p. 2

²⁸ Van Schaik and Dinnissen (2014), p. 16

which is currently performed by the Joint Research Centre (JRC) of the European Commission is scheduled to be published in late 2014²⁹.

On the northern margin of the Sahara Desert, desertification is also intensified by climate change as precipitation is in decline³⁰ and will continue to decrease in the course of this century.

4. Conflict constellations

The global environmental problems climate change and desertification lead to three important conflict constellations:

- *Conflict constellation "water scarcity"*: The decline of freshwater available in many arid areas may lead to conflicts if the downstream riparians in a river catchment area no longer have sufficient freshwater for supplying the population once the upstream riparians have ensured their own needs. So far, water conflicts apparently have rather enhanced the cooperation between countries concerned³¹. This situation may rapidly change in the future, though, especially concerning states abutting the Nile, the Euphrates and the Tigris as well as the Jordan Rivers. In the Nile region, for example, the relationship between Ethiopia and Egypt became strained in June 2013 because Ethiopia plans to construct a dam on the Blue Nile near the Sudanese border³². Egypt, however, cannot do with less water as the country relies on irrigation farming and, in spite of using almost all available Nile water, has to import about 50 % of its agricultural goods³³.
- *Conflict constellation "loss of land"*: Due to desertification and – too a much lesser extent – to the rising sea level, the agricultural area available world-wide and, consequently, the potential for the cultivation of foodstuff, will decrease. This may threaten the livelihood of many people, especially in poor developing countries, as far as they are affected in particular by loss of land, since most of them do not have the technology necessary for increasing agricultural productivity and most people lack the resources for buying the required food at the prices demanded on the international markets.
- *Conflict constellation "food insecurity"*: Agricultural yields will decrease in large parts of the tropics and subtropics which will have an impact on the supply of agricultural goods to the population living in these countries. This may trigger conflicts, especially in poor countries, where large parts of the population do not have the means for buying the food they need. This has been shown by many examples: From 2007 to 2008, crop failures caused by droughts, this time in the temperate zone, i.e. in Ukraine and Australia - both being grain-exporting

²⁹ Cf. World Atlas of Desertification (2014)

³⁰ Cf. World Bank (2012), p. 14

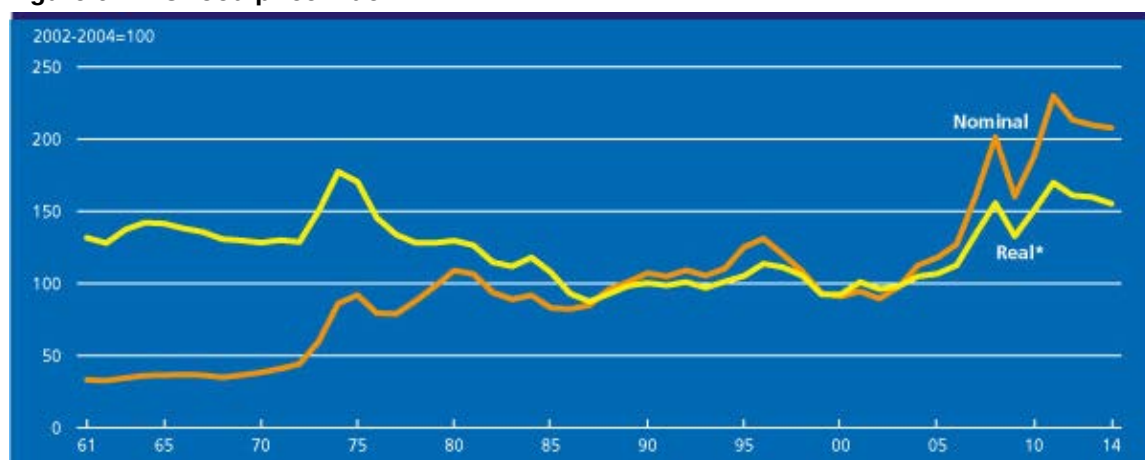
³¹ WBGU (2008), p. 83

³² George (2013)

³³ Cf. FAO-STAT, "Cereal Import Dependence Indicator", download of 17 Feb 2014

countries that are important for the world market - led to almost a doubling of the prices of internationally traded foodstuff³⁴. The gradual increase of the food prices started, however, as early as in 2001. The main reasons are the increasing demand caused by the growing population and rising living standards, the increasing production of biofuels and low investments into agriculture³⁵ (cf. Fig. 6). Therefore many relatively rich countries exporting agricultural goods stopped their grain exports in 2008 in order to ensure food supply to their own population. This finally led to unrest in 48 countries³⁶. In 2010, there was another rise in food prices, which is considered one – among others – of the triggers of the Arab Spring³⁷.

Figure 6: FAO food price index³⁸



* the real price index is the inflation-adjusted World Bank Manufacturers Unit price index³⁹

Conflicts may be intensified by interaction of the above-mentioned conflict constellations caused by these respective global environmental problems discussed in this study: If water and food resources in a region decrease to the extent that the people living there can no longer ensure their livelihood and do not have any chance for adapting to the situation, but still have enough resources for migrating, these people will move to regions where they hope to find sufficient freshwater and food. This is, however, often not possible for the poorest echelons of society, especially in the least developed countries. They have to depend on support provided by their government or authorities⁴⁰ but, also, often on food aid provided by, i.e., the World Food Programme (WFP).

³⁴ Brinkmann & Hendrix (2010), p. 21

³⁵ Brinkmann & Hendrix (2010), p. 13

³⁶ Brinkmann & Hendrix (2010), p. 2

³⁷ Johnstone & Mazo (2013), p. 15

³⁸ FAO (2014)

³⁹ World Bank (2014), quoted in FAO (2014)

⁴⁰ Cf. WBGU (2008), p. 127 f. and Forsight (2011), p. 43f.

In less developed countries, migration is therefore the most frequent way of adapting to climate change and desertification. The situation of people can be improved, in particular, if a family member migrates to a richer country in order to support his/her family by remittances, primarily for buying imported food which the family would not be able to afford otherwise. Often, entire families leave the country. Mostly, however, people migrate within their own country or to a neighbouring country as most of them do not have the means for travelling far. Moreover, they wish to return home as soon as the situation there has improved. People primarily migrate from rural to urban areas, thus intensifying urbanisation. The most important migration flux during the next few decades will be oriented towards the large cities on the coastal areas of the developing countries. For the period from 2000 to 2060, it is projected that the number of people settling in the coastal cities in South Asia and Southeast Asia will multiply by a factor of 5 to 10, mostly due to migration. In Africa, south of the Sahara desert, this factor is projected to be even higher⁴¹. Most of these migrants will live in the flood-plain areas of these cities. It should also be noted that now, already, 18 of the 24 megacities world-wide are located on coasts⁴².

Migration may increase the conflict potential, in particular if

- it is oriented from rural areas towards the cities. In urban areas, it is easier for people to join forces, which increases the risk of organised protests and riots;
- it is oriented towards the present and future floodplain areas of the big cities. More and more frequently, the people settling there will have to leave in order to escape from flood waves;
- it is oriented towards rural areas where the local population also suffers from the effects of climate change and/or desertification. Conflicts may arise between migrants and locals there⁴³.

The climate change and desertification-induced changes in the environmental conditions are only one of many factors that make people migrate and that consequently have the potential for weakening the governance of states. The most important reasons for migration are of economic and social, but also of a political and demographic nature. They are currently more relevant than environmental problems⁴⁴. This may change in the future, since the impacts of climate change, in particular, will clearly intensify. Normally, however, people will decide to migrate not only for one reason alone. Therefore, it is not possible to differentiate between “environmental migrants” and other migrants. Consequently, the climate change and desertification-induced changes to the environment cannot be considered in isolation as triggering conflicts. Nevertheless they are an important factor that may aggravate existing and future conflicts.

⁴¹ Forsight (2011), p. 88

⁴² Cf. AGeoBw (2013), p. 10, date: 2012

⁴³ Cf. WBGU (2008), p. 125ff.

⁴⁴ Forsight (2011), p. 44ff.

The conflict potential within a state may increase as a consequence of climate change and/or desertification and the state concerned can turn into a fragile state if

- its governance is excessively strained due to the acceptance of migrants, eroding its institutional and material resources, and/or
- parts of its population are strongly affected by climate change and/or desertification, but are too weak for migration, and the state can no longer provide the support they require for their survival, since its institutional and material resources have already been overexploited⁴⁵.

In fragile states, the conflict potential is substantially higher than in stable states because their institutions don't have the resources for controlling certain regions. Within these regions, therefore, the law can't be enforced so that, for example, terrorist groups have freedom of movement and can join forces, preventing assistance which is being provided to the local population.

5. Influencing variables

The conflict constellations explained in Chapter 4 should not be considered in isolation. Influencing variables such as the population growth and rising living standards as well as land grab in poor developing countries and the increasing consumption of biofuels are to be taken into account as well. Therefore, this chapter will elaborate on these variables and their interaction with the above conflict constellations.

5.1 Population growth and rising living standards

Population growth – along with a rising prosperity level, even in developing countries and emerging economies – is the driving force behind the demand for food, water, and energy, thus intensifying the global environmental problems climate change and desertification. During the last century, the global population has doubled every 40 years, approximately, and will further grow during the decades to come, albeit at decreasing relative, and later absolute, rates. The UN projects that the world's population will have increased by another 2 billion, i.e. to 9 billion people by 2050⁴⁶. Climate change has been fuelled by population growth and rising standards of living to about the same extent in the last few decades. Since the start of this century, the influence of rising standards of living has increased substantially while that of population growth has more or less remained the same⁴⁷.

⁴⁵ Cf. WBGU (2008), p. 129f.

⁴⁶ UNFPA (2012), p. 17

⁴⁷ IPCC (2014b), p. 7f.

5.2 Land grab

Increase of land grab decreases the food and freshwater resources if the land used by local farmers is leased or bought by foreign investors without adequate land being made available to the local farmers in compensation. This may increase the conflict potential, especially in the poorest developing countries, if more and more people no longer have the means for ensuring their livelihood⁴⁸. The major causes of land grab are the rise and increasing volatility of food prices on the international markets, the growing demand for biofuels, land speculation⁴⁹ and recently also the claiming of land for projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol⁵⁰. Climate change itself indirectly leads to an intensification of land grab as crop failures result in a surge of food prices on the global markets. It contributed essentially to the drastic rise in prices in 2008⁵¹. Rising food prices on the global markets, again, play an important role in increasing land grab.

Land grab has been manifesting itself to a larger extent only since 2007, when the international food prices rose and the global economic crisis started.⁵² As a result, for many hard-currency countries it became more cost-effective cultivating crops on the agricultural areas of poor developing countries that offer them at the lowest prices, than importing them.

The most important investors are state investors from Saudi Arabia, China, Japan, and South Korea who mainly aim at ensuring their own food supply, private investors from industrial states who want to procure biofuels, as well as banks and investment funds⁵³. Host countries primarily include developing countries, especially in Sub-Saharan Africa, that offer their arable land at the lowest prices⁵⁴. But these countries, many of them among the failing states, are those where people suffer from hunger most. Hunger and deteriorating governance add to the conflict potential in these countries.

Currently, as much as two to three percent of the global agricultural area is already under foreign control. More than half of this area is located in Africa, one tenth of it is already used. Last year, this area under foreign control which was already in use tripled, which is a proof of that dynamic development⁵⁵. Consequently, the impact of land grab on security in less developed countries is expected to significantly increase

⁴⁸ Cf. HLPE (2011), p. 8

⁴⁹ HLPE (2011), p. 19

⁵⁰ Jung et al. (2014), p. 270

⁵¹ Cf. Sternberg (2013)

⁵² GTZ (2009), p. 13

⁵³ Goesser (2011), p. 8

⁵⁴ Cf. Jung et al. (2014), p. 263

⁵⁵ The figures given for land grab originate from the latest land matrix; the figures for the agricultural land areas are based on FAOSTAT

in the next few years, if investors start using all acquired arable land. The trend of land acquisition is also likely to further intensify correlatively to the factors triggering it, e.g. the impact of climate change.

Many host countries approved foreign investments into their arable land, not only for acquiring foreign exchange, but also for accessing technologies increasing their own crop productivity and using the available freshwater more efficiently. Mostly, these expectations have not been met so far. Instead, they often lost the access to land and water by selling or leasing land. In addition, the competition for the remaining agricultural land has often led to rising prices for land, food, and water⁵⁶. Some host countries also transferred agricultural land that had been cultivated by local disadvantaged population groups to foreign investors⁵⁷.

5.3 Biofuels

In many countries, biofuels have been introduced in order to mitigate climate change by reducing the transport-related greenhouse gas emissions. Since the start of this century, they increasingly replaced fossil fuels in the transport sector in order to slow down the rise in the traffic-related greenhouse gas emissions. In 2004, the production of biofuels increased significantly⁵⁸, as the price of crude oil skyrocketed on the global market so that biofuels became increasingly cost-effective. Already now, 2 to 3% of the global agricultural area is used for cultivating crops for the production of biofuels, and this trend is increasing⁵⁹. This jeopardises food security, especially in those developing countries where foreign investors cultivate plants for the production of biofuels. One to two thirds of the land grab aim at the production of biofuels⁶⁰.

The 2008 WBGU expert report on *Future Bioenergy and Sustainable Land Use* revealed that the replacement of fossil fuels by biofuels can hardly reduce transport-related greenhouse gas emissions, depending on the particular conversion path from the cultivation of crops to the production of biofuels. Some conversion paths even increase emissions⁶¹. Reduction of the emissions had previously just been assumed because

- the carbon dioxide emitted by biofuels was considered to be fully reabsorbed by the crops cultivated for the production of biofuels,
- the greenhouse gases emitted due to the mineral nitrogen fertilisers of these crops (N₂O - nitrous oxide) were not taken into account, and

⁵⁶ Cf. Jung et al. (2014), p. 261

⁵⁷ Cf. Jung et al. (2014), p. 270

⁵⁸ Cf. HLPE (2013), p. 27

⁵⁹ HLPE (2013), p. 82

⁶⁰ HLPE (2013), p. 84

⁶¹ WBGU (2009), p. 188

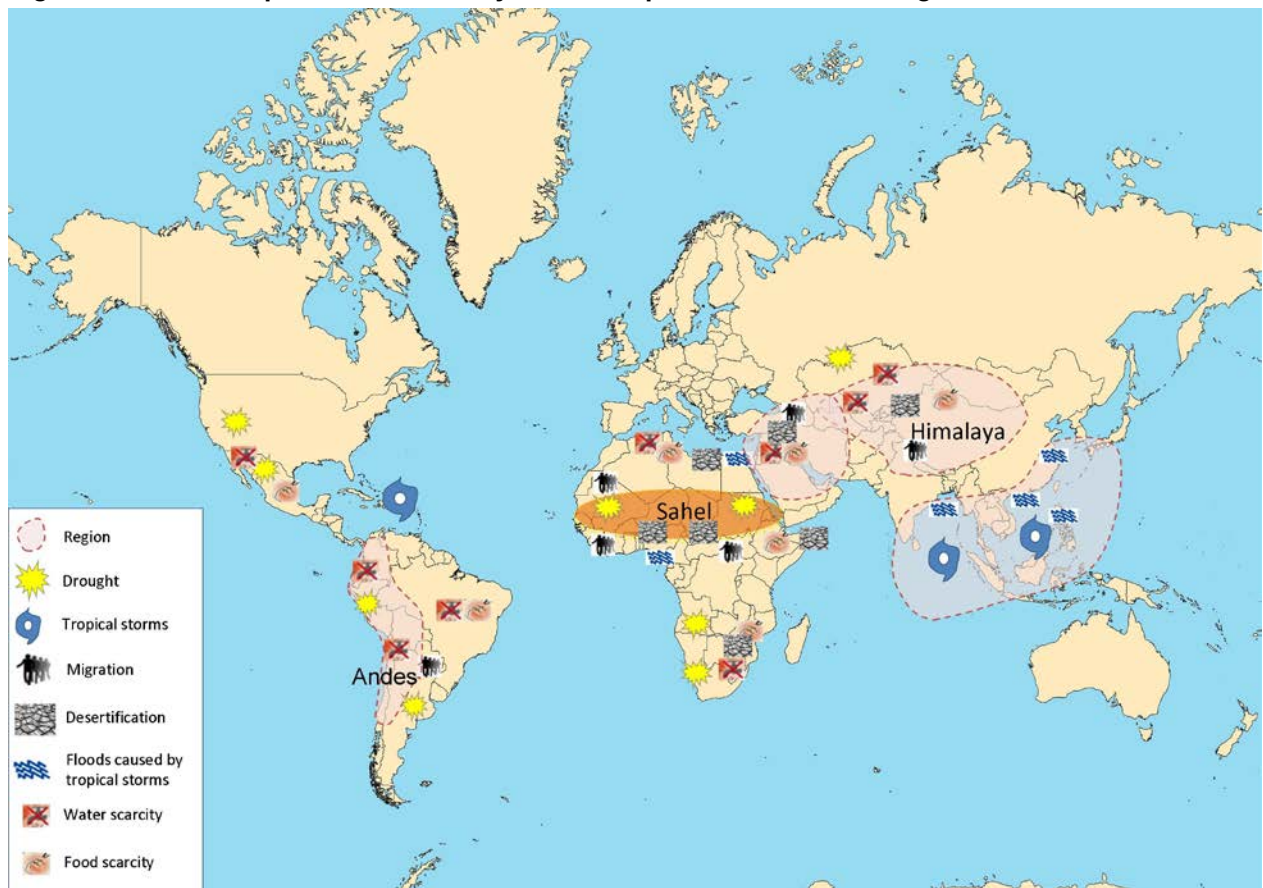
- it was neglected that the original owners of the agricultural land used for the cultivation of plants for the production of biofuels have to find new land and thus cause additional greenhouse gas emissions in the process.

The only conversion paths that lead to a clear reduction of greenhouse gases are the use of sugar cane and second generation biofuels⁶².

6. Hot spots

This chapter will have a closer look at the regions whose security is threatened most by climate change and desertification. Figure 7 highlights regional hot spots.

Figure 7: Hot spots of the security-related impacts of climate change and desertification



6.1 Desertification in the Sahel

In the last few decades, the Sahara has been spreading southward into the Sahel (1 to 3 km/year) due to the overexploitation of soils in combination with major drought periods since the 1970s⁶³. Since the early 1970s, the Sahel has been struck by devastating droughts. Afterwards, precipitation has increased again but with huge variations from year to year.⁶⁴ The main cause for desertification there is the excessive use of the already nutrient-poor soils for the grazing of cattle and for

⁶² HLPE (2013), p. 49

⁶³ According to UNEP (2007), p. 9, the Sahara Desert has spread by 50 to 200 km since 1930

⁶⁴ UNEP (2011), p. 35

cultivation. Moreover, torrential rains are becoming more common, leading to an increase in soil erosion.

In the Sahel, multiple conflicts recently occurred that were intensified by environmental degradation, and especially by desertification, most notably the conflicts in Darfur and in the north of Mali⁶⁵. The essential conflict constellation in the Sahel created by desertification is a conflict for the utilisation of agricultural land between nomads and the sedentary farmers further to the south⁶⁶. Due to desertification, the nomads on the southern border of the Sahara have to move ever further to the south in winter in order to ensure their livelihood. Other important factors that contribute to the development of conflicts in this region include

- the weak governance of almost all states⁶⁷,
- the significant food insecurity: The whole region is still suffering from the repercussions of the drought-induced famines of 2005, 2008, 2010, and 2012. In 2012, a record number of 18 million people were food insecure and it was only possible to prevent human disaster thanks to international aid. In early 2014, even 20 million people were food insecure in spite of good harvests⁶⁸.
- land grab, particularly in Sudan, South Sudan, Mali, and Senegal⁶⁹, and
- migration: A large flux of migrants currently moves from the Sahel towards the Gulf of Guinea. A megacity is emerging there that is predicted to extend from Lagos to Accra by 2020 and is expected to accommodate 50 million people⁷⁰.

Climate change is expected to result in an increase in precipitation in the Sahel and in a further rise of temperatures during the next few decades⁷¹. Despite the increased precipitation, desertification is likely to continue as long as sustainable agriculture is not ensured. But there are some first signs that the trend is changing in this respect. In some regions of the Sahel, a steady vegetation growth can be observed and some farmers have already enhanced their agricultural productivity by introducing new cultivation methods, primarily agroforestry. In Niger, in particular, there has been a shift towards agroforestry for an area of 50,000 km² in the last few years which resulted in substantially increased yields⁷².

It is highly probable that climate change and desertification will trigger new conflicts in the Sahel in the near future. The international community has to face the big challenge of containing or possibly preventing them. The region around Lake Chad is

⁶⁵ Cf. Van Schaik & Dinnissen (2014), p. 51

⁶⁶ Van Schaik & Dinnissen (2014), p. 52

⁶⁷ Cf. Haken (2013)

⁶⁸ European Commission (2014), p. 2

⁶⁹ Cf. Landmatrix

⁷⁰ Hewawasam (2002), quoted in UNEP (2011)

⁷¹ Cf. IPCC (2013), p. 1063 and Fig. 2

⁷² Garrithy (2010), p. 200

likely to be one of the hot spots. Lake Chad has already lost 95% of its surface area since the 1960s, and more and more local residents migrate to other regions⁷³.

6.2 Droughts in the Middle East

Large parts of the Middle East are affected by hydrological water scarcity and recently precipitation has been decreasing in wide areas while temperatures have been rising, especially in the Levant region⁷⁴. The whole region is subject to strong desertification (cf. Fig. 5), while agricultural yields are declining⁷⁵. In many areas, the aquifers are also gradually becoming exploited by irrigation in agriculture⁷⁶, and the water of the large rivers in the region (Jordan, Euphrates and Tigris) is overexploited⁷⁷.

Recently, the region was affected by several conflicts, primarily the wars in Iraq and currently in Syria. The decline in agricultural yields caused by a severe drought period that started in 2006 is one of the major factors that triggered the civil war there⁷⁸.

Saudi Arabia abandoned its programme for food self-sufficiency already in 2005 as the country's aquifers could no longer ensure irrigation. Since then, Saudi Arabia has increasingly been investing in agricultural land in poor developing countries⁷⁹.

For Israel, the West Bank areas occupied in 1967 make an essential contribution to water supply, which has already led to substantial tensions with the neighbouring states⁸⁰.

The Intergovernmental Panel on Climate Change (IPCC) projects that in those parts of the region that have not yet turned into desert, precipitation will continue to rapidly decline during the next few decades. This will intensify desertification, and both agricultural productivity and yields are expected to further decrease. Water availability is therefore likely to significantly threaten food production. This fuels the outbreak of additional conflicts in the near future, especially in the poorer countries of the region such as Yemen or Iraq that do not have enough foreign currencies for buying or leasing agricultural land in other countries. Moreover the dams on the upper Euphrates and Tigris in Turkey as well as the Israeli occupation of the Palestinian regions might lead to conflicts for water.

⁷³ UNEP (2011), p. 61f.

⁷⁴ IPCC (2013), p. 194 (temperature) and p. 203 (precipitation)

⁷⁵ Cf. World Bank (2012), p. 16

⁷⁶ Brown (2012), p. 60

⁷⁷ Cf. Brown (2012), p. 62

⁷⁸ Femia and Werrell (2013)

⁷⁹ Brown (2012), p. 60

⁸⁰ PG (2012), p. 44f.

6.3 Central Asia

Central Asia is characterised by low precipitation, a very high vulnerability to desertification and extensive hydrological water scarcity. The hot spot in this region is the Aral Sea whose volume – just like that of Lake Chad – is continuously decreasing due to the immense water consumption of the states bordering on it. Most of the water is used for the cultivation of cotton in Kazakhstan, Uzbekistan, and Turkmenistan which drain the water of its tributaries. The Aral Sea has already split into four residual lakes and shrunk by 90% over the past 50 years⁸¹.

As most Central Asian states – with the exception of Kazakhstan – are at a relatively low development level while at the same time the consumption of resources continuously increases due to the population growth, desertification may also intensify conflicts if no suitable countermeasures are taken, primarily with regard to improvements in agriculture and water management.

6.4 Tropical cyclones in South Asia and South East Asia

Bangladesh, Southeast China and the Philippines are affected in particular by tropical cyclones⁸², accompanied by flood waves, striking the densely populated coastal areas. Due to the fact that the sea level is rising, that an increasing number of migrants settles in the floodplain regions of urban agglomerations, that the land under many big cities is sinking due to overexploitation of the groundwater, and that the height of flood waves of tropical cyclones is expected to increase, such flood waves destroy the resources on which ever more people depend. Typhoon Haiyan which devastated central parts of the Philippines in November 2013 is the most recent example of what these countries may expect in the future. The looting of and fighting for relief supplies in the wake of the typhoon demonstrate how fast people are ready to use violence in such situations.

Special attention should be given to Bangladesh, as the country is almost at sea level and has one of the highest population densities world-wide. Already now, a large flux of migrants moves from Bangladesh towards India. Therefore India felt it necessary to build a fence for keeping away the migrants⁸³.

7. Geopolitical assessment and options for action

Figure 8 summarises the analyses of this study in a diagram.

The global environmental problems of climate change and desertification are basically fuelled by population growth and the rising living standards of large parts of the population, both increasing the demand for basic goods, i.e. food and water. On the other hand, the availability of these basic goods is limited due to the impacts of

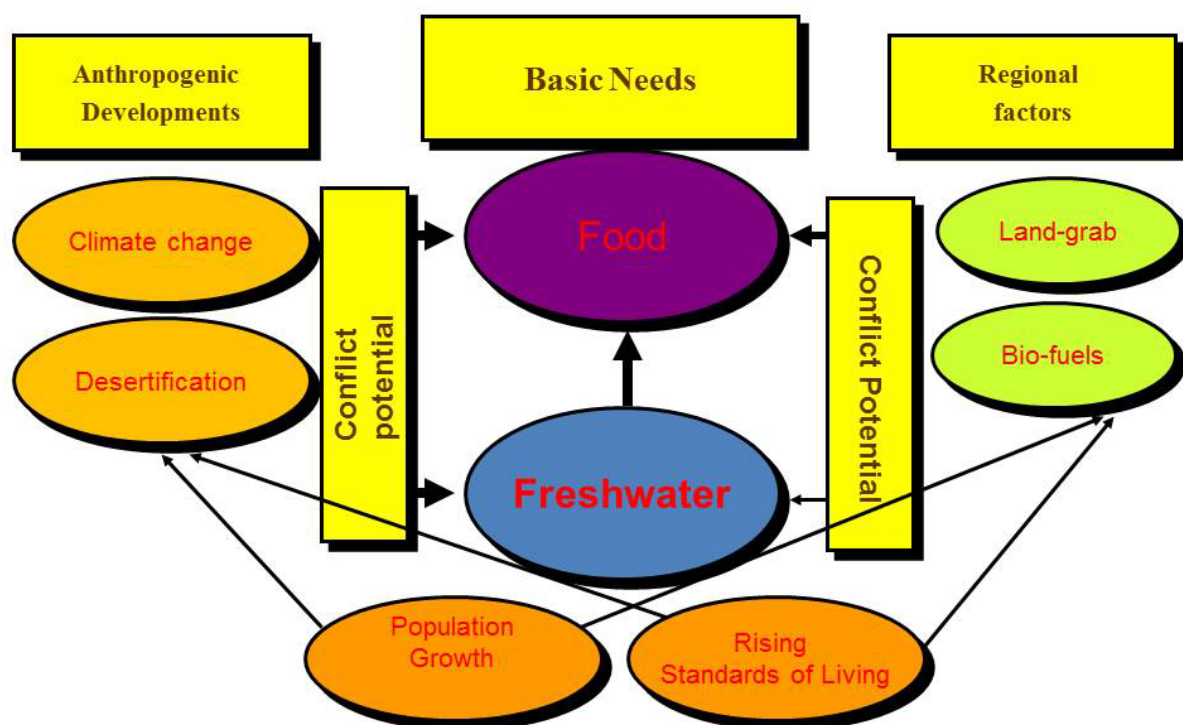
⁸¹ Micklin & Aladin (2008), p. 64

⁸² Cf. WBGU (2008), p. 112

⁸³ Kleber & Paskal (2012), p. 207

global environmental problems, especially in the arid regions of the world. The availability of food also strongly depends on the availability of water, as the largest part of the water which is used by the population is earmarked for the cultivation of food, primarily in irrigated agriculture in the arid areas of the Earth. One of the major factors limiting the cultivation of food is the lack of sufficient agricultural land. Especially in poor developing countries, arable land becomes continuously scarcer due to land grab and the cultivation of crops for biofuels, which are both influencing regional factors, too, that are closely related to the impacts of the global environmental problems discussed in this study. The poorer the developing countries, the more vulnerable they are.

Figure 8: Diagram showing the security-related impact of global environmental problems



From a geopolitical perspective, climate change and desertification count among the biggest challenges of our time. They are changing environmental conditions in many regions already now, especially in the four discussed hot spot regions whose climate change and desertification-related conflict potential is discussed in this study. These two global environmental problems will continue having a substantial impact on the environment during the next few decades if no extensive countermeasures are taken.

During the last few decades, desertification has already reached enormous proportions, while the impacts of climate change have become more noticeable only recently. They will, however, continue to intensify over the decades to come. While it seems to be possible to contain desertification by restoring the soils through sustainable farming and water management, measures aiming at the reduction of

greenhouse gas emission will take several decades before affecting the global climate.

Many players are already aware of the security impacts at least of climate change, but a comprehensive exchange of interests at the political level, e.g. the UN, has to be initiated in order to enable the global community to take decisive action against these problems. While a new and efficient climate agreement under the United Nations Framework Convention on Climate Change is currently slowed by oil-exporting countries, most notably by Saudi Arabia and Kuwait, the UNCCD still needs the attention necessary for promoting measures in order to mitigate desertification more efficiently.

On the other hand, the most important measure for the mitigation of climate change, i.e. the switch to renewable energy sources for energy supply systems, has recently been gaining momentum. Thus, since 2011 the overall electric power output from the newly established power-generating plants are generating more electricity from renewable energies than those from fossil fuels⁸⁴. In 2012, the total share of power plant capacities based on renewable energies stood at more than 26% worldwide⁸⁵.

The second most important measure for the mitigation of climate change is sustainable farming and water management, most notably agroforestry, especially in arid areas. Agroforestry not only provides the potential for mitigating climate change, but also for adapting to it, efficiently restoring soils and enhancing food security. In addition, it is the most efficient countermeasure against desertification. The fact that this form of agriculture is spreading, first of all in Niger, Zambia, and Malawi, has not yet been noticed by many players, though.

Due to their high conflict potential, the visibility of the impacts of the global environmental problems climate change and desertification on security should be vigorously stressed at the UN level so that the International Community can start working on its root causes and the associated conflict potential in a joint effort.

First, efforts should be made to reduce soil degradation. Regarding this issue, the importance of soils and their role as carbon sinks should be given higher priority in the negotiations under the United Nations Framework Convention on Climate Change. In addition, food security would be enhanced so that potential conflicts could be prevented. It would therefore be desirable to incorporate the aspects of soil restoration and their impacts on security into the new climate agreement.

⁸⁴ REN21 (2012), p. 15

⁸⁵ REN21 (2013), p. 13

Second, soils and their role should also be taken into consideration regarding the formulation of the Sustainable Development Goals that are currently negotiated by the UN and that are scheduled to replace the Millennium Development Goals during a UN conference in September 2015.

Moreover, the following policies would support the initiatives mentioned above:

- a common EU soil policy and
- a EU climate diplomacy that also covers the impacts of climate change on security. This was already proposed by the EC in 2011.

Within the EU framework, Germany has a special role to play as it is the EU member state with the highest political and economic leverage and which was the first to adopt climate policies⁸⁶. One of the key elements of political influence is credibility that manifests itself in successful German and European climate policies.

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⁸⁶ AGeoBw (2010), p. 6

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Glossary

Agroforestry: Production system that combines elements of agriculture with those of forestry. It is principally carried out in the arid areas of the tropics and subtropics, where trees provide shade for the agricultural crops and their roots increase the soil's capacity for storing water and nutrients.

Climate change: Changes of the climate that are directly or indirectly induced by human activities which alter the composition of the Earth's atmosphere and add to the natural climate variations observed over comparable periods of time.

Conflicts: Divergent intrasocietal, socio-economic as well as socio-cultural interests at any conceivable scale, from the subregional to the international levels.

Desertification: Final stage of land degradation caused by various factors incl. climate change and human activities in areas where the mean potential evaporation from the soil and the vegetation is at least 1.5 times higher than the mean precipitation.

Drought: Natural phenomenon that occurs when precipitation amounts were considerably below the climatic mean, thus causing serious hydrological imbalance which has a negative impact on the production systems that are based on the country's resources.

Global environmental problem: Environmental problem of a global dimension. Global environmental problems include climate change and desertification as well as the depletion of the ozone layer, the pollution of the oceans, etc.

Governance: Control and regulating system of a political entity. The term "governance" was coined to distinguish the concept from "government" and is to reflect that political control is not exerted hierarchically by the State, but also by private players, e.g. associations.

Greenhouse effect: One of the properties of glass and certain gases in the atmosphere is that they absorb the better part of infrared radiation, but not solar radiation. Greenhouses take advantage of this property. They are heated by the solar radiation penetrating through the glass windows while the better part of the infrared radiation from their interior is absorbed by the glass and thus retained. As a result, the temperature in the greenhouse is higher than in its environment. The greenhouse gases in the atmosphere have the same property.

Greenhouse gas: Gas that increases the greenhouse effect in the atmosphere and consequently leads to a rise in global average temperature. The most important anthropogenic greenhouse gases are carbon dioxide, methane, and nitrous oxide.

Human security: The concept of human security is focused on people's needs for security. The term "security" includes both Freedom from Fear and Freedom from Misery. Accordingly, economic and environmental crises or pandemics such as AIDS are security risks just as much as violent conflicts and wars.

Hunger: State in which people chronically do not get enough food for leading an active life and fully developing their capabilities. For children, it manifests itself by the

fact that they are much too small for their age, and for adults that their Body Mass Index is below 18.5.

Land: Biologically productive terrestrial system comprising soil, vegetation, other parts of the biotic environment as well as the ecological and hydrological processes within the system.

Land degradation: Reduction or loss of the biological or economic productivity and diversity of land due to its use or caused by one or more interrelated processes, including processes resulting from human activities and settlement patterns such as

- o wind- and/or water-induced soil erosion,
- o the deterioration of the physical, chemical, and biological or economic soil properties,
- o the long-term disappearance of the natural vegetation.

Land grab: Investments by foreign players into agricultural land of the host country.

Migration: Any form of voluntary or involuntary cross-border or internal migratory and refugee movement.

Soil restoration: Restoration of the availability of soils to accumulate water and nutrients.

Sustainable Development Goals: Political goals of the UN to ensure sustainable development at economic, social, and environmental level. These goals are currently being developed similar to the Millennium Development Goals which they will replace 2015. But, in contrast to the Millennium Development Goals, they will focus more on sustainability aspects and are to be conceived for all countries.

United Nations Framework Convention on Climate Change: International convention, in which the parties to the convention commit themselves to stabilising greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Almost all states of the world have ratified the convention.

Vulnerability: Vulnerability of an individual, an object, a social group, or a(n) (environmental) system to crises and hardships (here: vulnerability of the environment to the effects of desertification).

Water scarcity (economic): Due to a lack of institutional capacities and funds, the water requirements of people cannot be satisfied. However, less than 25% of the rivers' discharge are used.

Water scarcity (physical): People withdraw more than 75% of the rivers' discharge.

Water scarcity (approaching physical), *pre-stage of physical water scarcity*): People withdraw more than 60% of the rivers' discharge.