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„The link between migration and climate change

—

Is climate change enhancing pre-existing vulnerabilities?“

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Table of content

List of abbreviations	1
List of figures	1
Acknowledgements	2
1 Introduction.....	4
2 The link between migration and climate change - Is climate change enhancing pre-existing vulnerabilities?	9
2.1 Framing climate change	9
2.1.1 Definition of the term „climate change“.....	9
2.1.2 Climate change over the time (1000 – 1800 CE)	14
2.1.3 Types of climate change.....	16
2.1.3.1 Sudden-onset disaster	18
2.1.3.2 Slow-onset disaster.....	22
2.1.3.3 Environmental degradation	25
2.2 Framing migration.....	26
2.2.1 Definition of the term „migration“	26
2.2.2 Patterns of migration	32
2.2.2.1 Temporary/ permanent	35
2.2.2.2 Voluntary/ forced	36
2.2.2.3 Internal/ international	38
2.3 The link between migration and climate change.....	41
2.3.1 Historical overview: discourse on migration and climate change (1960 – 2010)	43
2.3.2 Direct link.....	49
2.3.3 Indirect link	50
2.3.3.1 Economic consequences.....	53
2.3.3.2 Social consequences	58
2.3.3.3 Sanitary and health-related consequences	61
2.3.3.4 Governmental consequences	65
2.4 Index of Vulnerability	70
2.4.1 Aims of the Index	72
2.4.2 Context of the Index	74
2.4.3 Guidelines for application	76
2.4.4 Application examples	78
2.4.4.1 Example: Syria	78
2.4.4.2 Example: Australia	87
3 Conclusion	93
4 Bibliography.....	97
5 Appendix.....	105
5.1 Abstract in English	105
5.2 Abstract in German	106

List of abbreviations

GDP	Gross Domestic Product
GHG	Green House Gas
IDP	Internally Displaced Persons
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
PDSI	Palmer Drought Severity Index
SRES	Special Report on Emissions Scenarios
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNO	United Nations Organization
UTCI	Universal Thermal Climate Index

List of figures

Figure 1: The variation of global average temperature and of atmospheric carbon dioxide concentration from the Vostok ice core.	12
Figure 2: The drivers of migration	29
Figure 3: International migrants, 1970 – 2015.	40
Figure 4: History of name-calling: “environmental migrant”	44
Figure 5: 50 years of publications on the interaction of migration and the environment	46
Figure 6: Magnitude of Migration According to Wealth Level	55
Figure 7: Climate Research Unit (CRU) baseline data for the period 1981–2010.	64
Figure 8: Syria.	79
Figure 9: Precipitation history and long terms trends in Syria.....	80
Figure 10: Climate of Australia.....	88

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1 Introduction

Climate change is already triggering displacement and migration, as a result of increasingly intense weather events, rising sea levels, and accelerated environmental degradation. In the future, we may be facing an increase in population flows that the world is presently ill-equipped to tackle effectively. While climate change is not the only driver of such movements, it is likely to be one of the major ones in the decades to come.

This is a quote by William Lacy Swing, the Director General of the International Organization for Migration, at the Sixteenth Conference of the Parties of the United Nations Framework Convention on Climate Change in Cancun, Mexico in 2010. Swing is highlighting an important aspect of the link between climate change and migration: we do not have enough information on the complex relations between these phenomena yet and we do not have the proper tools to ensure safe migration to people affected. These tools may include an adapted migration policy, a rich dataset on the link between migration and climate change and an appropriate international legal framework.

The declared goal of the International Organization for Migration (IOM) is to ensure “safe, orderly and regular migration” and it is this positive attitude that has been an inspiration for me to become more involved in the topic of environmental migration. In the course of my research process on the topic, I observed two main issues. First, there is a number of researchers in the field who follow a maximalist approach. This implies, that they assume migration to be a monocausal phenomenon. I am following the sceptical approach towards the link between climate change and migration, which assumes that climate change is not the only reason for migration in most of the cases of environmental migration. This assumption stands in contrast to the maximalist approach, also called alarmist approach.¹ The problematic aspect of this maximalist approach, supported for example by Norman Myers, is that it supports assumptions of alarmingly high estimates on people migrating because of climate change. These issues can be used by policy makers to justify restrictive immigration laws and by media to promote fear of migrants. The first aim of this master’s thesis is thus to highlight the complex interrelations between climate change and migration and to discuss the numerous factors playing a role in the decision to migrate or not.

The second main issue that I observed during the preparation of this master’s thesis is the inappropriate status of international legal framework in the context of environmental migration. This void is represented by the absence of a universally agreed upon term for designating environmental migrants. As a consequence of these unclear standards of definitions in the field, terms such as “environmental refugee” and “climate refugee” are commonly used, although the term “refugee”

¹ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 25.

generally implies the acquisition of refugee rights. These rights, however, do not apply to people displaced by environmental factors:

These terms however, have no legal basis in international refugee law. ‘Refugee’ is a legal term which has a very specific meaning and centres on a “well-founded fear of being persecuted”. Environmental factors that cause movements across international borders are not grounds, in and of themselves, for the grant of refugee status under the 1951 Refugee Convention.²

This legal gap in the field of environmental migration can be filled up more easily as soon as legal officials have a more detailed dataset of the link between climate change and migration at their disposal because they can refer to evidence.

From these two main issues, the topic of the present master’s thesis of the link between climate change and migration was inspired. The paper aims at approaching both issues by highlighting the complex interrelations between the two phenomena and by introducing the Index of Vulnerability. This Index will help to render the forced character of the migratory decision of people affected by environmental factors more evident by stressing its multicausality. The state of research in this field is still limited. Still, international organizations like UNHCR and IOM are important leaders of the discourse. Renowned authors committed to the link between climate change and migration are Jon Barnett, Kate Burrows and Etienne Piguet, who put their research focus on the climatic consequences of human movement in a general manner. Other authors like Neil Adger introduce the term “vulnerability” and describe which factors make humans vulnerable to climate change. Walter Kälin approaches the topic from a practical viewpoint, using his experience from his position as Representative of the Secretary-General for the cause of human rights of internally displaced persons. Finally, Jane McAdam stresses the legal implications with regard to environmental migration. In a majority of the works dealing with the link between climate change and migration, the factors of human vulnerability to climate change are of main interest. A number of indices and other tools aiming at measuring human vulnerability to environmental hazard and climate change exist. However, literature fails to address the impact of climate change on human vulnerability in general in the extent necessary. In addition to that, the majority of indices measuring human vulnerability as well as theories on drivers of migration focus on one factor only. One example of a restricted approach to the topic can be found in the “Laws of Migration” by Ernst Georg Ravenstein which was published in 1885. He is a representative of the group of scientists considering economic motivations as the main reason for migration. Similar approaches that limit the reasons

² Climate Change, Environment and Migration Alliance, “Climate Change, Environment and Migration. Frequently Asked Questions.”.

for migration to one aspect cannot achieve a comprehensive and complete picture of the real reasons. In contrast to that, a multicausal approach which uses a macro-level method of analysis is applied in this master's thesis. The approach aims at reflecting the complex causes of migration, which lead to most cases of migration.³ A multi-disciplinary approach helps to work against monocausal considerations and "methodological nationalism".⁴ This includes the consideration of information from the fields of history, economics, demography, sociology, political science and anthropology.⁵

Despite clear evidence that climate change has negative aspects on central factors of human adaptation capabilities, this link seems to receive too little awareness in research.

In contrast to the alarmist approach proposed by some authors, this paper will follow the assumption that climate change is not a direct reason for migration in a majority of environmental migration. On the contrary, the paper assumes that climate change effects the migratory decision indirectly, enhancing pre-existing human vulnerabilities. The vulnerabilities concerned can be of economic, social, sanitary or political nature. Individual vulnerabilities like gender, age, education and social ties play an important role in human resilience to climate change as well, and should be taken into consideration in the case of assessing the individual vulnerability to climate change and drivers of migration. However, the approach pursued in this master's thesis follows a global approach, which tries to highlight general ties between climate change and migration by assessing possible impacts on human vulnerability. This global approach allows the paper to propose general implications for human vulnerability and migration subsequently.

These implications are presented in the form of the Index of Vulnerability. It aims at uncovering climate change impact on human vulnerabilities and measuring the degree of vulnerability on one hand and the degree of linkage to climate change on the other hand. With the help of ten indicators covering sectors of economy, society, health, politics, topographical structure, demography, development and security, the Index aims at measuring human vulnerability as a consequence of climate change.

Having highlighted the link between the two phenomena, the Index will fulfil the goal of underpinning the hypothesis of this paper, which is that the link between climate change and migration is of indirect nature in a majority of cases. In addition to that, the Index will make a significant

³ Kälén, "Conceptualising Climate-Induced Displacement.", p. 81.

⁴ Samers, *Migration.*, p. 36.

⁵ Manning, *Migration in World History.*, p. 193.

step towards offering tools for adapting the international legal framework to the needs and requirements of environmental migrants. Both topics are highly relevant in the current political, social and scientific discourse and scarcely researched and underpinned with empirical information. In order to demonstrate the application of the proposed Index of Vulnerability, the Index will be applied to two examples. For this demonstration, the cases of Syria and Australia will serve as examples. Both countries have witnessed severe droughts and occurrences of desertification⁶ in their region during the 21st century. However, the social, political and economic circumstances are highly different and therefore offer the possibility to stress the importance of these factors in the context of human resilience to climate change. The regional situation will be assessed in a presentation of the context in order to apply the national information on the Index of Vulnerability.

Besides the central assumption, the main research issues addressed in this master's thesis are the following:

- How is climate change influencing human vulnerability?
- Is vulnerability measurable?
- Who is vulnerable?

Apart from the aims of this paper, it is useful to address its limitations as well. As already mentioned, there is more literature available on the topic of human vulnerability to climate change. The fine difference between this link and the consequences of climate change on human vulnerability in general is crucial. The assessment of climate change implications on vulnerability will assume a high vulnerability to climate stressors, as well. The reason for this is that factors of vulnerability are themselves vulnerable to climate change. Besides the biophysical vulnerability which is an indicator for increased risk of environmental hazard in a region, the social and economic security play a central role as possible shock absorbers and resilience generators. Other factors have an important influence on a community's or an individual's vulnerability to climate change, as well. Not all of them are subject to climate change impact as economic and social factors. Taking financial capital as an example, it can on one side act as adaptation resource against climatic threat, but on the other side is more or less vulnerable to climate change, itself.

However, the paper's goal is not to try to grade the vulnerability of populations to climate change itself as this is not the main question of the paper. It is important to highlight the difference between those factors influencing the vulnerability to climate change itself and those factors which are

⁶ Another reason for the choice of these two examples is the under-representation of slow-onset disasters in research on vulnerability.

affected by climate change and increase people's vulnerability in general terms. This happens through a decrease in their capacity to adapt to other stressors.

Another aspect that will not be treated in this paper are policy recommendations. Due to the limited extent of this master's thesis, it is not possible to approach the topic of political actions and possible improvements and recommendations in the context of environmental migration and coping or adaptation strategies.

With the objective of answering the question posed in the title of the master's thesis as well as the main research issues above, the paper will be structured in five main chapters. The second chapter is the main chapter and is subdivided in four main points. In chapter 2.1, the paper will deal with the general discussion on the topic of climate change. The central interest in the context of climate change is the definition of the term as well as a historical overview of climate change and its implications for human movement in the period between 1000 and 1800 CE. At the end of chapter 2.1, three types of climate change are presented in order to be able to draw conclusions on the relation between migration patterns as a response to climatic threat. The paper will show that certain forms of migration are more likely to succeed certain environmental threat. In chapter 2.2, a similar approach will be applied to the topic of migration. It is useful to start the chapter with a discussion on the definition of the term, which is central for the discussion with regard to the unadapted international legal framework in this context. After that, three different patterns of migration are introduced, which are then linked to different forms of climate change in order to allow first assumptions for climatic implications for human movement. Chapter 2.3 deals with the link between migration and climate change. The chapter is opened by a historical overview of the discourse on the link between the two phenomena and different approaches to this link. Then, the paper offers a short description of the case of direct linkage. This subitem is rather brief, because it lies beyond the scope of this work. Thus, the indirect form of linkage between migration and climate change is reviewed. Economic, social, sanitary and governmental factors are presented in the light of climatic influences. Finally, the Index of Vulnerability is presented in the chapter 2.4. After an explanation of general rules and aims of the Index, it is applied to the cases of Syria and Australia. The results are discussed in the context of the research issue of this master's thesis in order to underpin the hypothesis presented in the opening chapter. This global approach to a highly relevant and widely discussed topic is seen as the most important principle of this master's thesis, because, as Samers puts it: "All forms of migration indicate social problems, development inequalities, political conflict or other problems that are important to be researched in the context of migration."⁷

⁷ Samers, *Migration.*, p. 15.

2 The link between migration and climate change - Is climate change enhancing pre-existing vulnerabilities?

2.1 Framing climate change

In order to create a comprehensive and extensive picture of climate change, it is important to consider the contextual frame the process is happening in. It is necessary to put climate change in the context of the earth's ecosystem, particularly when it comes to such a complex issue. The aim of this chapter is thus the presentation of the structure that causes climate change and the consequences climate change has on the ecosystem and on human lives in turn. This is the reason why we will consider the performance of the earth's ecosystem and the factors that have an impact on climate change, natural as well as anthropogenic.

The word "climate" derives from the Greek word *klíma*, which means "inclination" or "slope" in English. This meaning refers to the fact that solar radiation meets the earth's surface in different angles depending on the viewpoint on the earth's surface.⁸ The angle of radiation will therefore be steep within the latitudes near the equator, leading to a high amount of solar energy in this region and vice versa. Changes in the amount of solar energy that penetrates the spheres of the earth (lithosphere, hydrosphere, biosphere and atmosphere) have major impacts on the functioning of the ecosystem and the interaction of its subsystems, including humans and animals, being part of the earth's biosphere.⁹

Within this thesis, the interrelation between climate and those four spheres is of high interest. However, the focus lies on the interplay between the human being and the ecosystem. Within this consideration, the focal point will be on the possibilities of adaptation human beings have at their disposal. However, one should keep the role of anthropogenic interventions within the ecosystem in mind and consider their consequences. This first chapter will thus explain the definition of "climate change" in a first subitem, the phenomenon within the spectre of 1000 until 1800 CE in a second subitem, and finally the types of climate change.

2.1.1 Definition of the term „climate change“

Therefore, this subitem will present a definition of climate change in a first point and address the explanation of the two main causes for climate change. After having cleared the definition of the term, it is useful to create a bigger picture of the earth's climate and its change over time. By considering past changes in climate and humans' reactions to these conditions, we can come to conclusions about possible scenarios for future climate change and its impact. The third subitem

⁸ Enfield et al., "Climate."

⁹ Cubasch and Kasang, *Anthropogener Klimawandel*, p. 31.

within this first chapter will deal with categorizing the major types of environmental disaster, dividing disasters in the following groups: sudden-onset disaster, slow-onset disaster and environmental degradation. This categorization should help to visualize the danger that arises from these different types of disasters for humans and the environment.

The general public might not be aware of the distinction between “climate” and “weather”. However, the clear differentiation between the two terms is crucial in order to allow an understanding of the proportions of a changing climate. “The climate of a region is its average weather over a period that may be a few months, a season, or a few years.”¹⁰ Weather, in turn, is the “state of the atmosphere at a particular place and time”¹¹. Thus, the observation of singular weather events should not be confused with a climate trend.

In the context of climate change, there is no clear consensus amongst experts in the field on how to define the phenomenon of climate change. In the interest of creating a coherent understanding of the term, it is useful to stress the multicausality of climate change and the complex linkages between the changing climate and its causes. The decision on the strategy on how to present the issue to the public is often influenced by political interests. In this thesis, the definition phrased by the Intergovernmental Panel on Climate Change (IPCC) is used. It includes human activity as a cause for climate change but does not exclude other causes at the same time. According to the IPCC¹², climate change is:

[...] a change in the state of the climate that can be identified (e.g. 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. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.¹³

Both climate change and climate variability have natural and man-made causes. In order to make the distinction between natural and anthropogenic causes, the factors of the two points are presented separately. Starting with the long-term changes in climate, natural causes for climate change will be observed first. CO₂, methane and other gases act as a natural shield in the earth’s atmosphere and keep the climate warmer by keeping long-wave solar radiation within the atmosphere.

¹⁰ Houghton, “The Science of Global Warming,” p. 247.

¹¹ Oxford University Press, “Weather.”

¹² The definition proposed by the United Nations Framework Convention on Climate Change (UNFCCC) includes the same core values but focuses more on the atmosphere’s alternation process, and therefore defects from the objective of covering different causal approaches to climate change. Although the two definitions both highlight the importance of climate variability, the IPCC definition makes the connection clearer. The definition proposed by the UNFCCC defines climate change as “a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.”, IPCC, “Climate Change 2007.”, p. 30.

¹³ Intergovernmental Panel on Climate Change, “Climate Change 2007.”, p. 30.

Natural variations in the concentration of these gases have an impact on the global average temperature, thus resulting in a natural “greenhouse effect”. Anthropogenic impact in the concentration of the GHGs will be discussed in more detail further below. Beside the greenhouse effect, regular changes in the earth’s orbit around the sun influence the global average temperature. These changes, called Milankovitch cycles, cause the glacial-interglacial alternation.¹⁴ We are currently experiencing the Holocene Interglacial on earth, resulting in a period of warm and dry climate.¹⁵ Regardless of these long-term variations, the global climate reacts to impacts that can lead to short-term alternations and interfere with the natural alternation in the climate cycle. In order to answer the question if and how climate change influences migration patterns, current incidents are in the centre of interest. However, it is useful to consider historical interrelations between the two factors, which will be done in point 2.3.1.

When observing long-term climate variability, one notes small discrepancies, such as a sudden increase of CO₂-concentration around the 19th century accompanied by a rise in the global average temperature. The cause for this strong discrepancy is anthropogenic: 97% of current scientists agree on the fact that an increasing amount of CO₂-emissions are the main cause of the rise of global average temperature.¹⁶

Ice core observations and the average atmospheric temperature in the respective time period are used in order to understand climate alternations and their connection to the amount of carbon dioxide.¹⁷ Sir John Houghton, co-chair of the Science Assessment Working Group of the IPCC¹⁸ provides information on these observations in the Vostok ice core, which is depicted in figure 1. Figure 1 shows the correlation between global average temperature alterations and global CO₂ concentration in ppm dating back 160.000 years to the year 2004 CE. The light line represents the CO₂ concentration and the dark line stands for the temperature difference in the indicated time span until 2001. The figure shows that although major alterations in CO₂ levels and temperature can be detected over the course of several thousand years, the increases in CO₂-emissions from the 19th, 20th and 21st century outnumber the preceding alterations by far. The CO₂-concentration for the year 2001 is indicated with 370 ppm¹⁹. The predicted CO₂-concentration for the year 2100 with no changes in CO₂-emission-rates, as far as the author of the graph estimated the situation, would

¹⁴ Orbital variations are the main cause for the alternation between glacial and interglacial periods on earth. This means that the climate on earth is cooler and drier during the glacial periods than during interglacial periods.

¹⁵ Church et al., “Sea Level Change.”, p. 6.

¹⁶ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 2.

¹⁷ Langway, “The History of Early Polar Ice Cores.”, p. 112.

¹⁸ The IPCC bases its work within policy projects and environmental science projects on information obtained by ice core observations, Langway, “The history of early polar ice cores”, p. 112.

¹⁹ Ppm (parts per million) – this is the common value for indicating the CO₂ content in the air. 1.000 ppm equals 0.1% CO₂.

be at about 650 ppm. The current concentration of carbon dioxide in the atmosphere has, however, already reached the 400-mark, standing at 408.05 (as of 04.02.2018).²⁰

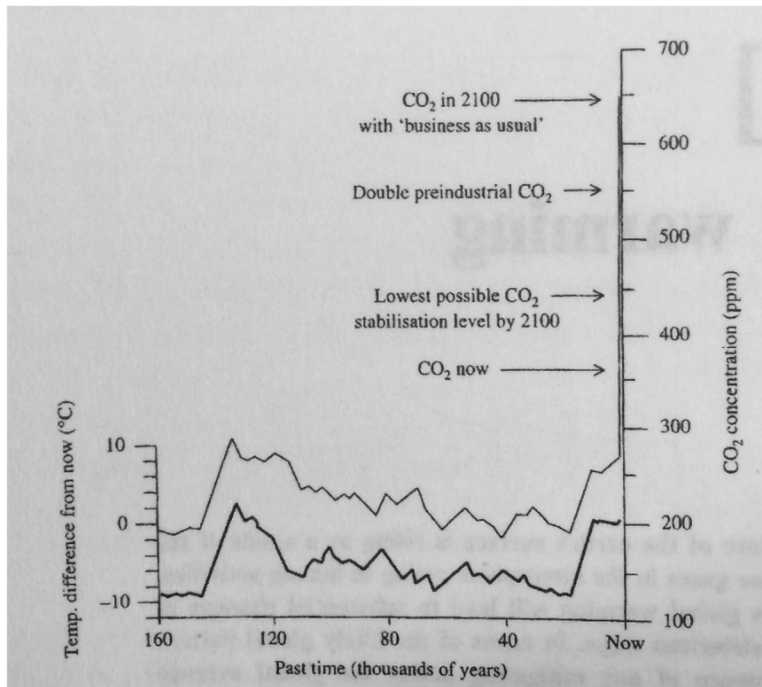


Figure 1: The variation of global average temperature and of atmospheric carbon dioxide concentration from the Vostok ice core.²¹

This implies that the rapid rise of temperature since the mid-20th century is caused mainly by an increase of the concentration of Greenhouse Gases (GHGs) in the atmosphere, resulting from burning fossil fuels like Methane and Carbon dioxide.²² Since the Industrial Revolution around 1800, we have experienced an exponential growth in CO₂-emissions. The concentration of CO₂ was at about 365 ppm in 1998, which corresponds to a growth of 30% in 200 years since the Industrial Revolution.²³ The most important gases with an increasing impact on the earth's climate are carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and others.²⁴ They have different impacts on the atmosphere, which will not find particular mention in the thesis. Still, it is crucial to mention that CO₂ and methane appear naturally in the earth's atmosphere and act as stabilisers for the global temperature. However, if the concentration of these GHGs increases, long-wave radiation cannot leave the earth's atmosphere and is sent back to the surface of the earth, heating up the atmosphere, lithosphere and hydrosphere. This effect is called the "greenhouse effect" and is a major factor of

²⁰ CO₂-Earth, "CO₂-Earth."

²¹ Houghton, "The Science of Global Warming," p. 248.

²² International Organization for Migration, "Climate Change and Migration: Improving Methodologies to Estimate Flows," p. 5.

²³ Cubasch and Kasang, *Anthropogener Klimawandel*, p. 45.

²⁴ Cubasch and Kasang, pp. 45-57.

climate change and variability.²⁵ Within the range of factors in the field of climate change, the rising temperature plays a central role. The IPCC Special Report on Emissions Scenarios (SRES) estimates that an increase of GHG-emissions of 25 to 90% from 2020 to 2030 will take place without mitigation. This scenario results in a warming of 0.2 degrees Celsius per decade²⁶ for the next two decades. However, estimations highly depend on assumptions about future policies and other factors influencing the global climate, which are difficult to predict.²⁷

Another human-made factor adding to climate change is the change of land use. One of the most important factors of the change of land use is deforestation. In order to create space for livestock farming, plantations or habitation, forests are cleared. The reason why deforestation has an aggravating impact on global warming is that the wooded area of the world, which plays an important part in climate stability and creates a living space for plant and animal species²⁸, is minimized.²⁹ If one considers deforestation individually, the consequences that arise from it alone can be a driver of climate change. This is because deforestation limits the ecosystem's capacity to absorb increasing CO₂-emissions through the trees storing CO₂, leading to increasingly dangerous and extreme conditions for humans to live.³⁰ As far as the natural causes for a change in climate are concerned, volcanic eruptions and variations in solar activity are major factors of influence.³¹ Still, the impacts of climate change, including sea-level rise, climate variability, soil erosion and an increase in intensity and frequency of extreme weather events, on human settlements are massive:

Current projections of temperature and sea-level rise and increased intensity of droughts and storms suggest that population displacement at significant scales will take place within the next 30–50 years, particularly for populations in coastal zones.³²

The thesis will concentrate on the consequences of climate change for human settlements and land in the section on migration under point 2.2. At this point, the focus lies on the phenomenon of climate change itself and the different forms that it can take.

²⁵ International Organization for Migration, "Climate Change and Migration: Improving Methodologies to Estimate Flows.", p. 11.

²⁶ John Houghton proposes a slightly different number for the rise of global average temperature with no change in the amount of CO₂-emission. He estimates an average rise of 0.25 degrees Celsius per decade, resulting in a rise of 2.5 degrees Celsius per century, Houghton, "Globale Erwärmung. Fakten, Gefahren und Lösungswege.", p. 9.

²⁷ Intergovernmental Panel on Climate Change, "Climate Change 2007.", p. 6.

²⁸ The forests of Amazonia alone host about a quarter of the earth's animal species.

²⁹ Houghton, *Globale Erwärmung: Fakten, Gefahren Und Lösungswege.*, p. 134.

³⁰ Malhi et al., "Climate Change, Deforestation, and the Fate of the Amazon.", p. 169.

³¹ International Organization for Migration, "Climate Change and Migration: Improving Methodologies to Estimate Flows.", p. 5.

³² Warner et al., "Climate Change, Environmental Degradation and Migration.", p. 696.

2.1.2 Climate change over the time (1000 – 1800 CE)

This subitem should give a compact overview over the earth's long-term climate, its changes and how these changes affected human livelihood, particularly considering migration and movement in general. The starting date of this investigation is set at the year 1000 CE³³, because this is according to scientists the time of the “Medieval Climate Optimum”, a time during which the climate – at least in some parts of the world – was warmer than the average during the Holocene period.³⁴ However, it is important to mention that natural fluctuations and periodical cycles of change are a regular condition of climate on earth:

Observational and palaeo-climatic [sic!] evidence indicates that the Earth's climate has varied in the past on time scales ranging from many millions of years down to a few years. Over the last two million years, glacial-interglacial cycles have occurred on a time scale of 100,000 years, with large changes in ice volume and sea level. During this time, average global surface temperatures appear to have varied by about 5-7°C. Since the end of the last ice age, about 10,000 BP, globally averaged surface temperatures have fluctuated over a range of up to 2°C on time scales of centuries or more. Such fluctuations include the Holocene Optimum around 5,000-6,000 years ago the shorter Medieval Warm Period around 1000 AD (which may not have been global) and the Little Ice Age which ended only in the middle to late nineteenth century.³⁵

The long-term alternations between interglacial and glacial periods take place in the timeframe of approximately 100,000 years and are triggered by the regular change in the earth's orbit around the sun. Another regular cycle influencing climate on earth is the Schabe cycle, which lasts 11 years and is determined by the relative sunspot number, which in turn affects solar activity and solar energy that can reach the earth's surface. Short-term changes can stem either from the ENSO³⁶-phenomenon in the case of short-term increase in temperature, from volcanic eruptions or the La Niña phenomenon in the case of short-term decreases in temperature.³⁷

For climatic research of the time around 1000 CE and in general until around 1400 CE, scientists need to use proxy-data (for example using growth rings from trees, deep-sea sediments and ice cores) in order to calculate the average temperature of the respective time period. In this thesis, the overview concludes around 1800 CE because this is around the time of the end of the Little Ice Age (1250 – 1850 CE).³⁸

³³ Calculations of the timeframe show slight discrepancies. In Houghton (1997), the Medieval Climate Optimum is said to have taken place between 1100 and 1300 CE.

³⁴ The Holocene period is “The relatively warm epoch, which started around 10.000 years ago and runs up to the present time.”, Burroughs, “Climate change: A multidisciplinary approach”, p. 287.

³⁵ Intergovernmental Panel on Climate Change, “Climate Change: The IPCC Scientific Assessment.”, p. 199. The acronym “BP” stands for “Before Present”.

³⁶ El Niño-Southern Oscillation.

³⁷ Cubasch and Kasang, *Anthropogener Klimawandel.*, p. 17.

³⁸ Cubasch and Kasang., p. 12.

During the “Medieval Climate Optimum” agriculture yields in North America and Europe were more generous because of the higher average temperature and more precipitation.³⁹ Warm periods in general were accompanied by a wetter climate and higher precipitation rates leading to higher sea levels and more agricultural yield.⁴⁰ Research by proxy data analysing cave temperatures on the basis of oxygen isotopes suggests that warmer climate during that time is witnessed also in Australia.⁴¹

Still, it is important to note the fact that this climate alternation probably did not take place globally, or at least not in the same dimensions.⁴² In some regions like North America and England, temperatures rose to more than 1 degree Celsius higher than the global average temperature of the end of the 20th century.⁴³ During this period, an increased number of important cultural shifts and migration movements took place. It is around the turn of the millennium that the Scandinavians colonized the North Atlantic Islands and eastern North America.⁴⁴ They also achieved to settle on the island of Greenland for a period of 200 years.⁴⁵ The colony in North America had to be abandoned by the middle of the 11th century because ice started blocking important trade routes. In contrast to that, tropical regions and the eastern Pacific region near the equator were found to have been cooler than the current average temperature during the “Medieval Climate Optimum” because of la-Niña impacts.⁴⁶ Hydrological anomalies such as a lack of precipitation that result in droughts or an increase of precipitation leading to floods can be detected for the period between 1100 and 1300 CE.⁴⁷ During that time, a shift of the Atlantic Intertropical Convergence Zone (ITCZ) took place and resulted in a temperature increase in the southern hemisphere, while temperatures decreased in the northern hemisphere.⁴⁸ This shift of the tropical rain belt is a consequence of the decrease in global average temperature during the “Little Ice Age”.⁴⁹

Research on sediment observations has brought information about the climate during the “Little Ice Age”.⁵⁰ This period experienced climate changes, which took place in the time span of 1250 – 1850 CE and led to crop failures and famine in many regions of the world.⁵¹ These two incidents of climate change between 1000 and 1800 CE can be correlated with human movements during

³⁹ Cubasch and Kasang., p. 11.

⁴⁰ Intergovernmental Panel on Climate Change, “Climate Change: The IPCC Scientific Assessment.”, p. 205.

⁴¹ Roberts, *The Changing Global Environment.*, p. 74.

⁴² Hughes and Diaz, “Was There a ‘Medieval Warm Period’, and If so, Where and When?”, p. 110.

⁴³ Hughes and Diaz., pp. 109 – 110.

⁴⁴ Xoplaki et al., “Medieval Climate Anomaly.”, p. 4.

⁴⁵ Cubasch and Kasang, *Anthropogener Klimawandel.*, p. 11.

⁴⁶ Diaz et al., “Spatial and Temporal Characteristics of Climate in Medieval Times Revisited.”, p. 1489.

⁴⁷ Diaz et al., p. 1491.

⁴⁸ Haug et al., “Southward Migration of the Intertropical Convergence Zone through the Holocene.”, p. 1307.

⁴⁹ Rüegg, “Little Ice Age Displaced the Tropical Rain Belt.”.

⁵⁰ Haug et al., “Southward Migration of the Intertropical Convergence Zone through the Holocene.”, p. 1307.

⁵¹ Cubasch and Kasang, *Anthropogener Klimawandel.*, p. 12.

the corresponding period of time. “Research suggests that human distribution, settlement and migration patterns in prehistoric and classical times were in many instances influenced by changes and variability in global and regional climate [...].”⁵²

The movement to new habitable ground can be interpreted as a migration movement – although it is not possible to determine the motivations for the migration movement and whether climate change influenced the decision directly. Climate changes have had an important impact on human livelihood since the beginning of human life on earth and the analysis of human movement through history shows evidence that migration as a form of adaptation has often been a solution for shifts in temperature or other changes in climate.⁵³

After the invention of the steam powered railway, transportation become faster and cheaper. This had an important impact on migration and facilitated transportation. In this context, it is important to mention that the outcome of the industrialization and the subsequent globalization of the world connected cultures and populations, which led and still leads to an increase in migration and human movement in general today. Even by means of a short overview of the historical development of environmental migration, it is possible to draw parallels between past events and today’s increasing impact of climate change on migration. between migration and climate change. Modern research techniques offer the possibility to learn from the past and realize the severity of the topic today. It is the purpose of the preceding subitem to render this opportunity clearer. In the following subitem, the different types of climate change will be presented in three categories in order to be able to analyse differences in human reactions and adaption possibilities with regard to the hazards that each of the climate disaster type might imply.

2.1.3 Types of climate change

The aim of the following classification of climate disaster types does not result from the interest of classifying climate change in general. Indeed, the concern of subdividing the various types of climate change for the present paper lies in the objective of linking the phenomenon of climate change with the phenomenon of migration. As humans show particular methods of adaptation to each type of climate disaster, it is useful to consider the various types separately. Still, the common context and similar causes within the research field of climate change should not be forgotten during the study. This is the reason why we will consider the beforementioned connection before starting the attempt to classify.

Climate change in general should not be considered as an unnatural and unwanted phenomenon. As already explained in point 2.1.1, the natural variation of the climate is regular and caused by

⁵² McLeman, “Developments in Modelling of Climate Change-Related Migration.”, p. 601.

⁵³ McLeman, *Climate and Human Migration: Past Experiences, Future Challenges.*, p. 11.

factors like changes in the earth's orbit and in solar radiation. Within the timespan of natural variability, the ecosystem is given the necessary time to adapt to the changing climate. In contrary, this is not the case for anthropogenic climate change in the current dimensions. As mentioned in point 2.1.1, the estimated future rise of the global average temperature is 2.5 degrees Celsius per century. Although this increase might not seem very high for the individual observer or with regard to an individual region or place, the number should be considered as concerning the global average temperature, reflecting the average temperature of a certain time span in the whole world. A rise of 2.5 degrees Celsius signifies a more rapid temperature rise than ever within the preceding 10,000 years. Considering the high level of connectedness between the actors of the ecosystem, the temperature has a strong universal impact resulting in considerable consequences in numerous areas that are vital for a balanced ecosystem. For reasons of better visualization of the severe impacts of temperature on the ecosystem of the earth, it is useful to recall the changes during the transition from an interglacial to a glacial period or vice versa, which results in a temperature variation of 5 to 6 degrees Celsius, comparing the highest average temperature during the warm periods and the lowest temperature during the glacial periods.⁵⁴ An example for a vulnerable actor within the ecosystem on the level of the biosphere are forests and woods, which are long-living and grow slowly. Thus, the effects of global warming are very grave in a short period of time.⁵⁵ It is therefore important to consider the timespan of temperature changes and climate change in general in order to assess the possibilities for adaption and mitigation that could be envisaged by humans and the other actors of the ecosystem. Common causes for climate disasters beside a rise in temperature are erosion and overuse of soil, increased abstraction of groundwater, to name only some of the factors.⁵⁶ Climate change increases the intensity and frequency of sudden-onset disasters like earthquakes, tropical storms and tsunamis on the one hand, and aggravates the factors of slow-onset disasters such as desertification and sea level rise and land degradation on the other. Climate change is leading to an increase of frequency and intensity of extreme weather events, which are aggravated by mean conditions.⁵⁷ As the two phenomena appear simultaneously in many cases, they impede a subsistent and secure livelihood for humans living in contested regions, making adaption measures difficult.⁵⁸ An example for this interaction is the influence of sea level rise on earthquakes. As the sea level increases, it decreases the bearing capability of soil, making it more instable and prone to earthquakes and landslides.⁵⁹ These and other issues are discussed in the

⁵⁴ Houghton, *Globale Erwärmung: Fakten, Gefahren Und Lösungswege.*, p. 9.

⁵⁵ Houghton., p. 121.

⁵⁶ Houghton., p. 101.

⁵⁷ Houghton, "The Science of Global Warming.", p. 247.

⁵⁸ Barnett, "Dangerous Climate Change in the Pacific Islands: Food Production and Food Security.", p. 231.

⁵⁹ McCarthy, *Climate Change 2001: Impacts, Adaptation, and Vulnerability: Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change.*, p. 365.

following subitems. Some of the types of disaster mentioned above, especially in the case of hydro-meteorological disasters, would happen in absence of anthropogenic climate change. In fact, many of sudden-onset disasters have a natural origin. However, this differentiation will not play a role in this thesis, as the people displaced by environmental disasters should not be distinguished on the basis of the disaster origin, but in light of their vulnerabilities and needs.⁶⁰

2.1.3.1 Sudden-onset disaster

First, the difference between the number of people affected by sudden-onset disasters and the number of people affected by slow-onset disasters is crucial to assess the threat that these disasters pose to humans. Extreme environmental events tend to get more attention in public headlines, although slow-onset disasters tend to affect more people worldwide. William Lacy Swing, the Director General of the International Organization for Migration (IOM), expresses himself for this purpose:

Extreme environmental events such as cyclones, hurricanes, tsunamis and tornadoes tend to capture the media headlines, but it is gradual changes in the environment that are likely to have a much greater impact on the movement people [sic!] in the future. For example, over the last 30 years, twice as many people have been affected by droughts as by storms (1.6 billion compared with approximately 718 million).⁶¹

However, it is interesting to consider sudden-onset disasters in this thesis in order to be able to compare different methods of migration in relation to climate change. As the interest concerning the topic does not lie primarily in the creation of an exhaustive account on climate events, but rather on the assessment of the vulnerabilities that they imply, the thesis will limit the description of particular examples of disasters to a number that still allows the reader to draw conclusions about the before-mentioned human vulnerabilities. Earthquakes and tropical storms will serve as examples for sudden-onset disasters within this master's thesis.

⁶⁰ Kälén, "Conceptualising Climate-Induced Displacement.", p. 85.

⁶¹ Laczkó and Aghazarm, *Migration, Environment and Climate Change: Assessing the Evidence.*, p. 5.

Sudden-onset disasters can be divided into four groups⁶²: tectonic disasters like earthquakes and volcanic eruptions, atmospheric disasters such as tropical storms, hydrological disasters like floods and mass movement disasters such as landslides.⁶³

In general, sudden-onset events trigger immediate flight of the affected population, because the environmental incident is threatening their lives in a direct and imminent way. Although economic and social factors in the form of consumption and transport decisions can play a role in the causing of these extreme weather events, they generally do not have an impact on the decision to migrate. It is important to keep the distinction between the two forms of disaster in mind when considering human vulnerability:

Sudden-onset events have the potential to cause considerable damage to infrastructure and property, as well as resulting in loss of life, and are therefore often associated with distress migration. In these cases, exposed populations may attempt to flee before the event occurs or evacuate during or after the event.⁶⁴

This point of difference between the reaction to sudden- and slow-onset disasters will be discussed in more detail in subitem 2.2.2, when different migration patterns are presented.

With regard to the issue of sudden-onset disasters, the characteristics of earthquakes and tropical storms will be reviewed, considering their physical causes, dimensions and consequences for the environment and human livelihood.

First, earthquakes as a form of sudden-onset disaster are analysed and described. A description of the phenomenon's causes, dimensions and effects on the environment should help in understanding the possible implications for migration decision, which will be elaborated in subitem 2.2.2. within the following chapter. Also, secondary earthquake-related disasters⁶⁵ like tsunamis should be considered, which in most of the cases occur when tectonic plates under the ocean go into

⁶² The author Keith Smith proposes the division into six groups of disaster, of which two are not included in the present paper. The reason for this decision is the difference in presentation of the topic. The book "Environmental Hazards. Assessing risk and reducing disaster" is not making the difference between sudden-onset disaster and slow-onset disaster very clear, as the purpose of the book is different from the purpose of the present paper. The decision makes sense within the scope of the book but will not be adapted to the frame of the thesis for the mentioned reason. In the search of completeness, the two remaining groups proposed by Smith are technological hazards and biophysical hazards like temperature extremes, epidemics and wildfires. In addition to that, the author includes droughts in the group of hydrological hazards.

⁶³ Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster.*, pp. 121 – 334.

⁶⁴ McLeman and Hunter, "Migration in the Context of Vulnerability and Adaptation to Climate Change: Insights from Analogues.", p. 451.

⁶⁵ Other secondary earthquake-related hazards will not be considered in the thesis because of the focus lying on the implications of sudden-onset disasters in general rather than focusing on numerous examples and going in the detail of the different causes and effects of every form of sudden-onset disaster. The focus lies on the distinction between sudden- and slow-onset disasters rather than on the distinction of several events within the groups. This is the reason why the remaining secondary earthquake-related hazards, which are soil liquefaction, landslides and avalanches, are not considered within this subitem.

motion, causing a focused earthquake that produces a seismic sea wave. These waves can also be caused by volcanic eruptions or large rocks falling into the ocean.⁶⁶ In some cases of sudden-onset disasters, like in the case of tsunamis, there exist well-functioning forecasting and warning systems, which can reliably predict imminent tsunami waves. In contrast to that, the prediction system for earthquakes is not well established and leaves little possibility for the contested population to take precautions and seek a safe shelter. This point leads us to one of the major problems within the field of earthquakes, which is habitation in endangered zones. As the global population is growing rapidly, the number of people affected by earthquakes increases. For example, the number of affected people grew from 60 million in 2013 to over 179 million in 2014.⁶⁷ Earthquakes also account for one of the deadliest environmental disasters, causing a fifth of the annual fatalities due to natural disasters with a total toll of 25,000 people per year. The majority of earthquakes worldwide occur in regions of the world where tectonic plates diverge, converge or move alongside each other producing friction. Many urban centres are constructed in the proximity of plate boundaries. This increases the risk of the occurrence of earthquakes and tsunamis.⁶⁸ Earthquakes can also occur at weak points within the tectonic plate.⁶⁹

The effects of earthquakes on human habitat and possessions are devastating particularly in the case of horizontal ground movement due to ground-shaking. Most of the buildings worldwide can support vertical movement better because the construction is built to resist gravity. However, the more unstable the habitat is, the more vulnerable its inhabitants are for ground-shaking.⁷⁰ The damage on buildings due to ground shaking will be highest in the epicentre of the earthquake. Buildings of inferior quality and stability are the most vulnerable to damage, leaving a greater number of people without accommodation. Gas pipes running through constructions and through the ground might break due to the shaking. Gas leaks can lead to large-scale fires, increasing the damage in the affected area.⁷¹ Other factors influencing the degree of destruction are the regional soil structure, wave intensity and wave frequency. Another important influence might be the resulting occurrence of secondary earthquake hazards like soil liquefaction, landslides, avalanches and tsunamis, as was already mentioned before.⁷² The economic losses due to an earthquake are high, thus the biggest part of the extremely poor population worldwide, living in south Asian countries like Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, are at

⁶⁶ Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster.*, p. 131.

⁶⁷ Global Facility for Disaster Reduction and Recovery, "The Making of a Riskier Future: How Our Decisions Are Shaping Future Disaster Risk.", p.xiv.

⁶⁸ Silva, Yepes-Estrada, and Weatherill, "Earthquake Hazard and Risk Assessment.", p. 2.

⁶⁹ Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster.*, p. 123.

⁷⁰ Smith., p. 128.

⁷¹ Schneider, *Erdbebengefährdung.*, p. 133.

⁷² Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster.*, pp. 128 – 129.

the same time living in the region particularly at risk of making them victims of hazards like tsunamis, earthquakes, cyclones and flooding.⁷³ The issue dealing with the fact that the most vulnerable people in the world are often also those who face the greatest impact of climate change and environmental disasters will be more thoroughly discussed in subitem 2.4 in the context of the presentation of the Index of Vulnerability.

The paper will now move on to describing the causes and impact of a second form of sudden-onset disaster: the tropical storm. When it comes to tropical storms, the occurrence of tropical cyclones is the highest within this group of environmental disaster.

The same factor of a growing number of affected people as for the risk of earthquakes applies to the risk of tropical storms and sea level rise: an increasing coastal population worldwide is living with the risk of becoming a victim of a tropical storm. Especially in Asia (particularly countries like China, India, Bangladesh, Vietnam, Indonesia and Japan) and North America, a great number of people lives in big cities in a coastal zone with low elevation.⁷⁴ Worldwide, about one fifth of the population is living near coastal regions affected by sea level rise and natural disasters.⁷⁵ The most dangerous zones to live worldwide are densely populated deltas, isolated islands and densely populated coastlines.⁷⁶

Depending on the region of appearance, the tropical cyclone is called by a specific name. In the regions of the Indian Ocean, the Bay of Bengal and in Australian waters, the term “tropical cyclone” is used. In the regions of the Caribbean, the Gulf of Mexico and the Atlantic Ocean, the storm is called “hurricane”, while the name “typhoon” is applied for storms in the north-west Pacific Ocean.⁷⁷ As the formation of a tropical storm depends on heat and moisture, an increased number forms during periods of the ENSO phenomenon and in general in a warmer climate.⁷⁸ There is strong evidence that the number of tropical storms increases concurrent to a rise in the global average temperature. The warm climate during the years of 1980 for example triggered a phase of intense activity in severe tropical storms.⁷⁹

With regard to the effects that a tropical storm has on the land mass that it meets and the habitation and infrastructure it might collide with, there are three main points to consider. First, the physical damage caused by the impact of the storm itself is considerable, destroying houses, public buildings, and important infrastructure such as hospitals, roads and schools. Second, tropical storms carry

⁷³ Thomas et al., *Social Vulnerability to Disasters.*, p. 89.

⁷⁴ McGranahan, Balk, and Anderson, “The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones.”, p. 26.

⁷⁵ McAdam, “Introduction.”, p. 1.

⁷⁶ Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster.*, pp. 211 – 212.

⁷⁷ Smith, p. 211.

⁷⁸ Smith, p. 214.

⁷⁹ Roberts, *The Changing Global Environment.*, p. 205.

heavy rainfall, which is released over the land masses as soon as the storm meets the first obstacle, causing inundations. Third, the storm surge that stems from the impact of the storm in the ocean will cause the greatest number of deaths. On the one hand, waves created by the storm will destroy land and inundate the coastal area, carrying objects that become deadly projectiles for humans and animals. On the other hand, tropical storms trigger a rise in sea level due to the reduction in air pressure.⁸⁰ Important factors with regard to the severity of the consequences caused by a tropical storm are not only the intensity and frequency of the occurrence, but also mitigation measures and preparation supported by the government or a regional organization. As the economic losses generated by tropical storms are generally high, financial capital is substantial for a successful and prompt reconstruction and recovery.⁸¹

In conclusion, earthquakes and tropical storms both imply similar physical and socio-economic consequences. Earthquakes as well as tropical storms can generate heavy floods and lead to the destruction of buildings and infrastructure in the region. Severe consequences of these two phenomena are a high death toll and serious economic losses for the government and the population. They stand as an example for the group of sudden onset-disasters, which in general generate a high amount of damage in a short period of time and mostly affect the most vulnerable population in the world.

2.1.3.2 Slow-onset disaster

By slow-onset disaster, one understands phenomena like sea-level rise and desertification, to name only the most important.⁸² This subitem wants to provide an overview of these two slow-onset disasters and of their causes and consequences. At the end of this subitem dealing with slow-onset disasters it will be possible to assess the particular threat to the human being that arises from these forms of climate change.

Within the slow-onset disasters, the rise of the sea level is a factor of increasing concern. The most important reason for the growing sea level is the thermal expansion of the world oceans because of the elevated water temperature. The second most important factor for the rising sea level is gradual melting of the glaciers.⁸³ The regional rise of the level has to be calculated in a case-by-case method because of regional factors like the amount of groundwater exploitation which affect the elevation of land mass. The consequences of sea level rise to the environment and for human

⁸⁰ Smith, *Environmental Hazards: Assessing Risk and Reducing Disaster.*, p. 218.

⁸¹ Diaz and Pulwarty, "Decadal Climate Variability, Atlantic Hurricanes, and Societal Impacts: An Overview.", pp. 3 – 4.

⁸² International Organization for Migration, "A Complex Nexus."

⁸³ Gönnert et al., "Der Meeresspiegelanstieg. Ursachen, Tendenzen und Risikobewertung.", p. 231.

life vary in degree of severity depending on the proximity to the ocean and on the resilience⁸⁴ capacities.⁸⁵ However, with a rise of 0,5 meters until the year 2100, coastal regions and islands – particularly low-lying islands and atolls⁸⁶ – will be severely affected and threatened by this slow-onset disaster.⁸⁷ Aggravating this situation, 10% of the current world population is living in coastal zones, being directly affected by a rising sea level, although the area makes up only 2% of the total land surface.⁸⁸ The consequences of the rising sea level for the affected regions are manifold: the economic stability of the country and the individual are weakened because of land loss. This is especially harmful to countries and individuals that rely heavily on agricultural productivity for their income and subsistence.⁸⁹ In addition to that, islands and coastal zones are at risk of contamination of fresh water sources like groundwater through the effects of inundations and flooding that cause the canalisation water to mingle with fresh water leading to sanitary and health problems, salinization of groundwater and soil degradation, heat stress and drought. These consequences of a rising sea level put the food security of island populations at danger. Changing climatic circumstances undermine food security in general, as weather conditions become more and more extreme with longer drought periods and intense rainfalls which do not allow cultivation of local products. A further threat of sea level rise is the destruction of infrastructure like roads and railways which ensure the supply of food and the transportation of staff to their local working place, which in turn harms local economy.⁹⁰ Thus, the effects of sea level rise to land mass and human habitat are far-reaching and complex.

The second form of slow-onset disaster that is to be treated in this context is desertification and drought. These factors in turn are highly connected with the term “water security”. In this context, the definition of the mentioned terms is unclear and imprecise. The concept of drought for example can be looked at from different disciplines focussing on different factors. In the present paper, the factor of moisture deficiency is used, because this term depicts the influence on human water needs in the most appropriate way. Aridity in general is the result of low average rainfall in a region and constitutes a permanent factor of the region’s climate. Drought, unlike aridity, is only temporary and can occur also in otherwise humid areas of the world.⁹¹

⁸⁴ “Resilience” means “The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.”, UNISDR, “2009 UNISDR Terminology on Disaster Risk Reduction.”.

⁸⁵ Houghton, *Globale Erwärmung: Fakten, Gefahren und Lösungswege.*, p. 104.

⁸⁶ Lazrus, “Sea Change: Island Communities and Climate Change.”, p. 286.

⁸⁷ Houghton, *Globale Erwärmung: Fakten, Gefahren und Lösungswege.*, p. 105.

⁸⁸ Warner et al., “Climate Change, Environmental Degradation and Migration.”, p. 696.

⁸⁹ Houghton, *Globale Erwärmung: Fakten, Gefahren und Lösungswege.*, p. 106.

⁹⁰ Barnett, “Dangerous Climate Change in the Pacific Islands: Food Production and Food Security.”, p. 232.

⁹¹ Kemp, *Global Environmental Issues: A Climatological Approach.*, pp. 41 – 42.

The IPCC defines drought as follows:

A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term; therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion.⁹²

In turn, desertification means the expansion of desert or desert-like conditions.⁹³ The causes of desertification are the convergence of air⁹⁴ in general, local divergence because of topographic obstacles like mountains, dry weather, little and irregular rainfall and no or dry airflows.⁹⁵ Temperature rise, evaporation, sea level rise and changes in precipitation patterns have a strong impact on water security. Although the fact of increasing desertification is a global threat, it is not a universal development. Indeed, there are strong regional differences in terms of water security worldwide. While water security is projected to rise in tropical and high-lying regions, it will decrease in the rest of the world, particularly in those regions of the world that are facing water shortages already.⁹⁶ The reason for that is the intensification of the hydrological cycle which is creating more extreme situations on both ends of the humidity scale because of a growing vapour content in the atmosphere.⁹⁷ Factors like a growing intensity of cropping, an increase in population and deforestation are adding to the impact of an increasing average temperature, aggravating the situation with regard to water security, leading to desertification.⁹⁸ These anthropogenic factors are additionally reinforced by the occurrence of natural droughts. Around 70% of the arid regions of the earth (meaning more than a quarter of the total land mass) and about one sixth of the total population are currently threatened by desertification, excluding natural hyper-arid areas.⁹⁹ With regard to the land area, this accounts for at least 50,000 km² per year of which the majority is located in developing countries.¹⁰⁰ The process of desertification leads to a development of a growing number of urban population affected by the phenomenon. Numerous urban settlements, constructed under conditions of dryland, are now situated in hyperarid regions. Increasing desertification is leading to crop failures, decreasing herds through starvation and death of thirst, famines, political conflict

⁹² Intergovernmental Panel on Climate Change, “Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (Eds.)].”

⁹³ Kemp, *Global Environmental Issues: A Climatological Approach.*, p. 59.

⁹⁴ The convergence of air describes the movement of air masses descending in the direction of the earth, causing air pressure to increase. This increase of pressure leads to a heating of the air, in turn.

⁹⁵ Portnov, “Introduction.”, p. 2.

⁹⁶ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 26.

⁹⁷ Houghton, “The Science of Global Warming.”, p. 253.

⁹⁸ International Organization for Migration, “World Migration Report 2018.”, p. 52.

⁹⁹ Houghton, *Globale Erwärmung: Fakten, Gefahren Und Lösungswege.*, p. 115.

Hyperarid areas are defined as a region corresponding to a desert, where rainfall can stay away for a period of several years and is characterized by no or very little vegetation, Portnov, “Introduction”, p. 4.

¹⁰⁰ Portnov, “Introduction.”, p. 5.

and socio-economic difficulties.¹⁰¹ The consequences of these conditions in the context of human vulnerability and migration will be considered in the third chapter of this thesis.

2.1.3.3 Environmental degradation

The concluding topic of environmental degradation links several of the before-mentioned factors and effects of climate change. Rather than describing singular events like sudden-onset disasters or periods of disastrous environmental conditions like slow-onset disasters, environmental degradation describes the “reduction or loss of ecosystem services, notably the primary production service”.¹⁰² By that one understands phenomena such as air pollution, loss of land and water resources and loss of biodiversity. There is increasing scientific evidence that environmental migration can be traced to climate change.¹⁰³

Because the connection between environmental degradation, climate change and the before-mentioned forms of environmental disasters is strong, the following subitem will present itself as a report subsuming and linking the factors influencing environmental migration, thus giving a complete picture of environmental hazards that can influence humans’ decision to migrate or not.

It is important to be aware of the high level of interconnectedness between all the factors mentioned with regard to climate change. This is the reason why the following section of the thesis will try to highlight the linking points and interference between the phenomena. As already mentioned, the CO₂-concentration is an important driver of global warming. Extreme weather events occur with more frequency and intensity due to an increase in the global average temperature and result in high death numbers, damage, displacement and soil degradation. Due to the rising temperature, glaciers and ice capes melt and the ocean expands, which leads to a rise in sea level, in turn leading to soil erosion and inundation. This in turn aggravates the problem of salinization and contamination of fresh water and decreases soil productivity. All of these phenomena therefore lead to an increase of water, food and resource shortages in the affected regions. Not only humans are affected by the degradation of soil quality and change of land use (such as deforestation), but also animal and plant species. A decimation of biodiversity results in further strain on the ecosystem, which can adapt to changes only if they happen over long periods of time.

This report on the complex links between the environmental changes and processes should paint a picture of the fragile balance of the earth’s ecosystem and the large impact that minor modifications within this system can have. The attempt to unduly simplify the interrelations can result in

¹⁰¹ Kemp, *Global Environmental Issues: A Climatological Approach.*, p. 69.

¹⁰² Adeel et al., “Millenium Ecosystem Assessment.”, p. 636.

¹⁰³ Warner et al., “Climate Change, Environmental Degradation and Migration.”, p. 691.

inaccurate assumptions dangerously shaping the public opinion on this sensitive topic. A similar attitude should be taken with regard to the link between climate change and migration.

2.2 Framing migration

In the second chapter of this thesis, migration as a human movement should be considered. The present chapter will be structured into two major topics and presented in subitems, the first one being the overarching definition of the phenomenon of migration. Conflicting definitions regarding the issue of environmental migration will be discussed in subitem 2.3.1. The second subitem depicts the three possible categories that migration can be outlined by. Similar to the structure adopted for the presentation of different types of climate change, this categorization aims at simplifying the linking process between climate change and migration in its various forms. Therefore, the paper tries to highlight human reaction to different types of environmental hardship or disaster in the second subitem. As a result, we will discover distinctive migration patterns that relate to particular situations of climate change. The research on this general linkage is the preparation for the more complex analysis that follows in chapter three, which will examine the precise way in which climate change exerts influence on human migration.

2.2.1 Definition of the term „migration”

In this subitem, the paper wants to give an overview of common definitions of important terms in the field of migration. In addition to that, the task will be to raise the topic of migration theories and methodological approaches to the topic. It will be useful to analyse different approaches critically in order to place the present work in the state of research and consider possible improvements. To introduce the second subitem of this second chapter, the drivers of migration will be presented.

The first matter of interest in this context of framing migration will be the definition of the term. The definition used in this thesis is formulated by the International Organization for Migration. It defines migration as:

The movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification.¹⁰⁴

¹⁰⁴ International Organization for Migration, “Key Migration Terms.”

It is important to recognize that the definition includes migrants with different motivations or reasons to migrate. The distinction between the term “migrant” and “refugee” in this context is also crucial, as the latter is a legal term, inclining international protection for the person/s concerned.¹⁰⁵ As represented by IOM, the negative perception of migration worldwide should be challenged, as the Deputy Director General of IOM, Laura Thompson, states in a speech on 25 September 2014:

The reality is that migration brings huge benefits, fuelling growth, innovation and entrepreneurship in both the countries people come from, and in those they move to. When governed humanely to promote safety, order and dignity, migration has endless advantages. It provides opportunities, and raises incomes and living standards.¹⁰⁶

It is the aim of the UN General Assembly to develop the Global Compact of Migration, promoting the positive aspects of human migration for the global development. Uniform with the guidelines of the Organization, Ms. Thompson argues for a safe and orderly migration monitored by national governments and international organizations.¹⁰⁷

In her wish for safe and orderly migration, she does not mention the case of environmental migrants. The reason for that is that people fleeing from slow- and sudden-onset disasters are not considered refugees in legal terms.¹⁰⁸ The term of “persecution” mentioned in the 1951 Refugee Convention does not include a persecution by environmental threats. Therefore, we are currently dealing with a legal framework which does not correspond to the current situation of global migration patterns, which is a deficiency that the present paper hopes to improve by introducing the factor of vulnerability into the legal context of migration.

From the argumentation of an ideal policy regulating migration flows in a manner that reduces migrants’ vulnerability during the movement of migration and ensures protection for those who are persecuted, including migrants fleeing from threats that are imposed by environmental factors, we will proceed to a discussion on the factors playing a role in the decision for migration. The following paragraph should explain possible factors of influence on the decision for and on the

¹⁰⁵ The Convention Relating to the Status of Refugees (also known as Refugee Convention) adopted on 28 July 1951 by the United Nations Conference in Geneva grants the right to be granted international asylum to refugees. A refugee is defined as a person who: “As a result of events occurring before 1 January 1951 and owing to well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it.” (United Nations, “Convention Relating to the Status of Refugees.”). The limitation in time and place was removed from the 1951 Refugee Convention by the 1967 Protocol, leaving the five reasons for persecution as the only condition defining a migrant as a refugee.

¹⁰⁶ Thompson, “A World on the Move: The Benefits of Migration.”.

¹⁰⁷ International Organization for Migration, “Global Compact for Migration.”.

¹⁰⁸ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 30.

destination of migration. Considering the complexity of reasons for a decision to migrate is essential in order to avoid over-simplifying the process. A complex phenomenon like migration, which is dependent on many factors that can be different in every singular case of migration, needs a subtle analysis which considers the wide range of possible impacts.¹⁰⁹

Within the analysis of migration drivers, the paper applies a modified model initially invented by Richmond Giddens in 1994. In the frame of this work, we will apply the adapted conceptual framework proposed by Van Hear, Bakewell and Long, dividing the impacts of the decision process into a range of functions: First, predisposing factors create the context which makes migration more probable. In this context, macro-political economy, shaping the discrepancies between national economies in the world, plays an important role in creating structural disparities between the nations, leading to some nations or regions being less favourable as a place of residence. Within these predisposing factors, one can find structural disparities reinforced by an increasing globalization, urbanization, demographic transition and – in the context of the link between migration and climate change the most important factor – environmental change. Economic disparities are produced by the globalization process of political economy, leading to a growing gap in earnings and living standards. Political disparities make migration more likely. This happens through the impact of political processes that lead to an increase in the prevalence of conflict, human rights violations and a lack of security. Environmental disparities manifest themselves through soil degradation, lack of resources and other factors. This point will be examined more in-depth in chapter three.

Proximate factors have a more direct relation to the moment of migration, as they include factors that aggravate the predisposing factors mentioned above. A factor of this sort can mean the outbreak of a civil war, the culmination of an environmental threat, or other changes in the situation in the country of origin. With regard to the receiving country, proximate factors can include an amelioration of the economic situation and the creation of new jobs or the alteration of the immigration policy, facilitating the immigration and integration process for the migrants.

The definitive decision to migrate is encouraged by precipitating factors. These factors stand for individual factors in the definition of Richmond. They can be found on the level of the family, the household, or the individual. Factors relating to health, employment or political persecution are part of precipitating factors, as well as the occurrence of a sudden-onset disaster. Mediating factors make up the whole context in which the migration is taking place, including possibilities of transportation, resources and information. Migration policies of the country of origin as well as in the receiving country play an important role as mediating factors, too.¹¹⁰ This short presentation of the

¹⁰⁹ International Organization for Migration., p. 9.

¹¹⁰ Van Hear, Bakewell, and Long, “Drivers of Migration.”, pp. 9 – 10.

modified model of the factors influencing the decision for migration has the aim to give a picture of the different impacts on a person involved in a possible migration.¹¹¹ Other than that, cultural, sociological and political factors play an important role in the decision-making process. For example, cultural structures, similarities and ties between two communities are relevant for the decision to migrate, as the culture of the region or country of destination promises better and easier integration for the person immigrating. In addition to that, migration flows regularly follow already existing paths and people tend to migrate the shortest distance possible.¹¹²

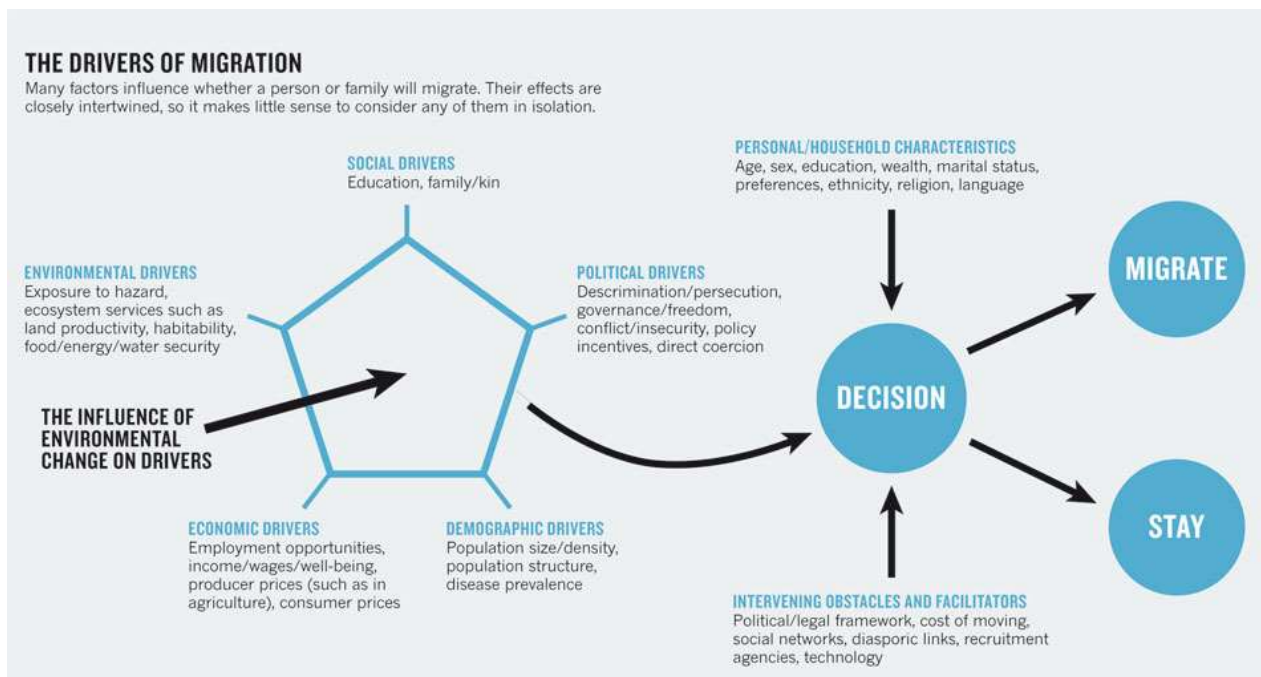


Figure 2: The drivers of migration¹¹³

Figure 2 helps to visualize the complex factors influencing the decision whether to migrate or not, which were already outlined in the preceding paragraph. Although the mind-map shows the general functioning of migration, it can be helpful for the analysis of environmental migration, too. This is the reason why the general drivers of migration are briefly introduced in this subitem. After introducing the topic of migration and explaining the most important factors controlling the decision to migrate, we will consider some methodological approaches and migration theories and discuss possible deficiencies. After that, the paper will go on with subitem 2.2.2 and argue for the categorization of migration, presenting the complex phenomenon in three groups. Many of the drivers mentioned in the figure can be affected and aggravated by environmental influence. The influence of environmental change on these drivers is presented by an arrow into the centre of the

¹¹¹ More information on the model on the drivers of migration established by Richmond can be found in: Richmond and Valtonen, "Global Apartheid: Refugees, Racism, and the New World Order."

¹¹² Hoffmann-Nowotny, "Weltmigration - Eine Soziologische Analyse.", p. 34.

¹¹³ Black et al., "Migration as Adaptation.", p. 448.

pentagon, representing the point where all the influencing factors come together. The drivers of migration which in turn affect the decision to migrate or not are environmental, economic, demographic, political and social. In comparison to other pictures painted in the migration theories in the preceding paragraph, the mind-map reflects the complexity of a migratory decision. The decision itself is once again influenced by individual constraints or interests, like age, sex, gender, religion, language, social networks, political framework, technology etc. These are all factors that will be considered in chapter four, when the index of vulnerability aims at creating a similarly complex and representative scheme for the drivers and interrelations of environmental migration. Only the individual factors will not be included into the index, because of analytical reasons, which will be explained further in subitem 2.4.1.

With regard to the methodological approach to migration, the restricted assessment of migration drivers is obvious in many cases. Starting from one of the first creators of a migration theory, Ravenstein presents a form of methodological individualism, which limits the unit of analysis to the individual.¹¹⁴ In his book *The Laws of Migration*, different reasons for migration are stated, although he focuses on the economic aspects of the motivation for human movement, linking this factor to development disparities:

I do not question for a moment that the principal, though not the only cause of migration, has to be sought for in over-population in one part of the country, whilst there exist elsewhere undeveloped resources which hold out greater promise for remunerative labour. It is obvious that this is not the only cause. Bad or oppressive laws, heavy taxation, an unattractive climate, uncongenial social surroundings, and even compulsion (slave trade, transportation), all have produced and are still producing currents of migration, but none of these currents can compare in volume with that which arises from the desire inherent in most men to "better" themselves in material respects.¹¹⁵

The rigidly formulated "laws" are deterministic and seem to ignore the complex interrelation between different aspects in the decision-making process for a migratory movement. Important factors like population growth are taken into account, but then introduced into the theory in an unsuitable manner, determining a singular possible influence that population growth can have on the human being, drawing conclusions for migration flows without considering the context that might alter the impact of population growth on a population.¹¹⁶

Another approach focussing on the economic motivations for migration is the neo-classical economic approach on the internal and international level, represented by authors like Lewis¹¹⁷ (1954)

¹¹⁴ Samers, *Migration.*, p. 55.

¹¹⁵ Ravenstein, "The Laws of Migration.", p. 286.

¹¹⁶ Samers, *Migration.*, p. 58.

¹¹⁷ For more information on the approach to modelling migration by Lewis, consider the book: Lewis, "Economic Development with Unlimited Supplies of Labour."

and Ranis and Fei¹¹⁸ (1961). On the level of the macro-perspective, the neo-classical economic approach works on the interplay between urban and rural areas with respect to the demand for labour. On the level of micro-perspective, however, representatives like Todaro¹¹⁹ (1969) analyse the motivations of individual migrants in the context of employment possibilities. It was also during the 1960s that Everett S. Lee divides the factors that cause migration into the groups of “push-factors” and “pull-factors”. This model is the core principle of the economic theory towards migration.¹²⁰ Similar to that, Friedmann¹²¹ formulates the “core-periphery paradigm” in 1973, arguing for the economic benefits of the core of the global system to be motivating migrants to move to urban areas. Both theories concentrate on economic interests in human migration and limit the complex phenomenon of migration to the economic driver. According to Richardson¹²² (1973) and Perroux¹²³ (1983), migration can be modelled as a movement following the paradigm of reducing the disequilibrium between low-wage regions and high-wage regions, therefore arguing within the same range of argumentation for the economic motivation of migration.¹²⁴

In order to represent more recent approaches within this theoretical context, it is appropriate to mention the new economics approach, within which the author Stark¹²⁵ (1991) is an important contributor. Using the household as the unit of analysis, this theory puts the maximization of income into context with the minimization of risk. This theory takes into account the risk of a possible migration, which is a factor that is often ignored in theories related to economic interests of migration movements.¹²⁶ Without going into the details of migration theories too much, this paragraph wants to show the restrictedness of specific theories by means of these three examples. As it was shown, the approaches try to simplify the methodological approach to migration theory by focussing on one representative factor without considering other impacts and drivers of migration

¹¹⁸ For more information on the approach to modelling migration by Ranis and Fei, consider the book: Ranis and Fei, “A Theory of Economic Development.”.

¹¹⁹ For more information on the approach to modelling migration by Todaro, consider the book: Todaro, “A Model of Labor Migration and Urban Unemployment in Less Developed Countries.”.

¹²⁰ For more information on how the “push-pull factors” impact migration from Lee’s point of view, see Lee, “A Theory of Migration.”.

¹²¹ Friedmann, “The World City Hypothesis.”.

For more information on the approach to modelling migration by Friedmann, consider the book Friedmann, *Urbanization, Planning, and National Development*. and the book (see citation number 112).

¹²² For more information on the approach to modelling migration by Richardson, consider the book: Richardson, *Regional Growth Theory*.

¹²³ For more information on the approach to modelling migration by Stark, consider the book: Perroux, “A New Concept of Development (London: Croom Helm).”.

¹²⁴ This point of view is criticized by Armstrong and Taylor (1993). According to them, migration does not follow rigid economic patterns. They argue furthermore, that labour does not have a mobile character, which would allow job seekers to respond to potential differences in the labour market without consideration of other influential factors, Portnov, “Modeling the Migration Attractiveness of a Region”, p. 113.

¹²⁵ For more information on the approach to modelling migration by Stark, consider the article: Stark, “The Migration of Labor.”.

¹²⁶ Samers, *Migration*., pp. 60 – 64.

or considering including them to a sufficient degree. This is a deficiency that the present thesis aims to mend by introducing the index of vulnerability, taking into account the context of migration in the country of origin and the receiving country and creating the connection between multiple factors influencing the migration decision. Within the analysis of a migration decision directly or indirectly induced by climate change, it becomes manifest, that a multitude of other factors, which do not stand in direct connection with climate change, can influence the decision to migrate. This argument should be reinforced in chapter three and demonstrated on the basis of the index of vulnerability applied on three examples in chapter four. The hypothesis proposed within this paper is that the most important factor influencing the decision to migrate is vulnerability. This factor plays an important role in the general perspective on migration as well as in the context of environmentally induced migration. The link between migration and climate change will be discovered more in-depth in chapter three of this master's thesis, introducing the factor of vulnerability.

2.2.2 Patterns of migration

The aim of the categorization of migration flows in the context of this master's thesis is to be able to link the categories to the different drivers of migration. In the case of environmental migration, we will try to create these links between migration forms and types of environmental disasters acting as a driver of migration, as only one of numerous drivers or as the factor enhancing pre-existing stress-factors. The importance of the decision to categorize migration within the frame of the present paper is on the basis of a simplification of the linking process in order to better understand the impact of climate change on migration.

It is useful, in order to promote a more homogenous discourse on the topic of migration, to agree on a set of definitional terms in the field. This can be seen in this example: the task of linking particular forms of climate change to particular forms of migration is possible only under the condition of clear definitions and distinctions of the groups, even if this distinction exists rather in theory than in reality. International organizations like UNHCR promote the homogenous use of distinctive nomenclature.¹²⁷ Another motivation for a categorization in terms of time, manner and distance as it is presented in the following is the legal frame. Although any attempt of categorization in the case of a complex phenomenon such as migration is also restrictive, this procedure represents the legal work approach and therefore enables affected people to have the possibility to seek asylum and make use of the migration laws however rigid they may be. The categorization

¹²⁷ Piguet, Pécoud, and Guchteneire, "Migration and Climate Change: An Overview.", p. 14.

thus helps introducing environmental migration into the standardized system of migration law.¹²⁸ This is why the three following subitems of this point are presented as categorizations of migratory movements into opposed pairs as follows: temporary/ permanent, voluntary/ forced and internal/ international.

Before breaking the phenomenon down into the categories, some numbers shall support the visualization of the dimensions of each of the categories. However, as already mentioned in the preceding subitem, it is difficult to set up numbers for some of the categories. The reason for this documentation obstacle is mainly the complexity of the human movement itself, but also the lack in collaboration between national institutions responsible for human movement within the country and international. To give an example, we can consider the projection of the number of international migrants for 2050 made by the UN in the year 2003. The UN estimated by then, that 2.6 per cent of the global population or 230 million people worldwide would be international migrants. However, in 2015 the number was already at 244 million people, surpassing the estimation made in 2003.¹²⁹ In addition to that, counting of border transgressions can be unfeasible because of a lack of technology and resources. Isolated borders and other obstacles that can impede the administration and tracking of the borders complicate this task in many cases, too.¹³⁰ In addition to that, there is a general lack of statistical data on short-distance and non-permanent movement. This lack of empirical information is one reason amongst others why it is difficult to predict future dimensions of migration flows.¹³¹ However, international organizations have come together for the first time with the aim of creating international migration measurement methods within the first International Forum on Migration Statistics in Paris in January 2018.¹³²

Furthermore, migration decisions are highly dependent on economic developments, geopolitical factors and several other possible impacts, which makes it difficult to predict future numbers of migrants.¹³³ In addition to that, several countries do not count departures, but only arrivals. Migration flows as well as the related administrative measures are heterogenous. Although it is easy to access numbers concerning migrant stocks, e.g. migrants living in a country, it is difficult to access numbers on migration flows, which are needed in order to set up an exact number of international migrants in the world.¹³⁴ However, IOM and other relevant international organizations like UNHCR, IPCC and others provide estimated numbers on the different categories. Within this context, it is important to keep in mind the large dark number and the dependency of the definition on the

¹²⁸ McAdam, *Climate Change, Forced Migration, and International Law.*, pp. 17 – 18.

¹²⁹ United Nations, “244 Million International Migrants Living Abroad Worldwide, New UN Statistics Reveal.”.

¹³⁰ International Organization for Migration, “World Migration Report 2018.”, p. 22.

¹³¹ Asian Development Bank, “Addressing Climate Change and Migration in Asia and the Pacific.”, pp. 14 – 15.

¹³² United Nations, Department of Economic and Social Affairs, Population Division, “First International Forum on Migration Statistics to Kick Off.”.

¹³³ International Organization for Migration, “World Migration Report 2018.”, p. 2.

¹³⁴ International Organization for Migration., p. 21.

legal framework. The following numbers are an estimation presented by IOM in the “World migration report 2018”:

The biggest group of migrants is the group of internal migrants, meaning those people who move within their country of origin and do not cross any international borders.¹³⁵ 740 million internal migrants are estimated to have lived worldwide in the year 2009. In comparison to that, the number of international migrants was estimated for 244 million people worldwide in the year 2015. Thus, it is obvious that the number of people migrating within their national borders is much bigger than the number of migrants crossing national borders. It is also important to highlight the difference between migrants and refugees worldwide.¹³⁶ 22.5 million refugees calculated in migration stock have been estimated worldwide for the year 2016.¹³⁷

Outside of the legal framework, the researcher should rather concentrate on the vulnerability of the individual that is concerned. It is not reflected by the legal denomination in a correct way, whether the people affected are living in vulnerable conditions or are exposing themselves to danger by the decision to migrate. Especially those people, who are forced to take illegal routes and pathways in order to reach security, are in a vulnerable state towards threats. Again, one has to note that the legal framework for migration is not well adjusted to real needs of people on the move.

In the context of a categorization of migration, it is important not to omit the group of persons who are the most vulnerable and because of that vulnerability do not have the capital to migrate. The people called “trapped populations” generally suffer from a loss of capital over a period of time and cannot afford the costly journey to another place. In many cases, they are disadvantaged by age, disability, gender or other factors.¹³⁸ Thus, financial barriers play a crucial role in the decision to migrate. Therefore, the poorest people do not have sufficient financial capital at their disposal and cannot migrate, or only migrate short distances.¹³⁹

After this introduction into the field of migration, it is useful to consider some possible classifications of the phenomenon of migration. Within this context, it is possible to identify certain patterns of migration as a frequent reaction to certain types of climate change. This is because the consequences caused by sudden-onset disasters in contrast to the consequences caused by slow-onset disasters are very different. Sudden-onset disasters are generally very destructive within a short

¹³⁵ Melde, *Glossary-Migration, Environment and Climate Change: Evidence for Policy (MECLEP)*., p. 13.

¹³⁶ As already mentioned in point 2.2.1, the difference between a migrant and a refugee is legal, the latter has the right to seek asylum and is assured international protection in contrast to the migrant.

¹³⁷ International Organization for Migration, “World Migration Report 2018.”, p. 2.

¹³⁸ Bremner and Hunter, *Migration and the Environment.*, p. 6.

¹³⁹ Barnett and Webber, “Migration as Adaptation: Opportunities and Limits.”, p. 41.

period of time, in contrast to slow-onset disasters which entail the reduction of productive resources in the affected area, gradually reducing the possibilities of resilience and enhancing vulnerabilities. These and other factors should be considered while creating the links between different types of migratory movements as a reaction to different kinds of environmental disasters.

2.2.2.1 Temporary/ permanent

The first distinction taken in this context of categorization is with regard to the factor of time. When it comes to the factor of time span of migratory movement, UNHCR proposes the distinction between temporary displacement as a change of habitat for less than three months, and long-term migration – here considered as permanent migration – as lasting for more than one year.¹⁴⁰

The most common reaction to sudden-onset disasters is temporary migration in the case of a successful recovery of the region and the community.¹⁴¹ Therefore, a return home is possible in the case of sufficient recovery effort and power of the government.¹⁴² However, with an increasing number of extreme weather events, the potential of recovery decreases because of shorter time periods available for the reconstruction and a gradual decrease of resources.¹⁴³

In contrast to that, slow-onset disasters and the migratory responses are more complex in their nature and more difficult to analyse. The usual reaction to gradual deterioration of the environment is permanent migration at some point, which can be preceded by temporary migration. This form of temporary migration is carried out in most cases by the young and able population in order to decrease vulnerabilities of the family through remittances¹⁴⁴.¹⁴⁵ Remittances worldwide have been higher than Official Development Assistance (ODA) since the 1990s.¹⁴⁶

Remittances, in turn, are an important way of increasing resilience towards economic stress of the people staying in the place of origin, which increases the possibilities to adapt to climate change.¹⁴⁷ In general terms, it is possible to draw the conclusion from evidence, that in most cases, stressors enhanced by slow-onset disasters as well as incremental degradation in general cause a permanent abandonment of the place of origin.¹⁴⁸ The crucial point at which an event can force people to leave

¹⁴⁰ Piguet, Pécoud, and Guchteneire, “Migration and Climate Change: An Overview.”, p. 14.

¹⁴¹ Graeme, “Climate Change-Induced Mobility and the Existing Migration Regime in Asia and the Pacific.”, p. 14.

¹⁴² Kälin, “Conceptualising Climate-Induced Displacement.”, p. 85.

¹⁴³ Ferris, “Making Sense of Climate Change, Natural Disasters, and Displacement: A Work in Progress.”, p. 4.

¹⁴⁴ Remittances are “financial or in-kind transfers made by migrants directly to families or communities in their countries of origin.”, International Organization for Migration, “World Migration Report 2018.”, p. 30.

¹⁴⁵ Graeme, “Climate Change-Induced Mobility and the Existing Migration Regime in Asia and the Pacific.”, pp. 14 – 15.

¹⁴⁶ International Organization for Migration, “World Migration Report 2018.”, p. 31.

¹⁴⁷ Barnett and Webber, “Migration as Adaptation: Opportunities and Limits.”, p. 44.

¹⁴⁸ Barnett and Webber., p. 43.

their homes can be prevented by quick-reacting adaptive policies and disaster assistance. Barnett and Webber explain this phenomenon as follows:

In so far as permanent migration may be triggered by a threshold event such as drought or a food crisis, well-timed and well-delivered disaster assistance can significantly offset migration. Effective responses to famines are those that seek to augment entitlements so that people in famine conditions do not lose assets and/or migrate, as these distress responses increase their vulnerability to subsequent famine events.¹⁴⁹

In addition to that, policies responding to climate change can not only prevent migration but can also improve the conditions for a return after a migration. Thus, well-addressed policies for adaptation to the consequences of climate change like care packages for the people affected and support for rebuilding homes can lead to a decrease of permanent migration.¹⁵⁰

To conclude the subitem of the spatial considerations on migration, it is important to say that the research on migration patterns after sudden-onset disasters is easier and more fruitful than the tracking of migration in context with slow-onset disasters. This is because the tracking of persons is clearer and easier linkable to a singular event than to a gradual degradation.

2.2.2.2 Voluntary/ forced

Migration is multi-causal, therefore the linkage to specific causes for migration is not easy. Thus, it is difficult to assess whether a migration decision is voluntary or forced. The distinction between the two forms of migration is hence done in order for the complex phenomenon to fit into the rigid frame of legal regulations.¹⁵¹ Nonetheless, the range of migration with regard to the degree of voluntariness should be imagined as a continuum. Only a small number of migratory movements can be placed at the extreme ends of this continuum and explicitly recognized as a voluntary or forced decision. Most of the cases can be located in between the two ends of this continuum and are difficult to classify as either voluntary or forced.¹⁵² Thus, it is crucial to note that the line between the two denominations is blurred and that migratory movement is a mix of both voluntariness and force in different proportions.¹⁵³

However, it is possible to define specific patterns of migration in the context of environmental impact. Slow-onset environmental degradation and disasters have a long-time impact on the economic situation and the conditions of life of the affected population. These negative impacts on

¹⁴⁹ Barnett and Webber., p. 51.

¹⁵⁰ Bremner and Hunter, *Migration and the Environment.*, p. 6.

¹⁵¹ International Organization for Migration, "A Complex Nexus."

¹⁵² Graeme, "Climate Change-Induced Mobility and the Existing Migration Regime in Asia and the Pacific.", p. 12.

¹⁵³ McAdam, "Introduction.", p. 2.

different levels might not force to migrate, but with the reinforcement of pre-existing stress factors, people reconsider their options and might choose migration as a form of adaptation in order to improve their resilience. However, the situation can evolve such that the people affected are forced to leave because their place of origin has become uninhabitable because of flooding or complete desertification.¹⁵⁴

With regard to the evaluation of the general migration, without taking environmental factors into account, it is possible to grade the voluntariness of migration with some basic assumptions about the movement. Involuntary migrants usually do not prepare for the move, maintain a stronger attachment to the country or city of origin, are likely to be in a state of stress, are less likely to bring assets (for example education) than voluntary migrants or to have good social connections in their country or city of origin. Although these assumptions are meant to apply for the entirety of migration, whether affected or induced by climate change or not, it can however be adapted to the field of analysis of environmental migration. Within this scope, the terminology differentiates between different degrees of voluntariness, too. “Environmentally motivated migrants” are generally those who chose to move because of environmental factors but are not yet in a state of acute stress or threat of life. “Environmentally forced migrants” flee because environmental factors destroy or are likely to destroy their livelihood, forcing them to migrate. The choice within the decision to migrate lies only within the spectre of time, but the migration itself is imperative. The third group are “environmental refugees” who have no other choice but to flee their habitat and no choice over the moment of flight.¹⁵⁵ This classification of the voluntariness of environmental migrants might help in the visualization of the phenomenon but is not very useful in the legal context. The use of the term “environmental refugee” merely depicts the compulsive character of the decision but does not reflect a legal reality. In addition to that, the term suggests a mono-causality, which is rarely the case in the context of environmental migration.¹⁵⁶ It is therefore useful to discard the strict distinction between forced migration and voluntary migration especially in the context of environmental migration, because of the difficulty to assess the totality of factors influencing the decision to migrate. Jane McAdam explains the rejection of the terms “environmental refugee” or “climate refugee” as follows: “When you talk about refugees – climate refugees – you’re putting the stigma on the victims, not the offenders.”¹⁵⁷ This fact is important to keep in mind while considering legal conditions regarding the topic discussed. After all, it is true that most people suffering from the

¹⁵⁴ Kälin, “Conceptualising Climate-Induced Displacement.”, p. 85.

¹⁵⁵ Graeme, “Climate Change-Induced Mobility and the Existing Migration Regime in Asia and the Pacific.”, pp. 12 – 13.

¹⁵⁶ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 30.

¹⁵⁷ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 41.

effects of climate change are the least responsible, which is also a reason for the difficulties with reluctances in addressing problems and in finding solutions to consequences of climate change and support environmental migrants and people affected by climate change.¹⁵⁸

However, regardless of the legal bases, it is recommended to adopt the term “displacement”¹⁵⁹ for people who are removed by force – in many cases in response to sudden-onset disasters. Displaced people are likely to travel short distances in order to escape the precarious situation they are fleeing and often wish to return to their home as soon as possible.¹⁶⁰ Those displaced staying within their national borders are called Internally Displaced Persons (IDP).¹⁶¹

In the context of forced migration, it is crucial to differentiate between people who flee because of conflict, persecution or disaster and those migrating because of work, studies or family. The first group of migrants is generally more vulnerable.¹⁶²

2.2.2.3 Internal/ international

On the spatial dimension, we can distinguish internal from international migration. The linkage between the type of environmental disaster and the pattern of migration in context with the spatial boundary is more easily recognisable than factors like voluntariness or the timeframe of migration. The difference between slow-onset and sudden-onset disasters in connection with migration can be formulated as follows:

Although slow-onset environmental processes are less visible than extreme events, over longer timescales, they tend to have a greater impact on the movement of people than natural disasters. Slow-onset events can produce a wide spectrum of migration flows, including cross-border as well as rural to rural and rural to urban, with the majority of movements likely to take place either internally or cross-border to neighbouring countries.¹⁶³

As the quotation cited above reveals, public awareness for sudden-onset disasters is higher than for slow-onset disasters. A reason for that might be the unexpected occurrence of the disaster and the disastrous losses of life and damage that most sudden-onset disasters involve. Political and media interest concentrates on international migration rather than internal migration, although the latter is the bigger group of the two migration patterns. This might be because migration is a very

¹⁵⁸ O'Brien and Leichenko, “Double Exposure: Assessing the Impacts of Climate Change within the Context of Economic Globalization.”, p. 222.

¹⁵⁹ The exact definition of the term “displacement” proposed by IOM is the following: “A forced removal of a person from his or her home or country, often due to armed conflict or natural disasters”, Melde, *Glossary-Migration, Environment and Climate Change: Evidence for Policy (MECLEP)*., p. 11.

¹⁶⁰ Barnett and Webber, “Migration as Adaptation: Opportunities and Limits.”, p. 43.

¹⁶¹ Ferris, “Making Sense of Climate Change, Natural Disasters, and Displacement: A Work in Progress.”, p. 4.

¹⁶² International Organization for Migration, “World Migration Report 2018.”, p. 13.

¹⁶³ Climate Change, Environment and Migration Alliance, “Climate Change, Environment and Migration. Frequently Asked Questions.”, p. 2.

powerful topic which can be useful in political messages and well formulated in the following quote:

Debates on the climate change-migration nexus often seem to focus overwhelmingly on international migration, and particularly on flows from the “South” to the “North”. But this bias tells more on Western fears than on actual trends, as there is evidence that most migration triggered by environmental factors concern internal migration.¹⁶⁴

However, slow-onset disasters produce a bigger number of migratory incidents than sudden-onset disasters worldwide. Internal migration (particularly rural-urban migration) and migration to neighbouring countries is the most dominant pattern in environmentally induced migration.¹⁶⁵ One reason for that is the reduction of capital through long-lasting strain on resources due to environmental changes. During droughts in Somalia for example, the number of international migrants decreases while the number of internal migrants and short-distance migration in general increases.¹⁶⁶

The majority of people affected by a sudden-onset disaster flee within their own national borders. In this case, the human rights protection is ensured by the 1998 UN Guiding Principles on Internal Displacement. In addition to that, there are regional agreements such as the 2006 Protocol on the Protection and Assistance to Internally Displaced Persons¹⁶⁷ and the 2009 African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa.¹⁶⁸ However, people responding to sudden-onset disasters might also choose to or need to flee their country of origin for different reasons. Some reasons are the hope for a better future or assistance in another country, the lack of resources and capacities of their country of origin and environmentally induced political reasons.¹⁶⁹ In this case, they are legally not considered as refugees except for particular conditions which entitle the migrant to fall into the category of refugees according to international law.¹⁷⁰

The global population is growing as well as the percentage of international migrants in relation to the world population. In 1970, the percentage of international migrants in relations to the world population was at 2.3%, while it grew to 3.3% in the year 2015. The number of international migrants worldwide from 1970 to 2015 as well as the evolution of the percentage of international migrants in relation to the world population can be seen in the figure below.

¹⁶⁴ Piguet, Pécoud, and Guchteneire, “Migration and Climate Change: An Overview.”, p. 14.

¹⁶⁵ International Organization for Migration, “A Complex Nexus.”

¹⁶⁶ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 21.

¹⁶⁷ This protocol entered into force on 21 June 2008 and covers the Great Lakes region in North America, Kälén, “Conceptualising Climate-Induced Displacement.”, p. 86.

¹⁶⁸ The convention, adopted on 22 October 2009 entered into force only on 6 December 2012, protecting the rights of African IDPs, “The Kampala Convention: Two Years on: Time to Turn Theory into Practice.”

¹⁶⁹ Kälén, “Conceptualising Climate-Induced Displacement.”, p. 87.

¹⁷⁰ For more information on international laws for refugees consider point 2.2.1 and the 1951 Refugee Convention.

Year	Number of migrants	Migrants as a % of world's population
1970	84,460,125	2.3%
1975	90,368,010	2.2%
1980	101,983,149	2.3%
1985	113,206,691	2.3%
1990	152,563,212	2.9%
1995	160,801,752	2.8%
2000	172,703,309	2.8%
2005	191,269,100	2.9%
2010	221,714,243	3.2%
2015	243,700,236	3.3%

Figure 3: International migrants, 1970 – 2015.

As already mentioned in chapter one, the majority of people affected by climate change live in low-income countries, which have little financial capital at their disposal to invest in adaptation strategies that decrease the people's vulnerability. As a consequence, little or no policies responding to environmental, social or political stressors will be set up, leading to the gradient pauperization of the population. In the moment of migration, people affected are not able to afford a travel that exceeds the distance of the national borders in most cases. In some cases, migration will be destined for a neighbouring country.¹⁷¹ In the case of international migration, international rights do not entitle migrants to be granted admission to other countries if they are legally not classified as a refugee.¹⁷² As environmental migrants do not classify as refugees in most of the cases of international migration, this group of migrants is especially vulnerable.¹⁷³

International as well as internal migrants face the problem of a lack of capability and willingness from the side of national governments with regard to the protection of the human rights of this particularly vulnerable group of people.¹⁷⁴ In this context, the importance of an international legally binding framework becomes especially evident. As could be already read in the introduction to this chapter, there are administrative problems and a lack of information when it comes to the tracking of international migrants. First of all, it is difficult to distinguish migration flows from tourism or work travel flows and second of all, there are currently only two international migration tracking datasets.¹⁷⁵

¹⁷¹ Barnett and Webber, "Migration as Adaptation: Opportunities and Limits.", p. 51.

¹⁷² Kälin, "Conceptualising Climate-Induced Displacement.", p. 87.

¹⁷³ Kälin., p. 90.

¹⁷⁴ Barnett and Webber, "Migration as Adaptation: Opportunities and Limits.", p. 49.

¹⁷⁵ International Organization for Migration, "World Migration Report 2018.", p. 23.

This consideration of migration patterns and legal inclinations forms the foundation of the more in-depth analysis of the links between migration and climate change that is to follow in chapter three. Clear categorization and working definitions help understand and work more efficiently on the topic of migratory flows that are a response to environmental change.

2.3 The link between migration and climate change

This chapter envisages the differentiation between two forms of relationship between migration and climate change. After the in-depth covering of the phenomena separately, it is useful to consider the nature of the possible link between migration and climate change. In order to be able to place the relationship in a historical context, the paper will present a historical overview of the discourse from 1960 to 2010 and discuss the legal problem of the term “environmental refugee” in a paragraph. With the historical knowledge and a short insight in the legal background, it is possible to distinguish the forms of linkage between migration and climate change. Within this paper, this distinction is undertaken in two points, which are presented in two subitems: the direct link and the indirect link between migration and climate change.

The aim of the distinction of these two forms of relation is to facilitate the identification of environmentally induced drivers for migration and categorize them. This categorization might help the adjustment of the legal framework to the actual situation of environmental migrants.

In general terms, this paper will apply the hypothesis that climate change has an indirect impact on migration in most of the cases, influencing the decision to migrate through the enhancement of pre-existing stress-factors. Thus, the term “vulnerability” plays an important role in this chapter, building the context for the presentation of the index of vulnerability in chapter four. The assumption that vulnerability is an appropriate criterion for the impact of climate change on migration can be found in the following citation:

While there is no consensus between the various disciplines on methodological issues, analyzing the vulnerability of human actors and socio-ecological systems is considered a fruitful approach to disentangle the complex relationship between human migration and climate change.¹⁷⁶

The link between climate change and migration is not linear in most cases of environmental migration. The climatic influence on human livelihood is very abstract and yet obvious. This link could be observed over time, as subitem 2.1.2 shows. However, as extreme weather events grow more frequent and intense and as slow-onset disasters are growing more intense and are affecting more people than ever in history, it is the task of today to assess the current link between migration

¹⁷⁶ Zehetner, *Environmentally Induced Migration and the Concepts Vulnerability, Resilience and Adaptation to Climate Change: A Qualitative Content Analysis.*, p. 1.

and climate change in a multi-disciplinary approach. The hypothesis of this work is that climate change is not a direct reason for migration in most of the cases, but rather leads to the aggravation of other stressors, that exist regardless of climate change, which in most of the cases then lead to a migratory decision.¹⁷⁷ The chapter tries to disentangle different drivers for migration and their affiliation with climate change. This means, that the following chapter aims at explaining the impact of climate change on human livelihoods in a direct and indirect manner. However, the important point to understand in this chapter is the recognition of the entirety of persons affected by environmental change as refugees. This recognition will be following the degree of vulnerability to climate change directly or to factors influenced by climate change, meaning the indirect linkage between migration and climate change. As already mentioned, the aim of the paper is to highlight possibilities of adaptation of the legal framework and designation of current migratory patterns in order to assure international protection and asylum rights to those environmental migrants who are disregarded by the current legal framework. Thus, the differentiation between direct and indirect links is not in the centre of interest, but rather a tool in order to detect the importance of assets such as human and financial capital with regard to adaptation possibilities and choices. Although human adaptive capacity depends on a number of factors and does not follow clear patterns, the following chapter tries to determine the most important points of climatic influence on human migration reactions.

Furthermore, an issue not directly related to the topic of how climate change influences migration flows but still of importance for the dimensions of risk worldwide is urbanization. The reason why this topic is crucial in context to climate change is because first of all, rural-urban migration is one of the most important migration patterns globally. Within this paper, we assume that migration is a form of adaptation, a movement away from the risk of climate change, or resulting from escape from imminent danger. However, with regard to urbanization, the migration pattern leads to an increase of risk, because a high number of urban areas in the world and particularly in Asian regions and the Pacific are low-lying coastal areas. Therefore, one can observe rapid population growth in areas exposed to high climatic risks. This paragraph should show that migration flows do not always follow clear patterns and are difficult to predict. Numerous factors can play a role in human vulnerability to climate change. In the case of migration to high risk areas, it is the migration itself which increases vulnerability to the consequences of climate change.¹⁷⁸ Within the same context, globalization plays a similar role. The high degree of global connection with regard to culture, economy, commerce and other fields, the impact of climate change in one particular

¹⁷⁷ McAdam, *Climate Change, Forced Migration, and International Law.*, pp. 15 – 16.

¹⁷⁸ Asian Development Bank, “Addressing Climate Change and Migration in Asia and the Pacific.”, p. 15.

region and possible migration flows do always affect other regions of the world to varying degrees. This means that international migration for example has become easier through the digital revolution, technology and decreasing travel costs.¹⁷⁹ These factors of global connection should be kept in mind when considering both fields, migration and climate change, and especially when considering the link between the two.

With the aim of creating an informed basis for the analysis of the discussed link, the chapter starts with a survey of the evolution of the discourse on the link between migration and climate change from 1960 to 2010. We will also be able to see, how the perception of the relationship between humans and nature can shape the opinion on humans' dependence on natural phenomena and the significance of processes like climate change. However, even if the degree of dependence on nature decreases, humans will always depend to a certain degree on resources provided by the earth. Certain activities, revenues and livelihoods depend on nature. On the macro level, climate change has an impact on the economic, political, social, cultural, health and other sectors of a country or other unit of analysis. On the micro level, the same aspects are affected but in another way. In addition to that, individual vulnerabilities can aggravate the situation. Age, religion, health, wealth, education and gender for example can have a decisive impact on an individual's adaptation possibilities.¹⁸⁰ In this context, it is also important to consider regional differences regarding the dependence on the ecosystem in order to lead a sustainable lifestyle. The higher the dependence on the ecosystem, the greater the vulnerability to climate change will be regionally.¹⁸¹ Climate change plays an enhancing factor in most of these cases.¹⁸²

2.3.1 Historical overview: discourse on migration and climate change (1960 – 2010)

In this subitem, the historical evolution of the discourse on migration and climate change shall be depicted. To come to a comprehensive portrait of this evolution, it is useful to analyse the modification process of the term “environmental migrant” over the years. With the help of a chart (see figure 3), we will be able to divide the evolution into periods of time, ranging from 1970 to 2010. This historical overview should create a context for the discourse on the relation between migration and climate change in order to highlight the connection between the policies of national governments, media, scientific discourse and the importance of definitions.

¹⁷⁹ International Organization for Migration, “World Migration Report 2018.”, p. 13.

¹⁸⁰ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 11.

¹⁸¹ International Organization for Migration., p. 26.

¹⁸² McAdam, *Climate Change, Forced Migration, and International Law.*, p. 6.

Migration is a phenomenon which is highly related to human existence. Human movement has been a reaction to environmental change already during the 12th century, as explained in subitem 2.1.2, and well before that. However, the scale of climate change and global warming has increased distinctively since around 1800. This fact – together with population growth and other factors – leads to a rise in numbers of migrants worldwide. It is therefore interesting to take a look at the public representation of climate change before considering the discourse on the context of climate change and migration. The aim of this analysis is to determine the period of time in which climate change becomes a widely discussed topic and when the connection between climate change and migration is drawn in the context of modern migration patterns.

Figure 4 below shows the history of the term “environmental migrant”, which will be used in the present thesis, following the definition promoted by IOM¹⁸³, which defines environmental migrants as

persons or groups of persons who, for compelling reasons of sudden or progressive changes in the environment as a result of climate change that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and move either within their country or abroad.¹⁸⁴

With the help of the following figure, the history of this term will be elaborated using the changes in designation as cornerstones.

Year	Term used
1958	primitive migrant
1984	environmental refugee
1986	famine refugee
1991	ecomigrants
1994	ecological refugee
1995	distress migrant
1996	environmental migrant
1997	ecological migrant
2002	environmentally displaced person
2002	eco-refugee
2006	climate-change exile
2006	climate refugee
2007	environmental displacee, development displacee

Figure 4: History of name-calling: “environmental migrant”¹⁸⁵

¹⁸³ This working definition is not generally accepted but often used in scientific publications, Kălin, “Conceptualising Climate-Induced Displacement.”, p. 89.

¹⁸⁴ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 31.

¹⁸⁵ Morinière, “Tracing the Footprint of ‘Environmental Migrants’ through 50 Years of Literature.”, p. 24.

One of the first to address possible problems of climate change for the environment and humans is the Swedish scientist Svante Arrhenius in the year 1896. He calculated that the earth's climate would become 5 to 6 degrees warmer in the case of a doubling of CO₂-emissions.¹⁸⁶ Also during the 19th and 20th century, there are first publications mentioning a connection between the environment and migration. This short trend can be seen in the shift in denomination, too. In the year of 1984, the term “environmental refugee” is used, accepting the environment as a driver of migration. However, this trend levels off again and environmental issues are mentioned less frequently in migration literature over the course of the 20th century. Authors of publications which can be considered core literature within the topic of migration in the 20th century do not mention environmental drivers in their work.¹⁸⁷ As figure 4 above shows, the term “primitive migrant” around 1958 and the term “famine refugee” in 1986 do not create the link to climate change in a general sense. The denomination “famine refugee” might have been chosen by authors because the 1980s were years of an elevated number of famines worldwide.¹⁸⁸ An increase of publications on the topic of international migration is taking place since the 1980s. However, the connection of migration with environmental factors is not evoked. There are four possible reasons for this decrease in interest on the connection between migration and climate change: first, it is possible that the idea concentrating on Western-centric ideals which perceive technological progress and development as the tool that helps the human being to reach an independence from nature, leads to the assumption that natural or environmental effects would not have an impact on the human life. This is approximately the time of the term “primitive migration” for designating environmental migrants¹⁸⁹, overlapping with the denomination of environmental migrants as “environmental refugees”. It is assumed that people who are not able to subjugate nature to a degree that makes it possible for them to maintain human livelihood, are just not sophisticated enough. Those who migrate as a response to environmental change are therefore considered “primitive”. The term “primitive migrant” for a person fleeing environmental changes is coined by William Peterson, who mentions it in a publication in 1958.¹⁹⁰ Another reason for the temporal rejection of the context between migration and climate change might have been the periodical preference for socio-cultural approaches. The explanation of migration through environmental factors was therefore rejected

¹⁸⁶ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 12.

¹⁸⁷ Piguet, Pécoud, and Guchteneire, “Migration and Climate Change: An Overview.”, p. 3.

¹⁸⁸ The number of famine victims is particularly high in the 1960s, counting 18 603 700 people whereas in the 1950s, the mortality rate due to famine was 12 200 200, Our world in data, “Famines.”.

¹⁸⁹ See figure 4 for further information.

¹⁹⁰ In his article “A General Typology of Migration, which is published in 1958, Peterson defines “primitive migration” as follows: “Here, then, primitive migration does not denote the wandering of primitive peoples as such, but rather a movement related to man's inability to cope with natural forces.”, Petersen, “A General Typology of Migration.”, p. 259.

because it was supposedly deterministic. A third possible reason might be that for this period of time, economic reasons were given more importance. Fourthly, authors of the 20th century supported the approach that states induce migration rather than other factors. However, the reference of different forms of the term “ecological” can be seen in the denomination in figure 4 for the 20th century.

In scientific literature, it is only from the 1980s and 1990s on, that the link between migration and environmental factors is established and discussed, again. In figure 5 below, one can see the development of publications as journals or books on the topic of the link between migration and the environment covering 50 years (from 1958 to 2007). It is obvious that the number of total publications on the topic increases from 1999 onwards, reaching a high in 2007. The scientific interest in this topic seems to have been increasingly high between 2002 and 2007.

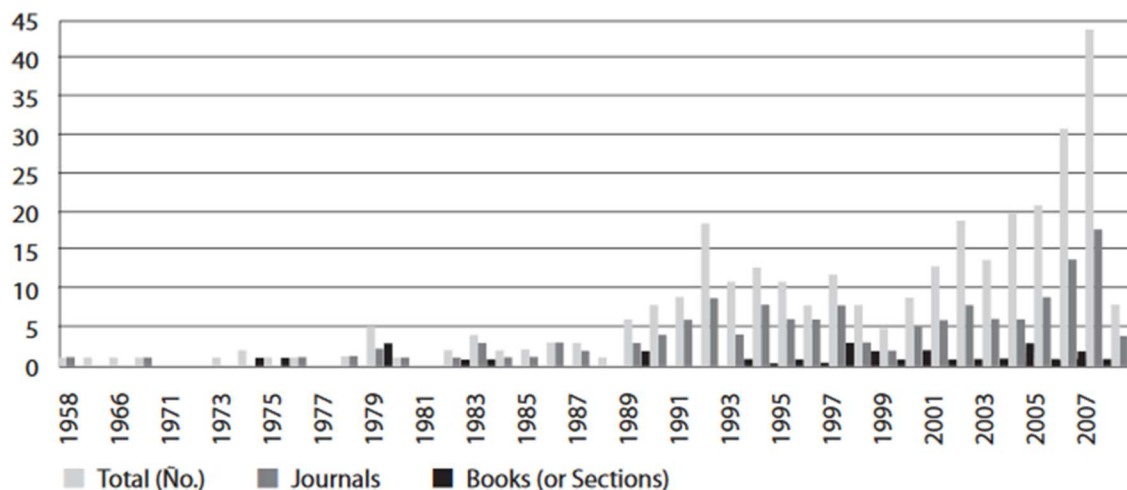


Figure 5: 50 years of publications on the interaction of migration and the environment¹⁹¹

One possible reason for this re-appearance might be the increasing public attention to and awareness of climate change. It is also in 2006, that climate change is evoked for the first time in the chart of figure 4 as “climate-change exile”. Authors like Norman Myers¹⁹² issue alarmist estimates of people displaced by environmental factors induced by climate change. Myers is a representative of the alarmist approach to environmental migration, estimating the number of people concerned by environmental degradation and disasters thus arguing for an estimation of 150 million people displaced because of climate change until the end of the 21st century. This approach towards environmental migration, also called the maximalist approach, leads to a change of perception within

¹⁹¹ Morinière, “Tracing the Footprint of ‘Environmental Migrants’ through 50 Years of Literature.”, p. 25.

¹⁹² For more information on the point of view presented by Myers, see Myers “Environmental Refugees.”.

the public opinion on the topic and its representation in the media. Large scale migratory flows imply a security issue and the maximalist approach leads to the perception of migration as threat.¹⁹³

Scientific data on the field created public awareness on the link between migration and climate change. An important event in this renovation in the public discourse on this topic was the establishment of the IPCC by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988. Two years after the founding, the first IPCC report is issued, marking an important point in the historical evolution of the research on the link between migration and climate change. The moment of publication of the fourth assessment report published by IPCC is the first time, that the link between climate change and migration is issued in the context of a well-researched, international scientific undertaking.¹⁹⁴ The publication of the first assessment gave an impetus for the foundation of the United Nations Framework Convention on Climate Change (UNFCCC), which aims for creating an international scientific framework on the issues of climate change and within this frame has released the Kyoto Protocol. This well-known protocol targets a decrease in the CO₂-emission rates in all the signing nations.¹⁹⁵ This agreement helps to reduce the number of people displaced by environmental disasters, in case the goals are met.¹⁹⁶

Today, the importance of an inter-disciplinary approach is widely accepted in the scientific community, although alarmist and monocausal interpreters still exist and together with alarmist media representation lead to a shift in national immigration policies.¹⁹⁷ Not only the alarmist approach or the monocausal explanation of phenomena is dangerous, but also the exaggeration and oversensitivity in the context of climate change impacts on human livelihood. This can be seen in the publications of the popular novelist and historian Philipp Blom. In his book “Die Welt aus den Angeln. Eine Geschichte der Kleinen Eiszeit von 1570 bis 1700 sowie der Entstehung der modernen Welt, verbunden mit einigen Überlegungen zum Klima der Gegenwart“, published in Germany 2017, he tries to explain numerous social and historical events in the 16th and 17th century with the Little Ice Age. However, within the scientific community and the network between international organizations, the consensus that “a single historical migratory event can be initially understood in environmental terms and be later reframed in economic or political terms”¹⁹⁸ is accepted as common ground. We can therefore speak of a shift in paradigm.

¹⁹³ Piguet, Pécoud, and Guchteneire, “Migration and Climate Change: An Overview.”, p. 4.

¹⁹⁴ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 31.

¹⁹⁵ Ferris, “Making Sense of Climate Change, Natural Disasters, and Displacement: A Work in Progress.”, p. 3.

¹⁹⁶ Kälén, “Conceptualising Climate-Induced Displacement.”, p. 82.

¹⁹⁷ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 4.

¹⁹⁸ Piguet, Pécoud, and Guchteneire, “Migration and Climate Change: An Overview.”, p. 6.

Following this overview of the historical evolution of the discourse on the link between climate change and migration, the legal problems and discrepancies in the context of the terms “climate migrant” in contrast to “climate refugee” will be discussed shortly in the following paragraph.

With regard to the topic of environmental reasons as a motivation for this migration, the definition provokes a legal discrepancy which will be discussed as a side note in the following paragraph.¹⁹⁹ The legal significance of the term “refugee” was already explained in subitem 2.2.1: it assures international protection and the right to seek asylum for a person persecuted for one or several of the five reasons of persecution mentioned in the 1951 Refugee Convention. However, besides the general heterogeneity within the designation of the phenomenon within the scientific as well as the public discourse, the term “environmental refugee” is employed repeatedly. This however does not reflect the legal reality for people displaced for environmental reasons.²⁰⁰ It can be argued that the current legal framework represents persons displaced by a sudden-onset disaster rather than those displaced by a slow-onset disaster, as the reasons of migration appear more clearly in this case.²⁰¹ As Stephen Castles from UNHCR argues:

By now it should be clear that the term ‘environmental refugee’ is simplistic, one-sided and misleading. It implies a mono-causality which very rarely exists in practice.²⁰²

The approach to a terminology of “environmental refugee” thus is not the aim of this paper. On the contrary, the aim is to adapt the legal framework to the changing interrelations and dimensions of migration with regard to climate change. Therefore, the focus should not lie on the search for an appropriate definition – the only requirement for the definition is the necessary highlight on the multicausality of environmental migration. In fact, the important issue for the future will be the adaptation of the legal state for people directly or indirectly affected by environmental factors which lead to migration. This and other legal questions related to migration and climate change, like the question of “disappearing nations”, might be some of the most pressing questions in the 21st century. This is one of the motivations for the present paper and the interest of researching the context between migration and climate change. The index of vulnerability has a similar objective, which is to make a step towards a change in the legal framework with regard to environmental migrants. The index should help in demonstrating the high degree of indirect impact of environmental constraints on stressors that can lead to migration. It should help within the argumentation

¹⁹⁹ Although dealt with only within a side note, the topic of legal recognition is crucial within the discourse on environmental migration.

²⁰⁰ International Organization for Migration, “Climate Change and Migration: Improving Methodologies to Estimate Flows.”, p. 17.

²⁰¹ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 20.

²⁰² Castles, *Environmental Change and Forced Migration: Making Sense of the Debate.*, p. 8.

of environmental threat as an actor of persecution following the wording of the 1951 Refugee Convention.

2.3.2 Direct link

After this historical overview of the discourse on the link between migration and climate change and the analysis of the legal problems in the field, the historical knowledge helps identifying possible relations between the two phenomena. This subitem deals with the direct relation between migration and climate change. Thus, the interest is to figure out the direct influence of climate change on migration.

We are dealing with a direct link between climate change and migration when climate factors endanger the imminent survival of a human being, forcing the affected person to flee. We are dealing with a direct link between migration and climate change in the case of an irreversible environmental degradation in the affected region.²⁰³ This understanding of a direct link is applied in this master's thesis. Another clarification on the method must be put forward. In the following subitems about the link between migration and climate change we will consider to what degree climate change can lead to migration and analyse the connection between the two phenomena. Within the discussion, the degree of vulnerability will play a crucial role, as the assumption is that climate change enhances pre-existing vulnerabilities. The consequences of climate change, particularly in high-risk areas, have an impact on the poor and the wealthy. However, the discussion will focus more on those who are already in a more vulnerable position rather than those who have an array of mitigation and adaptation methods at their disposal. The reason for this focus is the enhancement of the importance of different forms of capital and of the influence of the political, social and structural background of the observation.

To render the characterization of the direct link between migration and climate change clearer, one can state that a direct link exists when the movement is forced.²⁰⁴ In this case, the population deals with the occurrence of a sudden-onset disaster, which forces the people affected by it to leave their homes without making long-time preparations because the consequences of the disaster leave no choice but leaving home immediately. In this case, the link between the climate disaster and the migration is direct. One example for the direct link between an environmental disaster and migration flow is the incident of hurricane Katrina in North America in August 2004.²⁰⁵ With regard to

²⁰³ International Organization for Migration, "A Complex Nexus."

²⁰⁴ The description and characteristics of a forced movement are described in more detail in subitem 2.2.2 in the paragraph about forced and voluntary migration patterns.

²⁰⁵ Bremner and Hunter, *Migration and the Environment.*, p. 4.

the factor of vulnerability, its role in the context of sudden-onset disasters is highly limited. In reaction to a hurricane, a flood or an earthquake, the majority of people affected will be forced to flee their homes irrespective of adaptive capacity.²⁰⁶ We will not be able to consider discriminative factors like class, gender and race in the framework of this paper, it is however important to note the differences in human responses to disaster in relation to discriminative factors.²⁰⁷ They affect the moment of return, the probability of employment in the moment of return, the emotional stress in relation to the disaster and others.²⁰⁸ Financial capital as a factor of inequality will be included, though.

As the unrolling of the migratory reaction after sudden-onset disasters is rather linear and has been described at several points in this master's thesis, we will concentrate at this point on the description of the indirect link between migration and climate change. The focus within this task lies on the factor of vulnerability, as it is the central interest of this paper to show the influence of climate change on human vulnerability towards stressors related to or aggravated by environmental change.

2.3.3 Indirect link

The hypothesis adopted in this master's thesis says that climate change reinforces pre-existing stressors and increases human vulnerabilities to other factors.²⁰⁹ Based on this assumption, it is useful to assess existing vulnerabilities in the global human population and elaborate an analysis of migration drivers which is as complete as possible. As soon as one has an appropriate picture of existing stressors that might have an impact on the migratory decision, it is possible to draw conclusions on the probable effects of increasing climate change in the context of migration. By means of an assessment of existing patterns of migration and their motivations, one can predict probable environmental impacts on the movement. However, it should not be ruled out that climate change can give rise to new drivers that lead to migration.²¹⁰ In the following, the paper will highlight different fields where stress factors for migration can be found and how they are affected by climate change and its consequences. The important difference between this subitem which discusses the indirect link between migration and climate change and the preceding subitem on the direct link is that in the following case migration is not a direct consequence of imminent threat of

²⁰⁶ However, different forms of capital like financial and material capital are necessary in order to assure a return home. This capital might be delivered by the government, international aid or the individuals affected.

²⁰⁷ Liverman, "Vulnerability to Global Environmental Change.", p. 33.

²⁰⁸ Elliott and Pais, "Race, Class, and Hurricane Katrina: Social Differences in Human Responses to Disaster.", pp. 316 – 319.

²⁰⁹ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 16.

²¹⁰ Asian Development Bank, "Addressing Climate Change and Migration in Asia and the Pacific.", p. 13.

an environmental disaster. In contrast to that, the indirect effects of environmental changes on the economic, social, governmental and sanitary situation within a community will be the subject of discussion.

The following quote agrees on the point that the effects of environmental changes affect human livelihood also in an indirect way, mentioning issues like security, economy and development:

Environmentally induced migration has the potential to become a phenomenon of unprecedented scale and scope. Its effects on the global economy, international development, and national budgets could be profound, with significant implications for almost all dimensions of human security, in addition to political and state security.²¹¹

The paper will thus try to highlight some of these points of influence in the following subitem. Vulnerability is increased through the culmination of two or more sources of pressure on the population affected. On the one side, consequences of climate change are threatening the population, on the other side there can be political instability, economic difficulties or isolation, which are factors that are intensified in the moment they occur simultaneously, leading to an increase of vulnerability with regard to all existing hardships. Thus, the impact of one factor on the others is not unilateral but mutual. The complexity of the relations between those parameters is well represented in the following quote:

Climate change represents a classic multi-scale global change problem in that it is characterized by infinitely diverse actors, multiple stressors and multiple time scales. The existing evidence suggests that climate change impacts will substantially increase burdens on those populations that are already vulnerable to climate extremes [...].²¹²

After having made the complexity of this interrelation clear, it is useful to start the discussion by the definition of the term “vulnerability” and create a context of its consequences on human livelihood.

There is a number of definitions available on the term. I chose to follow the formulation by Timmerman, as his idea to link the term of “vulnerability” to the term of “resilience” is appropriate with regard to the present context of this paper. Timmerman defines “vulnerability” as “the degree to which a system, or part of a system might react adversely to the occurrence of a hazardous event. The degree and quality of that adverse reaction are partly conditioned by the system’s *Resilience* [sic!] [...]”²¹³ (accentuation by the author). He thus points out an important fact about vulnerability, which is the dependence of its degree on the system in which it is observed. In strong connection with this term, he also defines “resilience” in the following words: “*Resilience*, the measure of a

²¹¹ Warner et al., “Climate Change, Environmental Degradation and Migration.”, p. 692.

²¹² Adger, “Vulnerability.”, p. 273.

²¹³ Timmerman, “Vulnerability, Resilience and the Collapse of Society. Environmental Monograph 1.”, p. 21.

system's, or part of a system's capacity to absorb and recover from the occurrence of a hazardous event."²¹⁴ (accentuation by the author).

Liverman however proposes a distinction between biophysical vulnerability and social vulnerability. The distinction between these two forms of vulnerability is an important indicator for the significance of the context, in which an environmental threat is experienced in and reacted to. Liverman understands biophysical vulnerability as the fragility of a particular landscape. In this context, the biophysical conditions such as topography, soil quality and climate are considered, as well as the degree of human impact on the landscape such as the intensity of harvesting or the land use in general. Biophysical vulnerability increases for humans living in areas prone to experience flooding, land degradation, desertification or sea level rise, to name only a few environmental threats.²¹⁵ The dangerous conditions of environmental disasters have been sufficiently discussed in chapter 2.1. The interest point that can be taken up in the task of linking this hazard to migration lies in the fact that the biophysical conditions increase human vulnerability. The same phenomenon will be observed with regard to the second form of vulnerability, which is what can be summed up as social vulnerability. This means the political, social and economic influence on human vulnerability to climate change.²¹⁶ Both aspects will be discussed further in the following subitem and will be applied in parts in the Index of Vulnerability in chapter 2.4.

One advantage of considering vulnerability is that one can develop adapted solution strategies in response to particular vulnerabilities in order to improve resilience. It is not the task of one nation or one government to cope with climate change issues and to make sure that appropriate measures are taken in order to prevent human displacement. The topic is also highly connected to the global supply chain, economic stability and availability of resources.²¹⁷

Within this context, „[climate change] may provide a ‚tipping point’ that would not have been reached in its absence.”²¹⁸ This is the role of climate change in the indirect connection to migration. A general consequence of climate change on human existence is the loss of livelihood, which can be observed in the case of sudden-onset disasters as well as of slow-onset disasters, although in varying degrees within both of the groups, depending on the vulnerability and the damage caused by the disaster. Consequences of both phenomena have been explained in subitem 2.1.3. It is now useful to consider the consequences of these effects on human vulnerability. Loss of livelihood is one of the most serious consequences of climate change for a majority of people affected. It has

²¹⁴ Timmerman., p. 21.

²¹⁵ Liverman, “Vulnerability to Global Environmental Change.”, pp. 29 – 30.

²¹⁶ Liverman., p. 30.

²¹⁷ Liverman., p. 28.

²¹⁸ McAdam, *Climate Change, Forced Migration, and International Law.*, pp. 16 – 17.

far-reaching implications on the quality of life and prevents sustainable development in the region affected.²¹⁹ The loss of livelihood has important consequences with regard to financial security, food and water security, employment, health and many other factors. It decreases the human resilience capacity and thus increases vulnerability.²²⁰

In a situation of environmental stress, the context is crucial and decides over the adaptation possibilities of the society and the individual affected. Climate stress can even uncover governmental deficits leading to civil unrest and political dissatisfaction.²²¹ In the following subitems, we will deal with four main fields of influence by climate change successively. However, several arguments will apply to two or more of the fields of influence mentioned in this chapter. The reason for that is the high interconnectivity between the different fields of influence. Note however that the following discussion makes no claim of completeness.

It is important to keep in mind within the discussion of the indirect link between climate change and migration, that the degree of impact through climate change on different communities and regions in the world varies. First of all, the degree of impact depends on the baseline²²² vulnerability of the population considering different factors as well as the biophysical vulnerability, thus the risk of becoming a victim of climate change and to what extent. Other factors building the context of this connection will be discussed in the following subitems and have been discussed in this paper already. The crucial fact to keep in mind during the following discussion is that the range of vulnerability is never very clear or distinguishable from one individual case of observation to another. The degree of vulnerability, that we want to consider in its relationship with climate change should always be considered as a continuum. With this concept in mind, we will figure out the indirect linkage and influence of climate change on migration, which is assumed to happen through the enhancement of pre-existing vulnerabilities.

2.3.3.1 Economic consequences

When considering economic consequences of climate change, the first important point that comes to mind is the loss of agricultural productivity.²²³ Production of products and livestock farming are, in the case of degradation and desertification, only possible with the help of irrigation systems.

²¹⁹ McAdam., p. 21.

²²⁰ In the context of vulnerability, it is important to keep in mind the most vulnerable, who are those unable to migrate in a situation of stress. The “trapped populations” have not the necessary capital at their disposal that would allow a migration and therefore stay behind, Black and Collyer, “Populations ‘Trapped’ at Times of Crisis.”, p. 52.

²²¹ Chazalnoël, Mach, and Ionesco, “Extreme Heat and Migration.”, p. 8.

²²² Baseline at this point means the human vulnerability without considering the climate change impact.

²²³ Portnov, “Introduction.”, p. 6.

This in turn, requires high technology and financial capital. Technology in the context of adaptation strategies to environmental change thus plays an important role and can be linked to economic conditions as well as political conditions in a nation. Technological opportunities allow the construction of protecting dams, the installation of irrigation systems et cetera. However, the scope and manner of application plays a crucial role. The reason for that is that wrong application of irrigation systems for example can lead to salinization and finally to soil infertility.²²⁴ In addition to that, it can come to an increasing salinization of the soil, which leads to persistent infertility of the land. An additional barrier is the fact that financial capital is in most cases only available in a stable political and socio-economic structure, which can be found in few developing countries in the world.²²⁵ This is aggravated by the fact that nearly two-fifths of the world population are living in urban areas of low-or middle-income nations. Most of the world's megacities can be found in low-and middle-income nations as well.²²⁶ This leads to the fact that a high number of people are living in nations whose governments cannot bring up the necessary financial capital in order to provide adaptive measures and systems for their populations. Concordant with the discussion on financial capital as an asset for resilience capacity, the number of fatalities due to natural disasters affirms the assumption that human vulnerability to natural disasters is higher in low-and middle-income nations than in high-income nations. Evidence shows that more than 95% of fatalities caused by floods and storms from 2000 to September 2013 happened in low-and middle-income nations although exposure can be found in upper-middle- and high-income nations as well. Poor quality of housing construction, unsuitable infrastructure, lack of health care and service provisions are some of the reasons why nations with a lack of financial capital face higher vulnerability to environmental disasters.²²⁷ This inequality might be one reason why wealthier regions or nations are popular destination countries for environmental migrants.²²⁸

Considering the loss of agricultural productivity, it is most harmful to those people who depend directly on agriculture as their income. Particularly in the case of slow-onset disasters and slow land degradation, one can observe a gradual loss of capital within a household or a community

²²⁴ Liverman, "Vulnerability to Global Environmental Change.", p. 31.

²²⁵ Safriel, "Ecological-Oriented Options for the Sustainable Development of Drylands.", p. 154.

²²⁶ Revi et al., "Urban Areas.", pp. 544 – 545.

²²⁷ Revi et al., p. 547.

²²⁸ International Organization for Migration, "Climate Change and Migration: Improving Methodologies to Estimate Flows."

This is not to say that environmental migrants chose their place or country of destination with respect to economic aspects. Distance, cultural and familial ties, policies and many other aspects play an important role in the decision process. Depending on the context of the decision, a person will have to prioritize some aspects over others. However, most of migratory moves are intern and gradual, meaning that a person moves from one village to another, before moving to the closest city and only then will consider cross-border migration. Still, it is important to keep in mind that every decision is ruled by a particular, individual context, McAdam, *Climate Change, Forced Migration, and International Law.*, p. 16.

which leads to the subsequent loss of assets like education and loss of resources like food and fresh water, leading to health problems. In the moment of decision whether to migrate or not, one has to take the considerable loss of financial capital during a degradation process into consideration. In the context of climate change, the financial capital of a person or household affected decreases and with that the probability of possibilities for adaptation. The persons affected will be able to afford the costly migratory travel and integration process with a minimum of financial capital. This can be seen in the figure below, which shows the magnitude of migration in relation to the wealth level. The amount of wealth is divided into four categories: very poor, poor, middle-class and wealthy households. The fact that the members of poor households are those who are most likely to migrate, underlines the assumption that adaptation measures necessitate capital in the form of money and information. Thus, the group of people who do not have many of those assets at their disposal but can still afford the migratory movement is most likely to do so.

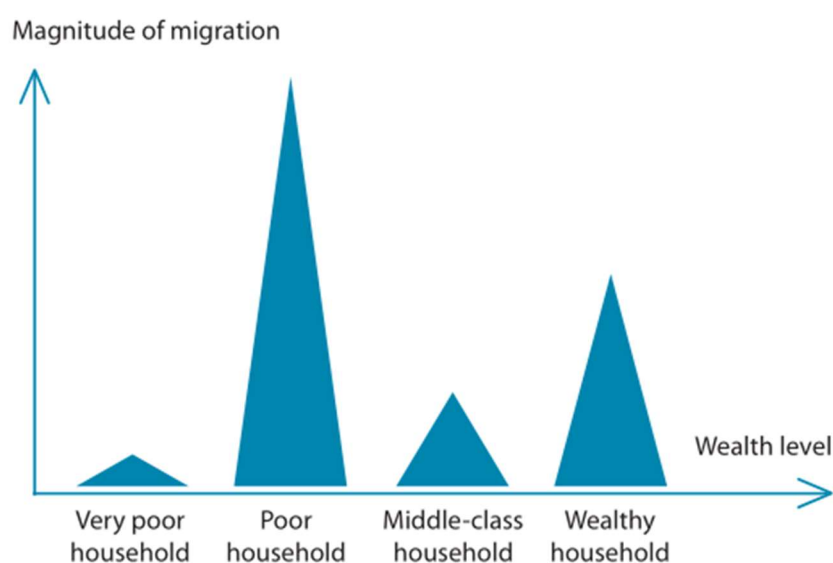


Figure 6: Magnitude of Migration According to Wealth Level²²⁹

As we have seen in the preceding paragraph, climate change and land degradation lead to a decrease in land productivity, leaving people working in concerned branches without enough income to meet basic needs. Depending on his or her resilience, other assets, the political and economic background and other adaptive possibilities, the person affected will take the decision to migrate or not. In this context, most choices within the migration pattern can be put in the scope of rural-urban migration. The reason for that is that not only half of the world population is already living

²²⁹ Asian Development Bank, “Addressing Climate Change and Migration in Asia and the Pacific.”, p. 47.

in cities, but urban areas also concentrate the majority of all global economic assets and activities.²³⁰ Also, in the context of the socio-political situation, it is problematic to have an elevated number of unemployed people. With the decreasing financial capital of the population, it is in turn not possible to uphold the national economic balance. The decline in purchasing power leads to an economic slowdown and the rise of prices. The rural population, which is particularly concerned by the loss of land productivity in general, will therefore sooner or later migrate to urban regions within the country in order to search for work. As we consult the example of the drought in Syria from 2007 to 2011, we can observe the economic consequences: in the year 2002, 8.9 million people lived in cities. Eight years later in 2010 and during the drought, a total of 13.8 million people was living in urban areas, which means an increase of about 50% within 8 years.²³¹ It is worth mentioning that a large proportion of the Syrian population (namely one quarter) has been working in the sector of agriculture before the outbreak of the drought.²³² This rural-urban movement is a typical pattern of migration as a response to economic strain due to climate change. In general, one can observe the Gross Domestic Product (GDP) in order to get information on the economic productivity level of a country.

Adding to this economic hardship caused by environmental stress is the rapidly expanding process of globalization. These two processes shape the world in a significant way and both play an important role in the human striving for a sustainable livelihood. Globalization probably even increases the pace of climate change by fostering rapid development, productivity and consumption. As mentioned in subitem 2.2.2, the benefits and drawbacks of these processes are not evenly distributed. This uneven distribution of profit leads to the further rise of global inequality in socio-economic concerns and in vulnerabilities to stressors like environmental stress.²³³ One phenomenon of high importance for the topic discussed in this paper is urbanization in general. The majority of refugees (60% as of the end of 2016) seeks urban areas.²³⁴ The high density of population in urban areas, which is in part attributed to the consequences of climate change²³⁵, leads to a number of other problems:

²³⁰ Revi et al., "Urban Areas.", p. 541.

²³¹ Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought.", p. 3242.

²³² Hourani and Scullard, "Syria."

²³³ O'Brien and Leichenko, "Double Exposure: Assessing the Impacts of Climate Change within the Context of Economic Globalization.", p. 222.

²³⁴ International Organization for Migration, "World Migration Report 2018.", p. 32.

²³⁵ We will not be able to consider other reasons for increasing urbanization due to the relative connection to the interest of this paper. The consequences of the urbanization process, however, which have an important influence on the risk of becoming affected by environmental disasters have been mentioned in the introduction to chapter 2.3 of this work.

Migration to urban centers in mega-deltas is an outcome of many forces: economic policies and incentives, local and destination institutions, government policies to develop small towns, and the geographic concentration of investments. Massive influx of capital to many deltas has transformed the local economic base from a primarily agricultural one to a manufacturing and processing economy.²³⁶

To name only some consequences of increasing urbanization, we will mention the price rise of products but also of services, accommodation and energy, which leads in turn to the emergence of slums and homeless people.²³⁷ The competition over resources comes to a head in the context of high population density, high prices and poor access to resources – the occurrence of civil conflict becomes more likely, especially in the context of an increasing heterogeneity of the population.²³⁸ Linking the increasing rate of urbanization to the risk of being affected by environmental disasters in the form of tropical storms and inundation, the fact that of the 23 megacities worldwide, 16 are built on the coast (as of 2011) is demonstrating the increased vulnerability to climate threat through urbanization.²³⁹ The population of these big urban zones is threatened by sudden-onset disasters, especially by hydrological disasters. This risk adds to the generally problematic situation in densely populated cities in environmental aspects. Studies show, that the number of people at risk living in a city affected by an environmental disaster will increase relative to the number of people living in this biophysically vulnerable place.²⁴⁰ In the year 2014, the number of people living in cities worldwide who are exposed to one type of natural disaster²⁴¹ was at 1.4 billion people already.²⁴²

Another economically related topic is the prevention of a sustainable²⁴³ development due to climate change.²⁴⁴ The functioning of a sustainable development is highly linked to the pressure that the population and other factors like climate change put on the environmental resources like food, fresh water and energy resources.²⁴⁵ Wrong farming techniques, overgrazing and overharvesting are only a number of anthropogenic factors that can prevent a sustainable development. In the

²³⁶ Seto, “Exploring the Dynamics of Migration to Mega-Delta Cities in Asia and Africa: Contemporary Drivers and Future Scenarios.”, p. 1.

²³⁷ IPCC, “Working Group II: Impacts, Adaptation and Vulnerability.”.

²³⁸ Reuveny, “Climate Change-Induced Migration and Violent Conflict.”, p. 659.

²³⁹ Blackburn and Pelling, “Coastal Megacities: Risks and Opportunities.”.

²⁴⁰ Liverman, “Vulnerability to Global Environmental Change.”, p. 30.

²⁴¹ This study refers to the following sorts of natural disaster: cyclones, floods, droughts, earthquakes, landslides and volcano eruptions.

²⁴² United Nations, Department of Economic and Social Affairs, Population Division, “The World’s Cities in 2016.”, p. 8.

²⁴³ Sustainability and sustainable development are terms which are not very homogeneously defined. However, the definition of “sustainable development” most widely accepted is the definition proposed by the World Commission on Environment and Development which reads as follows: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”, Portnov and Pearlmutter, “Sustainable Population Growth of Urban Settlements: Preconditions and Criteria.”, p. 37.

²⁴⁴ Portnov, “Introduction.”, p. 6.

²⁴⁵ Portnov and Pearlmutter, “Sustainable Population Growth of Urban Settlements: Preconditions and Criteria.”, p. 38.

context of climate change, the fertile soil is dried up through changing precipitation patterns, droughts and slow desertification and land degradation processes.

The issue of rising isolation due to climate change in cases such as desertification or sea level rise is a topic between the fields of economic and social influences of climate change on human vulnerability. The maintenance of infrastructure and services can be restricted and reduced when a region is experiencing deteriorating climate conditions. Reasons for this increasing isolation can be migration on one side, but firms and enterprises leaving for more favourable conditions on the other side. This leads to an increase in transportation costs, the complication of reaching services like stores or infrastructure like schools, working places, or hospitals. This situation is particularly applicable to extremely arid zones, in which the population density remains below 15 persons per km² in average. Population density stays below 20 persons per km² in arid zones and below 70 persons per km² in semi-arid zones.²⁴⁶

This decrease in population density has social implications, too. Besides the social effects of urbanization and isolation, other social influences of climate change on human vulnerability and migration patterns will be examined in the following paragraphs.

2.3.3.2 Social consequences

The subitem on the impact of climate change on social vulnerabilities treats subjects like demographics, employment and topics related to population growth. Social capital is a resource for adaptation, as is financial capital. As social implications are highly connected with economic conditions, some of the relevant points have already been mentioned or discussed in the precedent subitem.²⁴⁷ Social vulnerabilities such as poor access to education, isolation, poor infrastructure²⁴⁸ and underemployment will be discussed in the light of environmental factors.

In connection with the economic consequences of isolation for human vulnerability, we will continue the discussion on this point from a social viewpoint. Climatic hardship and disasters can lead to spatial as well as social isolation. Infrastructure services, transport and other opportunities might no longer be available in a region affected by climate change. Although isolation and remoteness

²⁴⁶ Portnov, "Introduction.", p. 6.

²⁴⁷ The crucial point is to convey the important impact of climate change on human vulnerability – the division in groups of vulnerability is mainly a matter of clarity.

²⁴⁸ Portnov and Errell, "Long-Term Development Patterns of Peripheral Desert Settlements.", p. 21.

are becoming increasingly insignificant with the growing communication and transport infrastructure, it is still a growing challenge to lead a sustainable existence for the person affected.²⁴⁹ Climatic influences can lead to a decrease in the regional job opportunities in two ways: on the one side, sudden- and slow-onset disasters can destroy on-site infrastructure of companies directly. On the other side, the risk of being negatively affected by environmental disasters can convince company owners and investors either to decrease the risk and transfer the company to a safer location, or not opting for the region affected by climate change as the company location in the first place. In both scenarios, the number of job opportunities and their range decreases.

Another factor highly linked to employment is education. Both are an important element of resilience to climate change. A stable income leads to financial capital and good education, and a wide range of knowledge is the key element of social resilience. However, both are also highly exposed to the impact of climate change. The link between climate change and secure employment and income has been discussed in depth in the point on the economic influences within this subitem and linked to the social aspects in the precedent paragraph. We will thus move on to considering education in the context of climate change and isolation. The prevention of a good education through climatic threats, spatial remoteness or other factors leads to a further increase of isolation and restriction in the later aspiration of a professional career.²⁵⁰ The lower the education of a person, the more vulnerable he or she is to changes in the labour market. If we take an agricultural worker as an example, it will be difficult for him/her to consider another field of work after his/her usual employment is made unfruitful through climate change. It is the people working in the agricultural sector who are most vulnerable against climate change because they are most dependant on a functioning eco system. However, their vulnerability is even aggravated by the fact that climate change generally also takes education possibilities from them. The increased vulnerability will lead to a positive migration decision in many of the cases.

Summing up the topics of education, employment and isolation, these subjects stand under the general heading of development problems.²⁵¹ Vulnerability to climate change is already highest in countries under development and low- and middle-income countries in general. However, development problems are aggravated by the impact of climate change.²⁵²

In the context of urbanization, overpopulation in urban areas plays an important role when talking about the impact of climate change on vulnerabilities. This process is probably the consequence

²⁴⁹ Portnov and Errell, "The Effect of Remoteness and Isolation on Development of Peripheral Settlements.", p. 91.

²⁵⁰ Portnov and Errell., p. 87.

²⁵¹ Portnov and Errell., p. 88.

²⁵² McAdam, *Climate Change, Forced Migration, and International Law.*, pp. 16 – 17.

of an increasing isolation of rural areas in the context of education, employment and social inclusion as well. An increasing urban population density leads to the exacerbation of existing pressure on key resources.²⁵³ Just as underpopulation in remote areas leads to a lack of services, the overpopulation of urban areas has an overstrain of the social, health and economic system as a consequence. This can lead to the aggravation of already existing – political, social, religious or other – conflicts or cause conflict due to an increase of competition on scarce resources. There is evidence of climate change-related migration and rural-urban migration in general leading to a more heterogeneous ethnic population in urban areas.²⁵⁴ In addition to that, climate change can cause homelessness. Due to different impacts that have a connection to climate change, it can come to the loss of a home. The reasons might be economic, a direct consequence of destruction through disaster, or indirect through economic difficulties caused by environmental factors. Also, as already mentioned in this work, financial capital plays an important role in the resilience capacity of a person. This shows equally considering the topic of housing. Poor housing quality cannot protect the inhabitants from extreme weather conditions or sudden-onset disaster.²⁵⁵ The inhabitants are therefore more vulnerable to climate change than wealthier people living in a robust construction equipped with heating and air-conditioning which protects from extreme cold or heat.²⁵⁶ Those without a home are exposed to the threat of climate change without any protection.²⁵⁷

To conclude the point of social influences in the context of climate change as an aggravating factor of human vulnerability, the following quote provides a well-chosen wording: “The mediating function of social factors in the relationship between climate change and migration points to the fact that people do not have access to the same resources when it comes to reacting or adapting to environmental change.”²⁵⁸

Spatial isolation, poor education, high dependence on the eco system and poor housing conditions are some of the social stress factors that are exacerbated by climatic stress and lead to migration. For the following point we can again see a strong link to and a correlation with the other elements of the indirect relation between climate change and migration. Social and economic features are linked to a very high degree. In the following, we will discuss the influences of climate change on the political situation of a country, which lead to an increase of human vulnerability to already existing stressors. The strong link between the political situation and social and economic factors

²⁵³ Asian Development Bank, “Addressing Climate Change and Migration in Asia and the Pacific.”, p. 14.

²⁵⁴ IPCC, “Working Group II: Impacts, Adaptation and Vulnerability.”

²⁵⁵ McAdam, *Climate Change, Forced Migration, and International Law.*, p. 21 – 22.

²⁵⁶ Hanson et al., “Climate Change, Housing and Homelessness. Report on the Homelessness and Climate Change Forum.”, pp. 2 – 3.

²⁵⁷ Ramin and Svoboda, “Health of the Homeless and Climate Change.”, p. 654.

²⁵⁸ Piguet, Pécoud, and Guchteneire, “Migration and Climate Change: An Overview.”, p. 13.

will be evident, as well as the interesting connection between the aggravation of instable political situations in view of climate stress.

2.3.3.3 Sanitary and health-related consequences

Sanitary and health challenges are in high risk of being enhanced by climate change and thus increasing human vulnerability forcing people to migrate. The cause for these existing vulnerabilities exhibits a strong link with economic and physical pre-conditions. As we have seen, most sudden- and slow-onset disasters happen in low- and middle-income countries which are also in a weak position when it comes to precautions and adaptation. In addition to that, the infrastructure and the health and sanitary system are under-developed in many cases.²⁵⁹ These vulnerabilities are aggravated by slow- and sudden-onset disasters, as infrastructure providing health care can be destroyed or transferred, food shortages occur due to a decrease of agricultural productivity and financial pressure, fresh water becomes scarce because of inundation through salty water, the destruction of water pipes and sewage systems. These are only some of the consequences that can arise from the impact of climate change and can be difficult to repair in a situation of economic problems and other stress factors like non-responsive political guidance.

Some of the most pressing health consequences of climate change are discussed in separate paragraphs. However, the account of arguments is non-exhaustive.

First, consequences of climate change can lead to a worsening of the already critical situation of access to fresh water and drinkable water. Especially slow-onset disasters like desertification and sea-level rise have a strong impact on this important resource. Within the desertification process, precipitation patterns change and lead to an increasing rate of dryness by for example increased evaporation and decreased groundwater levels.²⁶⁰ The negative effects of global warming on fresh water availability outweigh the positive impact due to runoff water from melting glaciers and ice.²⁶¹ Regarding sea-level rise as a threat for water security, one notices that the temporal and permanent inundation of land causes salty water to contaminate fresh water resources and to mingle with sewage water. Not only does the penetration of sea water contaminate drinkable water, it also leads to soil degradation and salinization.²⁶²

²⁵⁹ The impact of environmental disasters in high-income countries shows different consequences for the population: contrary to the same impact happening in low-or middle-income countries, an environmental disaster will lead to a higher economic and insurance loss, but a lower number of fatalities, Reuveny, "Climate Change-Induced Migration and Violent Conflict.", p. 657.

²⁶⁰ Ebi and Bowen, "Extreme Events as Sources of Health Vulnerability: Drought as an Example.", p. 99.

²⁶¹ Intergovernmental Panel on Climate Change, "Climate Change 2007.", p. 49.

²⁶² Barnett, "Dangerous Climate Change in the Pacific Islands: Food Production and Food Security.", p. 232.

Focussing on the health consequences of sea-level rise and water contamination, the fact that these phenomena favour microbial proliferation and the increase of water-borne diseases is of concern.²⁶³ This point leads us to the general topic of diseases and viruses and their proliferation in the context of global warming. Climate change increases the cases of fatality in general. This includes fatalities through diseases, drought, heatwaves, flooding, storms, forest fires and so on. Existing viruses and diseases like malaria and diarrhoea are aggravated by global warming because they are passed on more easily in higher temperatures.²⁶⁴ Furthermore, drought as well as inundations and other environmental threats can destroy critical infrastructure that provides health services as well as the food and water supply chain.²⁶⁵ The destruction of local infrastructure results in an increase of transportation costs or the impossibility of claiming the service. In this context, people with individual pre-existing vulnerabilities like disabled, ill, old and young people are particularly vulnerable to additional threats.

Slow-onset disasters play a major role in the decrease of water security, as well as in malnutrition and lack of food.²⁶⁶ Food shortages and its consequences are another health factor aggravated by climate change. Changing climatic circumstances undermine food security in general, as weather conditions become more and more extreme with longer drought periods and intense rainfalls which do not allow cultivation of local products. In addition to that, storms, cyclones and inundations destroy the island's infrastructure like roads and railways which ensure the supply of food and the transport of staff to their local working place.²⁶⁷ Like the majority of arguments in the context of the discussed topic, the effects of climate change on food security cannot be limited to the damage to local food production but must be considered in a broader framework of related issues like economic growth, public health and poverty.²⁶⁸

Following the discussion of the two main topics of resource shortages caused by environmental factors, the paper will present the explanation of another central impact of climate change on human health, which is heat stress and other forms of climate harshness in general. Heat stress constitutes a representative example of how vulnerabilities can be enhanced in the context of climate factors influencing human health and work productivity.²⁶⁹ This is the reason why the phenomenon

²⁶³ McMichael, Woodruff, and Hales, "Climate Change and Human Health: Present and Future Risks.", p. 862.

²⁶⁴ International Organization for Migration, "Climate Change and Migration: Improving Methodologies to Estimate Flows.", p. 28;

McMichael, Woodruff, and Hales, "Climate Change and Human Health: Present and Future Risks.", p. 862.

²⁶⁵ Ebi and Bowen, "Extreme Events as Sources of Health Vulnerability: Drought as an Example.", p. 96.

²⁶⁶ International Organization for Migration, "World Migration Report 2018.", p. 54.

²⁶⁷ Barnett, "Dangerous Climate Change in the Pacific Islands: Food Production and Food Security.", p. 232.

²⁶⁸ Barnett., p. 233.

²⁶⁹ Portnov and Erell, "Long-Term Development Patterns of Peripheral Desert Settlements.", p. 20.

of heat stress and its effects on human livelihood will be discussed in more detail in the following paragraph.

Climatic harshness in general is a driver of migration or at least repelling in-migrants from a region or city of climatic harshness.²⁷⁰ The dimensions of climate variability and extremes have been sufficiently demonstrated in subitem 2.1.3. The important point to note in the context of vulnerability is the capability or incapability of adaption to a changing temperature. Amongst the two extremes of the temperature scale, the days of increasingly hot climate and its impacts on human vulnerability are however more present and thus cause more problems than cold extremes. The frequency of hot extremes and heat waves is constantly growing.²⁷¹

However, we are considering the indirect impacts of climate change and are therefore putting the focus on the indirect impact of heat stress on human vulnerability: “The expansion of super-hot areas in parts of the world is one of the major public health threats that climate change brings, and it also leads to labour productivity loss.”²⁷² Thus, extreme heat is not only a threat to human health in a direct way, but exerts influence on human work power, too. This fact is again mostly affecting people who work within a close connection with nature, for example in agriculture.

Heat strain and heat stroke are only two symptoms of heat stress triggered by an overheating of the human body which normally maintains around 37 degrees Celsius of temperature. With the increasing pace of global warming, the risk of suffering from one of these consequences of elevated body temperature grows. This leads at least to a diminishment of the working capacity in both mental and physical tasks and to a growing risk of work accidents. If the body temperature is higher than 39 degrees Celsius, heat strokes can occur and above 40.6 it can come to life-threatening situations for the persons affected.²⁷³ However, in order to determine the degree of heat stress, the average global temperature is useful only to a certain limit. Local heat stress can be assessed by considering the local temperature, humidity rates, wind speed and solar radiation as well as topographic conditions.²⁷⁴

Kjellstrom et al. developed an index indicating the degree of heat stress in the world. The Universal Thermal Climate Index (UTCI) includes information like temperature, humidity, air movement and heat radiation and distinguishes between five degrees of heat stress: no heat stress, limited, strong, very strong or extreme heat stress. Very strong heat stress is noted in temperatures of 36 degrees Celsius with a humidity of 50%. Moderate work under these conditions would lead to a body temperature of about 39 to 40 degrees Celsius within less than four hours. Many regions in

²⁷⁰ Portnov and Erell., p. 20.

²⁷¹ Intergovernmental Panel on Climate Change, “Climate Change 2007.”, p. 8.

²⁷² Chazalnoël, Mach, and Ionesco, “Extreme Heat and Migration.”, p. 3.

²⁷³ Kjellstrom, Holmer, and Lemke, “Workplace Heat Stress, Health and Productivity—an Increasing Challenge for Low and Middle-Income Countries during Climate Change.”, p. 2.

²⁷⁴ Kjellstrom, Holmer, and Lemke., p. 5.

Western and Eastern Africa as well as in Asia are already confronted with strong heat stress, as the map below shows:

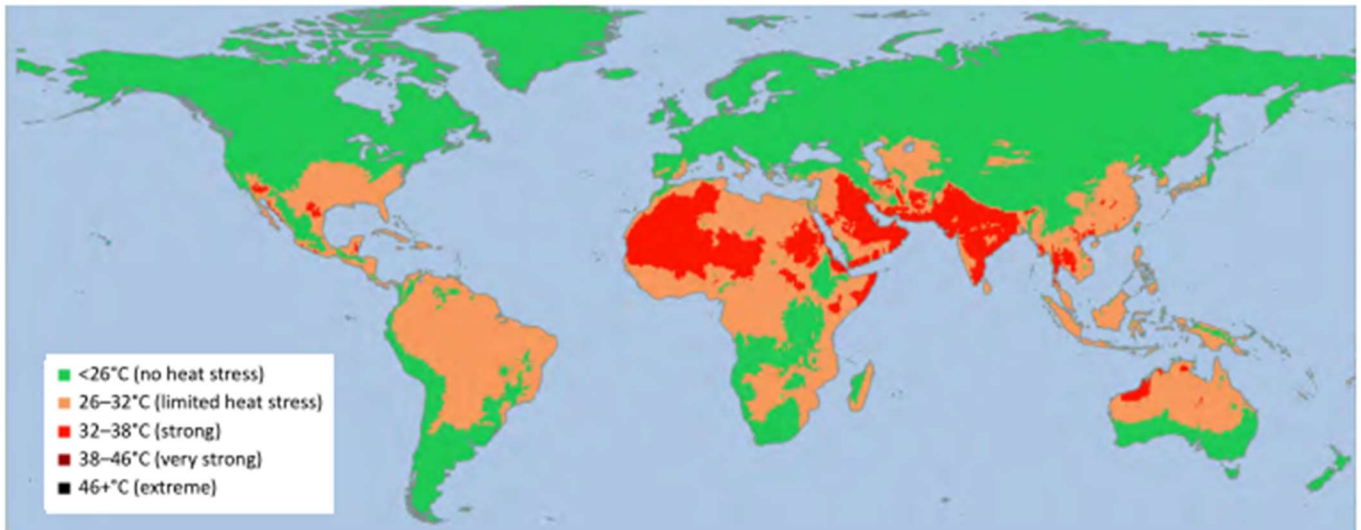


Figure 7: Climate Research Unit (CRU) baseline data for the period 1981–2010.²⁷⁵

The map shown in figure 7 represents the classification of regions into areas of varying heat stress according to the mean levels of temperature during the hottest month of the year from 1981 to 2010. The estimations for the period between 2071 and 2099 with an estimated increase of the global average temperature by 2.6 to 3.1 degrees Celsius predict the deterioration of the global situation, assessing extreme heat stress in parts of Africa, the Arabian Peninsula and Asia, strong heat stress in both South and parts of North America, the majority of Africa, Asia and Australia.²⁷⁶ This data should help to understand the impact of an increasing global mean temperature as well as the deterioration of the local situation in particularly vulnerable and exposed regions. Migration decisions in these cases have strong connections with health factors, but also with economic conditions and can be influenced by other factors such as social and political factors. The example of heat stress and its impact on human vulnerabilities like financial difficulties, the pressure of globalization, isolation and many other areas that impede a sustainable existence depicts the delicate connection between climate change and migration very well. In a case of global warming and increasing heat stress, a person affected will try to adapt and take measures for mitigation. In the moment when adaptation and mitigation are not possible because of a lack of resources, capital or the external hindrance through political orders, war, civil unrest, or other factors that make an adaption to the changing climate impossible, the decision of migration will be taken. Still, the individual context will have a strong influence on the moment and outcome of the decision. As

²⁷⁵ Chazalnoël, Mach, and Ionesco, “Extreme Heat and Migration.”, p. 5.

²⁷⁶ Chazalnoël, Mach, and Ionesco., p. 6.

discussed in the chapters 2.1 and 2.2, a number of conditions influence whether a migratory decision is positive or negative and whether the migration will be permanent or temporary and short- or long-distanced, to name only some of the possibilities. This short digression aims at giving an example of how climate change can have an impact on human livelihood and vulnerability with the help of an example.²⁷⁷

In general, heat stress will be experienced differently in different regions of the world. In urban areas, global warming will have other effects than in rural areas. Particular problems caused by an increase in the air temperature in cities are air pollution through wind erosion, increased risk of disease and overstrain of the sanitary system.²⁷⁸ As the tendency of urbanization is rising, the question of climate change impact on big cities is as pressing as the dealing with its consequences for rural population as well as the inclusion of the respective context in the consideration process.

Health and sanitary factors like a lack of food and water security, an increased risk of diseases and general heat stress are conditions that can lead to migration. Caused or influenced by climate change, these conditions can alone be a reason to decide for migration but can also be enhanced by other factors. These factors can be external, like economic, political or topographic, but they can be individual as well, like religion or be linked to age or gender. We continue in the last subitem to consider the impact of climate change on human vulnerability and keep the interrelations between different factors in mind. In the following point we will focus on the governmental and political situation and how it can be affected by climate change. As already said in the introduction to the subitem treating the indirect link between migration and climate change, the point on the political field will help in resuming and summarizing the complex interrelations between the different areas discussed in this context.

2.3.3.4 Governmental consequences

This last thematical division on the indirect influence of climate change on migration through enhancing stressors focusses on the consequences from lack of resources, financial and health problems, and finally political instability and non-responsive governments. These topics will be discussed from a political and governmental viewpoint. We will see in the following subitem how climate change can play a role in the overall political dissatisfaction of the population. Political dissatisfaction will be observed to different degrees and in different forms such as civil conflict,

²⁷⁷ Another reason for the example of heat stress is that the implications of the Index of Vulnerability presented in the last chapter will focus on droughts as environmental disaster aggravating human vulnerabilities, so it is interesting to comprehend the same observation in the case of heat stress.

²⁷⁸ IPCC, "Working Group II: Impacts, Adaptation and Vulnerability."

war, or discontentment with policies and legal provisions in response to climate change.²⁷⁹ Political dissatisfaction can have various reasons; therefore, the focus will lie on causes correlated with or caused by climate change. However, the topics evoked in the preceding subitems will play an important role as well, as the governmental incapability to establish adaptation measures in order to increase resilience in the region can provoke political discontentment, for example. Thus, the following subitem on political and governmental issues as an area of vulnerability due to climate change will link various already discussed topics and bring them together in a discussion on whether climate change can be the reason for civil unrest.

It is useful to start the topic by asking the question if and to what extent climate change can cause conflict. Scientists generally agree on the fact that climate change is not the only reason for conflict to break out. There is however no consensus on the answer to the question to what extent climate change causes conflict or not.²⁸⁰ Also, the link between these phenomena and the potential for climate change related conflict are topics not strongly represented in scientific literature.²⁸¹ However, there is evidence that suggests that the impact of climate change on conflict is not direct, just as it functions in relation to other factors of vulnerability. This is formulated in the following quote: “While it is agreed that climate change will not alone cause conflict, it is also acknowledged almost universally that it has the potential to exacerbate or catalyse conflict in conjunction with other factors.”²⁸² It is therefore assumed that an unstable government or a nation troubled by war, strife or conflict, create a setting in which factors of vulnerability are enhanced and people’s adaptive capacities to climate change are reduced.²⁸³ Studies show that civil unrest levels are generally higher than the benchmark levels.²⁸⁴ We will adopt in the following the assumption that climate change can under specific circumstances - but does not forcedly - cause conflict.

We will discuss the political circumstances which determine whether it comes to conflict or political discontentment in a situation of climate change. First, it is to say that scientists agree on the fact that climate change is a security issue.²⁸⁵ However, it does not have to become a security risk or threat for the population. The reason is the importance of the political circumstances in which

²⁷⁹ In this paper, the term “conflict” will be employed to describe different forms of violence (international, inter-group and interpersonal) as this is proposed by Burrows and Kinney, Burrows and Kinney, “Exploring the Climate Change, Migration and Conflict Nexus.”, p. 3.

²⁸⁰ Burrows and Kinney., p. 10.

²⁸¹ Burrows and Kinney., p. 2.

²⁸² International Forum on Migration Statistics on 15 and 16 January 2018, in Paris (Burrows and Kinney., p.8).

²⁸³ Adger, “Vulnerability.”, pp. 271 – 272.

²⁸⁴ Nardulli, Peyton, and Bajjalieh, “Climate Change and Civil Unrest: The Impact of Rapid-Onset Disasters.”, p. 321.

²⁸⁵ Burrows and Kinney, “Exploring the Climate Change, Migration and Conflict Nexus.”, p. 2.

climate change is experienced. The political situation and stability is one of these factors of influence.²⁸⁶ It is therefore interesting to search for the form of state which provides the most appropriate political circumstance to empower the population to deal adequately with disasters and environmental threats and to increase their resilience. For this purpose, a government has different options of adaptation and mitigation measures to imply. However, prerequisites are sufficient resources and financial capital. Adaption is facilitated when the government achieves to provide resources such as healthcare, education and assistance. The provision of those services increases the possibility of maintaining peace in the country as well as the overall stability in connection with environmental stress. A democratic form of government – in contrast to a dictatorship or other repressive form of state – has shown to be most responsive to constraints due to climate change, because it is accountable to its population.²⁸⁷ Democratic systems offer possibilities to address discontents and therefore prevent an outbreak of conflict. This task can be carried out by a responsive legal system, for example.²⁸⁸

To answer the question of how climate change can cause conflict due to political inadequacy, it is important to discuss the dimensions of measures taken as a response to the environmental threat to the affected population. Climate change can lead to political unrest because of unsuitable reactions or policies as a reaction to climate change or topics related to climate change, which are issued by the government. Also, it could lead to political dissatisfaction if the government does not seem to react to the changing environmental situation at all, thus missing the opportunity of reducing the population's vulnerability to the phenomenon. One example might be the lack of resources like fresh drinking water. A lack of resources can lead to a growing competitiveness and a tense political and social situation in a country, which can lead to social and political unrest in case an appropriate reaction is not implemented by the government.²⁸⁹ The government can increase the population's resilience for example by establishing management policies and sustainable development strategies in order to counteract lack of resources and financial capital for adaptation measures. The financial and humanitarian losses can be reduced by adaptation measures and relief packages and first aid kits for affected people. Another measure the government can take is risk reduction in order to reduce the risk of people being affected by consequences of climate change. In addition to that, it is important to offer services like housing assistance, social security

²⁸⁶ Burrows and Kinney., p. 9.

²⁸⁷ Burrows and Kinney., p. 9.

²⁸⁸ Nardulli, Peyton, and Bajjalieh, "Climate Change and Civil Unrest: The Impact of Rapid-Onset Disasters.", p. 314.

²⁸⁹ International Organization for Migration, "Climate Change and Migration: Improving Methodologies to Estimate Flows.", p. 32.

and employment opportunities for a generally higher resilience towards environmental threats.²⁹⁰ However, not only the type of governmental help is crucial but also the time of implementation. The earlier these services and policies are implemented, the more of a positive effect will they have on the population's vulnerability. During the elaboration of such policies it is crucial to focus on a holistic approach to the topic and to keep the multi-causality of climate change and its numerous consequences on the population in mind.²⁹¹ Still, even when people react to environmental threats with migration, the government has the possibility to accelerate their moment of return by offering political support for rebuilding destroyed homes and care packages or with the implementation of adaptive resource management policies, which increase the population's adaptive capacity and shorten the time needed to recover from disasters.²⁹² However, the less political and financial support can be offered by the government, the more capital must be provided by the individual, leading to an increased vulnerability of the population affected. As could be observed in subitem 2.3.3.1, the costs for adaptive measures to climate change are generally high, which leads to the conclusion that countries with a low budget will be less capable of providing the population with suitable support, leaving them more exposed to the environmental threat.

In general, one can conclude that it depends on the measures taken and the capability to take measures by the individual and the government. Conflict and political contentment can lead to migration. This is the indirect link between climate change and migration from a political or governmental point of view.

Another interesting point to observe is the connection between conflict and migration. The discussed topic in this paragraph focuses on how conflict fuelled by environmental problems can lead to migration. However, the connection between the two phenomena can be noted in the reverse order, as well. Migration can lead to conflict for different reasons. However, as the focus of the present work does not lie on this topic in particular, only one crucial argument in this correlation will be picked up: the lack of resources and an increased competition over them. The reason why this particular subject seems to be of interest for the content of this paper is because climate change amongst other factors can be the cause for lacking resources like water, food or others (see subitem 2.3.3.3). However, we will change the viewpoint in the context of political conflict and discontentment.

As already mentioned in subitem 2.3.3.2, the social vulnerability grows in some cases in the context of migration leading to an increase in ethnic heterogeneity in urban areas. However, this fact

²⁹⁰ Asian Development Bank, "Addressing Climate Change and Migration in Asia and the Pacific.", pp. 42 – 44.

²⁹¹ McAdam, *Climate Change, Forced Migration, and International Law.*, pp. 21 – 22.

²⁹² Bremner and Hunter, *Migration and the Environment.*, p. 6.

can also become a political issue as soon as the tension results in a conflict.²⁹³ Migration itself must therefore be considered as a possible cause for political conflict. Although the majority of migratory flows does not lead to conflict,²⁹⁴ the perceived risk of migrants in a community might already be subject for conflict.²⁹⁵ If it comes to the actual or perceived lack of resources in a region, the increasing competition over resources can lead to conflict.²⁹⁶

To conclude the topic of the link between climate change and political conflict, one must keep in mind the general complexity of the correlations between conflict and migration as well as of the connection between climate change and migration.

Numbers of persons displaced by conflict or violence have doubled since 2000 (until 2018).²⁹⁷ However, due to the complex linkages between conflict, environmental impacts, the economic situation, the political framework and other factors, it is very difficult to isolate and detect the reasons for conflict or violence.²⁹⁸ „Reasons for migration are diverse and interweaved with economic, social and security drivers, as people might choose to migrate in search of better economic opportunities, for family and educational reasons or to escape conflicts.”²⁹⁹ This is why it is important to intensify research on those complex interrelations in order to be able to adapt the legal framework to existing problems and the causes for migration.

Within this paper, a multitude of factors fuelled by climate change and disaster have shown to have an impact on the migratory decision of an individual or a population affected. Remarkable is the high degree of interrelations between the different factors. As shown in subitem 2.3.2 within the discussion of the direct linkage between climate change and migration, people can find themselves in a situation which leaves no choice whether to migrate or not. This link can be detected more easily than the indirect form of relation between the two phenomena. It is therefore crucial to increase research, data and information on the complex impact from different factors on various forms of migration. Chapter 2.2 of this thesis showed that there is information on patterns of migration that are likely to follow specific forms of environmental threat, differentiating between slow- and sudden-onset disasters. Information of this kind must be deepened, and research must be further developed in order to provide political actors with useful policy recommendations and to adapt international legal regulations to the situation.

²⁹³ Burrows and Kinney, “Exploring the Climate Change, Migration and Conflict Nexus.”, p. 8.

²⁹⁴ Burrows and Kinney., p. 8.

²⁹⁵ Burrows and Kinney., p. 8.

²⁹⁶ Chazalnoël and Ionesco, “IOM Perspectives on Migration, Environment and Climate Change.”, p. 2.

²⁹⁷ International Organization for Migration, “World Migration Report 2018.”, p. 41.

²⁹⁸ Nardulli, Peyton, and Bajjalieh, “Climate Change and Civil Unrest: The Impact of Rapid-Onset Disasters.”, pp. 330 – 331.

²⁹⁹ Chazalnoël, Mach, and Ionesco, “Extreme Heat and Migration.”, p. 10.

With the help of a further developed data set and information on the link between migration and climate change, it is possible to improve and update legal frameworks for international migration such as the 1951 Refugee Convention. This is crucial for the well-being of migrants who do not fit into the definition of a refugee in current international law and can therefore not enjoy the right for protection and to seek and enjoy asylum in other countries.

Chapters 2.1 and 2.2 of this work aimed at giving an appropriate background of information on the topic discussed, while chapter 2.3 linked the two phenomena with each other and tried to highlight linkages between them. The term “vulnerability” played an important role in this discussion. With the information gathered during the research of the indirect link between migration and climate change, it is possible to choose specific information on population affected by climate change and to assess the impact of climate change on their vulnerability to pre-existing stress factors and in turn to migration.

2.4 Index of Vulnerability

After the analysis of factors that can cause migration in chapter 2.1 of this thesis, the discussion of vulnerability to climate change in chapter 2.2 and finally the various points of climate change impact on human vulnerabilities, the Index of Vulnerability will represent the link between climate change and migration with the help of selected indicators. The link between the two phenomena was discussed in chapter 2.3, however the consequence of migration was only implied, in view of the complexity of the migratory process. Therefore, the assessment of vulnerabilities enhanced by climate change was dealt with in the preceding chapter. It was divided in the groups of “direct link” and “indirect link”, helping with the distinction between those cases in which climate change can be recognized as the only or at least the main reason for migration and those cases in which climate change has an indirect impact on the decision to migrate, enhancing pre-existing vulnerabilities. The Index of Vulnerability deals with both cases of environmental migration, but the present work puts the focus on the indirect linkage.

Regarding the selection of representative indicators for the Index of Vulnerability, the chosen indicators should meet the objective of reflecting “social processes” as well as “material outcomes” as well as qualitative and quantitative figures at the same time.³⁰⁰ A holistic approach to the topic is again crucial in order to reflect the complex interrelations of human vulnerability. Still, the per-

³⁰⁰ Adger, “Vulnerability.”, p. 274.

ception of vulnerability plays an equally important role. A lack of awareness can thus have a prohibitive effect on adaptive measures that are taken in respect of environmental threat.³⁰¹ This perception of vulnerability, as it is part of the field of psychology, cannot be taken into consideration in the Index of Vulnerability and would go beyond the scope of this paper. Another restriction in the elaboration of the Index is the heterogeneity of the choice of indicators. As the choice is dependent on cultural and institutional principles and frameworks, the indicators can never be an exhaustive representation of human vulnerability. This defect is also due to insufficient access to informative indicators for nations worldwide. In addition to that, human vulnerability is highly dependent on the factors of time and place. Although several indicators can be chosen to measure human vulnerability, it is important to consider the spatial and temporal context of the case in examination.

Social, economic, health and political indicators are included in the consideration of the Index of Vulnerability, to create the most significant and expressive reflection of human vulnerability to climate change and stress factors that are influenced by climate change.

The choice of indicators shall be explained as well. As already mentioned in chapter 2.2, migration causes are argued by several scientists to be highly linked to economic motivations. As this reflects a monocausal approach to the topic, the economic indicator chosen for the representation of financial capital in the Index of Vulnerability should not reflect this approach. The factor of lacking financial capital should not be perceived as the singular factor causing migration. On the contrary, financial capital should be perceived in this context as the asset facilitating access to services and assets and thus improving resilience.³⁰² In the view of the findings on human vulnerability with the help of the Index, the proportions of migration movements within the country and across national borders will be assessed and linked to the results on human vulnerability. As the literature dealing with the topic highlights the importance of social dynamics and economic systems within the observed scope, these points are reflected in the choice of indicators.³⁰³

³⁰¹ Adger., p. 276.

³⁰² Alwang, Siegel, and Jorgensen, "Vulnerability: A View from Different Disciplines.", pp. 5 – 6.

³⁰³ Adger, "Vulnerability.", p. 273.

SECTOR	INDICATOR	VULNER- ABLE	LINKED TO CLI- MATE CHANGE
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Economy			
GDP per capita			
Society			
Health expenditures*			
Education expenditures*			
Health/ Resources			
Drinking water sources			
Children under 5 underweight			
Government/ Politics			
Degree of democratisation			
Structure			
Exposure to hazard			
Demography			
Rate of urbanization**			
Development			
Unemployment rate youth (15-24)			
Security			
Political conflict			

* percent of the GDP.

** annual rate of change.

The elaboration of the Index of Vulnerability is realised by the author of this thesis and follows two main aims, which are demonstrated in the following subitem.

2.4.1 Aims of the Index

The two main interests of the Index of Vulnerability can be described as the legal aim in the first place and the aim of creating evidence for the hypothesis which is the basic assumption of this thesis. The first aim is to create an index for the measurement of a community's vulnerability to climate change, which should also be applicable for the use of stakeholders. In addition to that, the legal interest of the Index is a step towards the adaption and renovation of the legal framework on

migratory movements. As already mentioned in this thesis, the definition and framework conditions in the field of migration and refuge need renovation and adaption to current causes of migration and migrants' needs. The Index aims at highlighting and measuring the degree of vulnerability to climate change in order to create awareness for the topic.

The second interest of the Index of Vulnerability is the confirmation of the basic hypothesis of this thesis. I assumed that climate change acts as an indirect cause for migration in most migratory movements. Rather than triggering migration directly, climate change enhances existing vulnerabilities in fields such as economy, health, politics and others. In this interest, the global view on the link between the two phenomena has been chosen. However, research on the more detailed influences of individual factors on human livelihood would be an interesting objective for further engagement in the context of migration and climate change. An insight into this micro-level perspective will be given in subitem 2.4.4.1 when the Index is applied to Syria. The reason for that choice are the complex interrelations between three factors in particular that seem to play an important role in the regional context: unemployment, urbanization and political conflict. The aim of this micro-level approach is to highlight more complex and crucial interrelations between these factors in order to tackle possible underlying reasons for increased human vulnerability in Syria.

At this point, it is interesting to compare the aims of the presented Index of Vulnerability with existing approaches to assess human vulnerability in the context of climate change. There are several attempts to measure human vulnerability to environmental hazard including economic, social and other factors. An example for this approach is the "Index of Vulnerability" created by the Global Environmental Change and Human Security Project of the International Human Dimensions Programme on Global Environmental Change in 1998.³⁰⁴ However, important distinctive features show when comparing the aim of the two indices. The index presented in this paper does not focus solely on the human vulnerability to environmental hazards but includes the assessment of how human vulnerability is influenced by climate change, leading to possible migration. In addition to that and in contrast to other tools of measurement in this field, this Index of Vulnerability highlights the areas in which climate change negatively affects human vulnerability.

In order to come to representative results, it has been mentioned that the spatial and temporal context of the observed case is crucial. The context in which the Index should be used and evaluated is presented in the following subitem.

³⁰⁴ Kasperson and Archer, "Vulnerable Peoples and Places.", p. 150.

2.4.2 Context of the Index

First of all, the Index of Vulnerability and its indicators and results should be considered in light of the temporal framework. This means that recent developments and transformations in the observed region should be taken into account. Additionally, the spatial context will be taken into consideration as well. This implies, that local influences which have an impact on the human vulnerability and affect migratory decisions in the respective region must be respected, too. Thorough background knowledge on the observed case is therefore a prerequisite of the application of the Index of Vulnerability.

Before the application of the Index on particular cases is explained, it is useful to explain the context of its elaboration and the line of thought behind it. In general, this Index of Vulnerability should constitute the applied summary of the analytical findings of this thesis. As various factors causing migration as well as stress factors enhanced by climate change have been assessed in the frame of this thesis, the aim of the Index is to highlight the link between climate change and migration, which is presented as human vulnerability. On the basis of the respective findings, one can take migratory flows in the region into consideration and analyse the results in light of vulnerability. By comparing the outcome of the examined examples, it will become evident that climate change and its impact on human vulnerability have an important effect on adaptive capacities of communities, which can lead to migration.

The information used to calculate the Index of Vulnerability is taken from the database of The World Factbook created by the American Central Intelligence Agency (CIA). This is done out of reasons for completeness and better comparability of the information. The indicator on the degree of democratization is taken from the Democracy Index created by the Economist Intelligence Unit. The choice of indicators is explained in the following paragraph.

In general, indicators that can potentially be influenced by climate change were admitted to the Index of Vulnerability. This is because the Index aims at measuring the impact of climate change on human vulnerability. This approach stands in contrast to a tool for measuring human vulnerability in general. In addition to that, the Index embodies quantitative as well as qualitative factors of human vulnerability.³⁰⁵ After this remark on the general nature of the chosen indicators, the paper will continue explaining the choice of individual indicators as a parameter for different factors of vulnerability.

³⁰⁵ Adger, "Vulnerability.", p. 274.

The Gross Domestic Product is used as a parameter for economic vulnerability because it is the most reliable and easy to find indicator for financial capital. Although financial capital is not distributed evenly within a nation, the GDP per capita still reflects the overall average capacity to minimize threats from hazard and recover from damages.³⁰⁶ Concerning the society, health and education expenditures have been chosen as the indicators to represent vulnerabilities that can be found in the social context of a community or country. These indicators imply the government's efforts in health and education promotion and support on the one hand and represent the overall situation of health and education services in the case examined. Although it is measured using financial indicators, that does not mean that it has a solely economic meaning for the Index. In the section on health and resources, the access to drinking water sources and the number of underweight children under the age of 5 are used to indicate vulnerability. The reason for that choice and the importance of this section is that the access to resources such as fresh water and food are an important basis for human health. The access to fresh water is therefore indicated with the percentage of people with access to an improved water source. The distinction between "improved water source" and "unimproved water source" is a categorization of water quality with regard to its cleanness. An improved water source is therefore a water source protected from contamination. The indicator of the number of children under 5 underweight aims at representing the nutritional health of the population, mirroring the access to food of sufficient quality. The degree of democratization is used as an indicator for political stability. It is assumed that democratic political systems support a more open and stable political situation. In structural matters, the risk of hazards in a nation is considered a parameter, assessing the overall topography of the region and its possible threats to human livelihood. This indicator can be understood as an equivalent to the understanding of "biophysical vulnerability" as proposed by Liverman.³⁰⁷ If there is at least one indicator for increased threat from environmental disaster like high volcanic activity, large coastlines or a low-lying land mass, this parameter is marked as positive. The rate of urbanization is adopted as a parameter for demographic vulnerability. The reason for that choice is that a high rate of urbanization can be caused by rural-urban migration, leading to an overstrain of the urban infrastructure. Another important factor in measuring human vulnerability is development. The unemployment rate of young people between the age of 15 and 24 years is taken as a benchmark. The reason for this choice is that development is in most of the cases made possible through the young population. In the case of a high unemployment rate of this highly active part of the population, there is little possibility for development in a country. In addition to that, the assessment of the general situation

³⁰⁶ Peduzzi et al., "Assessing Global Exposure and Vulnerability towards Natural Hazards: The Disaster Risk Index.", p. 1156.

³⁰⁷ Liverman, "Vulnerability to Global Environmental Change.", pp. 29 – 30.

regarding security in a country is achieved by examining whether political conflict exists in the region. This information is obtained by reviewing general information on the country. After this explanation of how the Index is put together, there are some general thoughts that shaped its outcome.

Finally, the availability of information for a maximal number of countries was a criterion during the choice of the indicators. The indicators were therefore chosen to facilitate an easy and universal application in research. With the scope of the Index lying on the nation, the Index as presented in the present appearance cannot be applied to measure individual vulnerability. This limitation is accepted and intended by the author, because the aim is to highlight general reference points and information on the link between climate change and migration. However, the importance of the micro-level approach in this context and of individual factors in the migratory decision should be kept in mind. The Index could be extended with a number of indicators representing individual vulnerability such as gender, education, age, social status, social ties and religious beliefs. Thus, it is important to keep in mind the central role that individual factors play in the migration decision. Depending on alternative possibilities, capital and other capacities, individual households and individual people will react differently to environmental hardship and hazard.

The following subitem sets some guidelines that ensure an appropriate application of the Index of Vulnerability to selected examples.

2.4.3 Guidelines for application

This subitem 2.4.3 aims at giving some instructions on the application and explaining its four columns and its ten indicators before it will be applied to two examples in the subitems of point 2.4.4 in the following.

There are four columns named “Sector”, “Indicator”, “Vulnerability” and “Link to climate change”. The sector names the field in which the chosen indicator can be found and the indicator itself, for example the annual GDP per capita for the sector “economy”. The column “Indicator” is then filled with the information concerning this sector of the respective case observed, for example \$49,900 in the case of Australia in the year 2017. The same method is likewise applied to the other indicators. With the information in this field, the vulnerability can be assessed. Thus, one can mark a cross in the column “Vulnerability” in case the indicator points to a vulnerability in this sector. If this is not the case, a circle is entered in this column. The fourth column shall decide whether one can detect a link to climate change in the observed sector. If this is the case, the field

can again be filled in with a cross.³⁰⁸ In this manner, the ten indicators will tell whether the observed community is highly vulnerable to stressors (climate change amongst others) and measure the degree of linkage between this vulnerability and climate change at the same time.

In order to decide on the degree of vulnerability and the degree of linkage to climate change, the degree of vulnerability will be divided into three classes: highly vulnerable, at risk and not vulnerable. The focus here does not lie solely on the human vulnerability itself, but also on the degree of impact from climate change, which is assessed with the help of the Index. The results in the column concerning human vulnerability do not have to be in line with the results in the column concerning the link to climate change. A community or nation can for example be highly vulnerable without environmental influence. Hence, the community is highly vulnerable, but the link to climate change is not existent. This results in the following classification:

Number of positive factors	Vulnerability	Link to climate change
Less or equal to 2	Not vulnerable	Not existent
Between 2 and 7	At risk	Existent
More or equal to 7	Highly vulnerable	Strong

With regard to the choice of the respective thresholds, it is important to say that they are chosen as a subjective decision. Adger points out that the decision on a threshold must always be culturally determined, as the value of the indicators is dependent on the spatial and regional context.³⁰⁹

After the evaluation of the Index of Vulnerability, it is important to bring the information together with the temporal and spatial context on the case. This includes linking the information with the migration movements in the region in order to come to a conclusion on the link between the vulnerability in the observed case and its impact on migratory decisions.

³⁰⁸ If we find a circle in the first and a cross in the second column, this fact is an indicator for climatic impact in this sector. However, the sector seems to have dealt with the impact and balanced out the negative influences. Incidents such as these are highly interesting to concentrate further on. They can give important information on possibilities to foster resilience to climate change consequences.

³⁰⁹ Adger, "Vulnerability," p. 276.

2.4.4 Application examples

The presented Index of Vulnerability will be applied to two examples using a context in order to create an informed background for the vulnerability assessment. The chosen examples are Syria and Australia. The reason for this choice lies in the climate threat common to the regional environment, which is drought. However, the circumstances and capacities of adaptation and mitigation vary. For both of the examples, information on topography, climate, climate change impacts, demography, economy, adaptation measures to climate change and a historical overview of political development are given. The depth of information on selected points can vary depending on the regional circumstances. The focus can therefore lie on different areas in the respective case study. A decision of this sort will however be explained at that point. After the positioning of the case in the thematic context, the Index of Vulnerability will be applied in order to assess the community's vulnerability and the role that climate change plays in this context. For both cases, an analysis of migratory flows will complete the assessment of the link between migration and climate change in the respective case study.

2.4.4.1 Example: Syria

In order to create a coherent picture of human vulnerability in the context of climate change and its consequences in the case of Syria, it is of particular importance to begin with the presentation of the geographical, climatic, historical, political, demographical and economic context.

A description of the topographical situation in Syria helps assess climate vulnerabilities in the region.

The Syrian Arab Republic is a country, which gained its independence from France on 17 April 1946 after a 23-year colonial period. The total land area covers 185 180 km² and the coast along the Mediterranean Sea is 193 km long. The risk of a hydrological disaster and the threat of sea level rise is therefore not very high in Syria. However, the country is situated in the Middle East, which is a region highly affected by desertification and frequent and severe periods of drought. Syria and its major cities and neighbouring countries are shown in the figure below.



Figure 8: Syria.³¹⁰

Generally, the terrain is semiarid and large parts of the country are desert landscape. Mountains can be found in the West of the country. The climate is very dry during the summer season (June until August) and generally wet during the winter season (December until February). The climate is wetter along the coastline. However, Syria is facing global warming and its consequences: decrease in annual precipitation, increasing frequency and intensity of droughts, soil erosion and desertification. These factors can be seen in parts in figure 9.

The first graph in figure 9 as well as the Palmer Drought Severity Index (PDSI), which is used to measure relative dryness in a region, show that winter rainfalls have been decreasing on average since the beginning of the 20th century.³¹¹ This change in the precipitation pattern strains the agricultural production as rainfall represents 68.5% of the available water sources in Syria.³¹²

In contrast to that, the annual mean surface temperature is increasing, which leads to a higher evaporation rate as well as desertification.

³¹⁰ Central Intelligence Agency, "Syria."

³¹¹ The index estimates relative dryness within a span from -10 (dry) to +10 (wet). The decrease of the PDSI thus stands for an increasing relative dryness in the region of the Fertile Crescent of which Syria is part.

³¹² Erian, Katlan, and Babah, "Drought Vulnerability in the Arab Region.", p. 5.

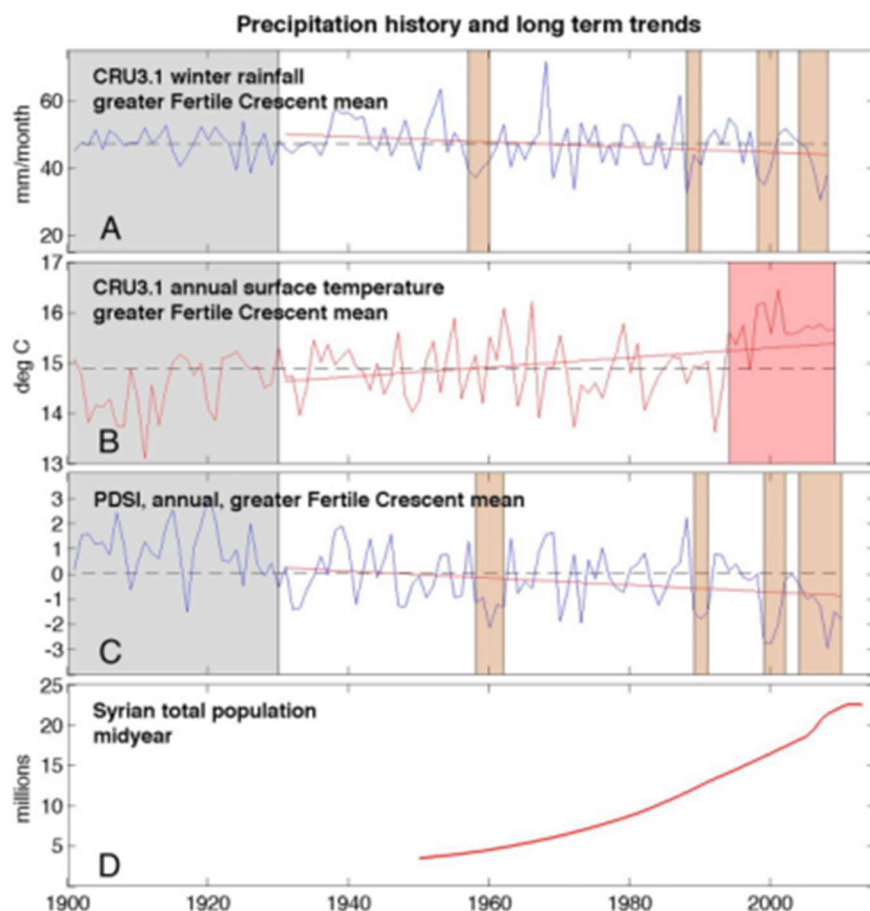


Figure 9: Precipitation history and long terms trends in Syria.³¹³

The change in precipitation patterns, the increase of average temperature and other factors like the inadequate water management of the last 70 years led to the devastating effect of the 2007 – 2011 drought in Syria. The trend of an increasing total population in Syria will be treated in the paragraph on the demographic situation in Syria.

Before that, the political history will be discussed, focusing on climate-related events, environmental policy decisions and governmental actions taken between 1971 and March 2011. The reason for the limitation of the discussed period is that the year 2011 marks the beginning of the Syrian Civil War, which constitutes a terrible chapter of history, and a discussion of the global implications of the war would require the composition of another master's thesis. Instead, the present paper aims at explaining the influence that climate factors had on the different crucial aspects in the context of this war, which led to the situation that 13.5 million people in Syria are in need of humanitarian assistance.³¹⁴ It is in the year 1970 that the father of the current president Bashar al-Assad rose to power from his position as minister of defence. One year later, Hafiz al-Assad declared himself president of Syria. Both Bashar Al-Assad and Hafiz Al-Assad were leaders of

³¹³ Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought.", p. 3242.

³¹⁴ International Organization for Migration, "Syria Crisis IOM Appeal 2017.", p. 1.

the Ba'ath party and members of the religious minority group of Alawites. The Alawi population makes up approximately 12.5% of the total Syrian population.³¹⁵ With regard to the high degree of religious heterogeneity in Syria, the rule of a minority group adds to the instable character of the political situation.³¹⁶ Although the focus lies on the governance under Bashar al-Assad, it is important to mention that the agricultural management system during Hafiz al-Assad's rule was already an economically and environmentally misleading project in a corrupt system with poorly educated officials.³¹⁷ It is interesting to see how the information on water policy and its development from a political viewpoint add to the severity of the Syrian drought 2007 – 2011 and the general desertification of the region.

The incorrect reaction of the government with regard to agricultural difficulties and water deficiencies aggravated the situation and added to the political dissatisfaction of the population. A liberal water policy in the context of groundwater pumping permissions after the introduction of the Diesel pump in the 1960s led to a rapid drop in groundwater levels in Syria. This inappropriate decision led to the fact that withdrawal levels in the 1980s and 1990s were approximately five times as high as the respective levels in the preceding decades.³¹⁸ In addition to that, Hafiz al-Assad enforced agricultural production, expanding groundwater-irrigated regions from 651 000 hectares in 1985 to 1.5 million hectares in 2010, doubling the irrigated agricultural area in a timespan of only 25 years.³¹⁹ Strongly related to the political demand of increasing agricultural production was the rapid growth of the population. Agriculture, which accounts for a large part of the Syrian GDP, consumes 90% of the water resources in the country.³²⁰ It was not until the year 2005, that the president decided to pass a law which requires a license for digging wells. However, the difficult economic and environmental situation forces the farmers to ignore the prohibition and further deepen the wells in order to reach the water level while the government does not enforce the law.³²¹ It was in June of 2000 that Bashar al-Assad took over the presidential role. In the early months of his presidency, he passed economic and political reforms, promising a liberalization and democratization of the political system in Syria. However, these efforts did not last long, and political and economic liberty was limited in the middle of 2002.³²² In the context of water management, building resilience and improving adaptive capacities, president Bashar al-Assad decided on a number of unfruitful actions. To name only some examples, the paper refers to the decision to

³¹⁵ Faksh, "The Alawi Community of Syria: A New Dominant Political Force.", p. 149.

³¹⁶ Carpenter, "Tangled Web: The Syrian Civil War and Its Implications.", p. 1.

³¹⁷ Châtel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution.", p. 531.

³¹⁸ Châtel., p. 531.

³¹⁹ Châtel., p. 529.

³²⁰ Châtel., pp. 529 – 530.

³²¹ Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought.", p. 3241.

³²² Zisser, "Does Bashar Al-Assad Rule Syria?".

cancel subsidies on diesel fuel in 2008, which led to the inability of many farmers to continue the irrigation of their lands and added to their inability to adapt to the environmental changes. Al-Assad ordered the liberalization of the prices for chemical fertilizers, thus further aggravating the situation for farmers.³²³ It is implementations like these that were an inappropriate response to a changing climate and prevent adaptation possibilities for the population. The fact that the people affected by climate change are not given any other possibilities for adaptation, leaves them hardly any other option than migration: “This path runs through a landscape of vulnerability to drought that encompasses government policies promoting unsustainable agricultural practices, and the failure of the government to address the suffering of a displaced population.”³²⁴

As already indicated in the preceding overview of the political history, demographic factors play a particularly important role in Syria’s regional development. There are two central facts to mention: First of all, the ethnic and religious heterogeneity in the country increases the risk of conflict. Sunni Arabs make up approximately 60% of the total population. Other than that, 10 – 12% of the population is Christian. As mentioned above, the Alawite community makes up about 10 – 12% as well. Druze believers constitute about 6% of the population and add to the religious heterogeneity in Syria.³²⁵ Kurds, Armenians, Circassians, Turkomans and other ethnic groups also live in Syria amongst Arabs.³²⁶ The borders decided during the colonial occupation add to the difficulties in creating a national cohesion.³²⁷ Second, the rapid growth of the Syrian population in the last 70 years is a central factor in the complex linkages between climate change, conflict and migration. While the total population in the 1950s was at approximately 3.3 million,³²⁸ it is currently at 18 028 549 (as of 2017).³²⁹ This population growth is represented in Figure 9 in the fourth curve from the top.

From a political viewpoint, this rapid rise in population is a major challenge which asks for important reforms and investment. Therefore, al-Assad reinforced agricultural production, which still occupies 75.8% of the land area today.³³⁰ Other important factors in the context of the country’s financial vulnerability in the light of climate change will be considered in the following paragraph. The high share of agricultural production in the national income, which has an important influence

³²³ Châtel, “The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution.”, p. 526.

³²⁴ Kelley et al., “Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought.”, p. 3245.

³²⁵ Carpenter, “Tangled Web: The Syrian Civil War and Its Implications.”, p. 1.

³²⁶ Minority Rights Group International, “Syria.”.

³²⁷ Randall, “When Climate Change and History Spark Violent Conflict: New Research Linking Climate Change and Conflict Might Actually Tell Us More about Colonialism.”.

³²⁸ Châtel, “The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution.”.

³²⁹ Central Intelligence Agency, “Syria.”.

³³⁰ Central Intelligence Agency.

on employment, plays an important role in the Syrian context. Vulnerability to climate change increases for people working as farmers or herders. Syria has a particularly high share of farmers and people engaged in the agricultural production. While the agricultural production accounted for approximately one quarter of the national GDP in 2003, it decreased rapidly and accounted for only 17% of the national GDP in 2008 – only five years later. The drought of 2007 – 2011 caused agricultural failures, livestock mortality and loss of livelihood in households engaged in agricultural production, mainly in the rural areas of the country.³³¹ About 1.3 million people and 60% of Syrian territory is thus directly affected by the consequences of climate change, particularly drought and desertification.³³² The total share of unemployed people is very high and lies at 50% (as of 2017) and at 35.8% for the young population between 15 and 24 (as of 2011).³³³ This high unemployment rate, which mainly represents the situation of the rural society, leads to rural-urban migration because cities offer better job opportunities and services. The interaction between environmental hardship, ineffective water management and a repressive political system leads to an increase in human vulnerability and a limitation of adaptation possibilities. This is the main driver for a flow of rural-urban migration to big cities such as Aleppo, Damascus, Dara'a, Deir ez-Zour, Hama, and Homs. Within this flow of human movement, approximately 1.5 million people were displaced during the drought of 2007 – 2011.³³⁴ It is in one of these cities, namely Dara'a that the Civil War broke out in March 2011.

The economic vulnerability in the Syrian population is also highly linked to climate change factors. It has already been said that agricultural production accounts for a large part of the national economic income. Not only do the people working as farmers, herders or in other jobs in agriculture lose their income and livelihood, the drop of agricultural performance has an important impact on national economy, as wheat and barley yields dropped by 47 and 67% respectively from 2007 to 2011.³³⁵ This decrease in output led to an increase of food prices and aggravated the situation of food security in the country. For the first time, the Syrian government decided to import wheat in the year 2008.³³⁶

The conclusion about the economic impacts from the above-mentioned factors of climate change and drought in Syria can be made by bringing the different aspects together. In the paragraph above, this master's thesis showed that political factors (decline in democratization, inappropriate

³³¹ Kelley et al., "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought.", p. 3241.

³³² Integrated Regional Information Networks, "Drought Driving Farmers to the Cities."

³³³ Central Intelligence Agency, "Syria."

³³⁴ Gleick, "Syria, Water, Climate Change, and Violent Conflict: Syria, Water, Climate Change, and Violent Conflict.", p. 334.

³³⁵ Erian, Katlan, and Babah, "Drought Vulnerability in the Arab Region.", p. 15.

³³⁶ Châtel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution.", p. 527.

water management and a lack of health and support services), as well as demographic factors (population growth, urbanization and unemployment) are strongly linked to climate change. The government's inadequate reaction to the threat of livelihood led to an increased political dissatisfaction and strong rural-urban movements created political hotspots of discontent, which led to the outbreak of the Civil War. Although it is difficult to entangle the connections between different events during the years before the outbreak of the conflict, a link between unemployment, urbanization and political conflict seems apparent.

In the context of the present topic, the paper will try to focus on these three facts in the light of climate change. The reason for this more in-depth, micro-level analysis of the connection between these three factors is the conceptual limit of the method of analysis presented in this master's thesis, the Index of Vulnerability. Three of the sectors presented in the Index of Vulnerability will therefore be taken out of context and analysed outside of the general assessment. The example of Syria shows that complex relations in situations of climate change and conflict cannot be analysed solely by a macro-level approach. The following analysis of the connections between unemployment, urbanization and political conflict – all information on these aspects already been discussed above – aims at highlighting the in-depth information that can be lost in a more global approach. As a consequence of the loss of livelihood in a majority of farmer and herder households in the Syrian rural areas, the urbanization rate increases, and many people are internally displaced. This is represented in the rate of urbanization between 2015 and 2020 which lies at 3.59% annual change. The total urban population accounts for 58.5% of the total population in 2017.³³⁷ On one hand, the influx of people in urban areas of Syria led to an overstrain on the urban infrastructure and competition over resources like fresh water and over employment opportunities.³³⁸ The exact reasons why a political conflict broke out are difficult to determine and gather in order to create a complete account. Still, the climatic consequences that lead to an aggravation of human vulnerability clearly play an important role in the unemployment rate of Syria's population, particularly amongst farmers and herders, and the high urbanization rate in the country. The most vulnerable groups of society are brought together in central places, which give the people the opportunity to exchange political opinions and discontent. "It is logical to conclude that escalating pressures on urban areas due to internal migration, increasing food insecurity, and resultant high rates of unemployment have spurred many Syrians to make their political grievances publically known."³³⁹

³³⁷ Central Intelligence Agency, "Syria."

³³⁸ Femia, Sternberg, and Werrell, "Climate Hazards, Security, and the Uprising in Syria and Egypt.", pp. 78 – 79.

³³⁹ Saleeby, "Sowing the Seeds of Dissent: Economic Grievances and the Syrian Social Contract's Unraveling."

As with all cases of people affected by climate change, it is crucial not to ignore individual competences, capital, capacities and possibilities, as well as possible hardships and additional vulnerabilities or burdens.

The link between human vulnerability, climate change and migration will be further discussed after the application of the Index of Vulnerability to the case of Syria.

SECTOR	INDICATOR	VULNER- ABLE	LINKED TO CLI- MATE CHANGE
Economy			
GDP per capita	\$2,900 (2015)	x	x
Society			
Health expenditures*	3.3% (2014)	x	o
Education expenditures*	5.1% (2009)	o	o
Health/ Resources			
Drinking water sources	90.1% (2015)	x	x
Children under 5 underweight	10.1% (2009)	x	x
Government/ Politics			
Degree of democratisation	1.43 (2017)	x	o
Structure			
Exposure to hazard	x	x	x
Demography			
Rate of urbanization**	3.59% (2015-2020)	x	x
Development			
Unemployment rate youth (15-24)	35.8% (2011)	x	x
Security			
Political conflict	x	x	x

* percent of the GDP.

** annual rate of change.

This information will be evaluated with regard to the evaluation system established in subitem 2.4.3. The factor of vulnerability in the case of Syria is 9, which stands for extreme vulnerability.

The degree of linkage to climate change of this factor is 7, which is equivalent to a strong link between human vulnerability and climate change. The link can be seen in the sector of economy, which can be attributed to the high importance of agricultural production in the national economy – climate change has a severe impact on the productivity of this field of income. Another sector in which climate change seems to play an important role in aggravating human vulnerability in Syria is the sector of resources and health. Food and fresh water deficits are a consequence of climate change and drought in combination with an inadequate reaction by the government, which performed poorly in establishing an adapted water management policy and support services for the population affected. The region Syria is situated in is generally affected by desertification and changing precipitation patterns, which has negative effects on human vulnerability, as the risk of environmental hazard is high. As a consequence of the high vulnerability of the rural population, one can observe significant rural-urban migration – the link to climate change in this case is existent, as well. A high rate of youth unemployment can be assumed to be linked to the poor economic situation, political conflict and a decrease in job opportunities. The last sector concerning security is linked to climate change, as well – at least in parts. One should not assume climate change as the reason why political conflict and Civil War broke out in Syria. However, parts of the political discontent are linked to climate change and the vulnerability of the population.

In the Syrian case, human vulnerability as a consequence of climate change is not the reason for the high number of Syrians fleeing the country. The reaction to this vulnerability was rural-urban migration. The loss of livelihood through climate change and the unresponsive political system in Syria drove between 40 000 and 60 000 families to urban centres, especially from the remote regions in East and South Syria.³⁴⁰ This case of human movement is therefore indirectly linked to climate change through economy, resources and politics. The international migration of 5 379 644 (as of 1.12.2017) Syrian refugees³⁴¹ must be seen as a reaction to the Syrian Civil War and as a highly complex issue. The war started when children were arrested for painting anti-regime graffiti on a wall in the city of Dara'a in the South-West of Syria in March of 2011. Demonstrations against the arrest and against the regime started as a reaction. It is an interplay of factors that caused the political discontent in Syrian population. One of these factors, however, is the lack of services and reactions to the problems caused by drought provided by the government.³⁴² The city of Dara'a was particularly affected by urbanization by displaced persons and young unemployed people.³⁴³

³⁴⁰ Integrated Regional Information Networks, "Drought Driving Farmers to the Cities."

³⁴¹ 3RP Regional Refugee and Resilience Plan, "Regional Strategic Overview."

³⁴² McHugo, *Syria: A History of the Last Hundred Years.*, p. 221.

³⁴³ Gleick, "Syria, Water, Climate Change, and Violent Conflict: Syria, Water, Climate Change, and Violent Conflict.", p. 335.

It is crucial, however, to distinguish between the internal displacement and the international migration of people in this case, as the motivations are not identical. Still, with the help of the Index of Vulnerability, one can observe that internal migration in Syria, which in part caused demonstrations leading to the outbreak of the Syrian Civil War, was highly linked to climate change.

We will observe another case study in the following point, taking interest in the consequences of the climate change impact on various situations of adaptation capacities and structural resilience.

2.4.4.2 Example: Australia

Before analysing the vulnerability of the Australian population in regard to factors aggravated by climate change and to climate change itself, the aim is to develop a context in which this assessment can be carried out.

Australia is the smallest continent on earth, measuring 7 682 300 km² of total land area.³⁴⁴ The Commonwealth of Australia comprises the main island, the island of Tasmania and other smaller islands. It gained its independence from the British Empire and merged with other former colonies on 1 January 1901.³⁴⁵ The capital of Australia is Canberra. Australia, surrounded by the Indian and the Pacific Ocean, is considered the largest island on the planet. As a result, Australia's coastline spans 25 760 km, making the country vulnerable to hydrological disasters and sea level rise.³⁴⁶

In addition to that, the territory is characterized by a low mean altitude of the land, which results in a rather flat topography with little mountainous area.³⁴⁷ Climate and territorial restrictions are the two main factors prohibiting habitation in some regions of the continent. There are three main physiographic zones: The first one, the Australian Shield, which occupies two thirds of the land mass, is the oldest land mass of the continent and is very rich in mineral gas and oil. Second, the Lowland Zone in the central East of the country provides soil of good quality and water resources. Third, the Highland Zone in the far East constitutes the only mountainous region in Australia and the coastline along the Pacific Ocean. While providing good water resources and coal resources, the region is difficult to cultivate because of the hilly character.³⁴⁸ The river Murray is the only major river in Australia.³⁴⁹ In a general topographical view, the Australian land mass is very old, and the fertile sheet of soil has been removed through erosion.³⁵⁰

³⁴⁴ Lamping, *Australien.*, p. 16.

³⁴⁵ Central Intelligence Agency, "Australia."

³⁴⁶ Central Intelligence Agency.

³⁴⁷ Jennings and Mabbutt, "Physiographic Outlines and Regions.", p. 38.

³⁴⁸ Hofmeister, "Australia and Its Urban Centres.", p. 11.

³⁴⁹ Hofmeister., p. 7.

³⁵⁰ Lamping, *Australien.*, p. 17.

With regards to the Australian climate, like the physiographic zones, it is very diverse and can be divided in two groups. The area north of the Tropic of Capricorn can be described as having a tropical climate, which brings monsoonal rains in the summer months from November to April. The area south of the Tropic of Capricorn, which makes up 61% of the total land mass³⁵¹, is predominantly subtropical with higher precipitation in the winter months from May to October.³⁵² As a result of these climate zones, Australia supports numerous different ecosystems, each of them adjusted to the regional climate and topography.

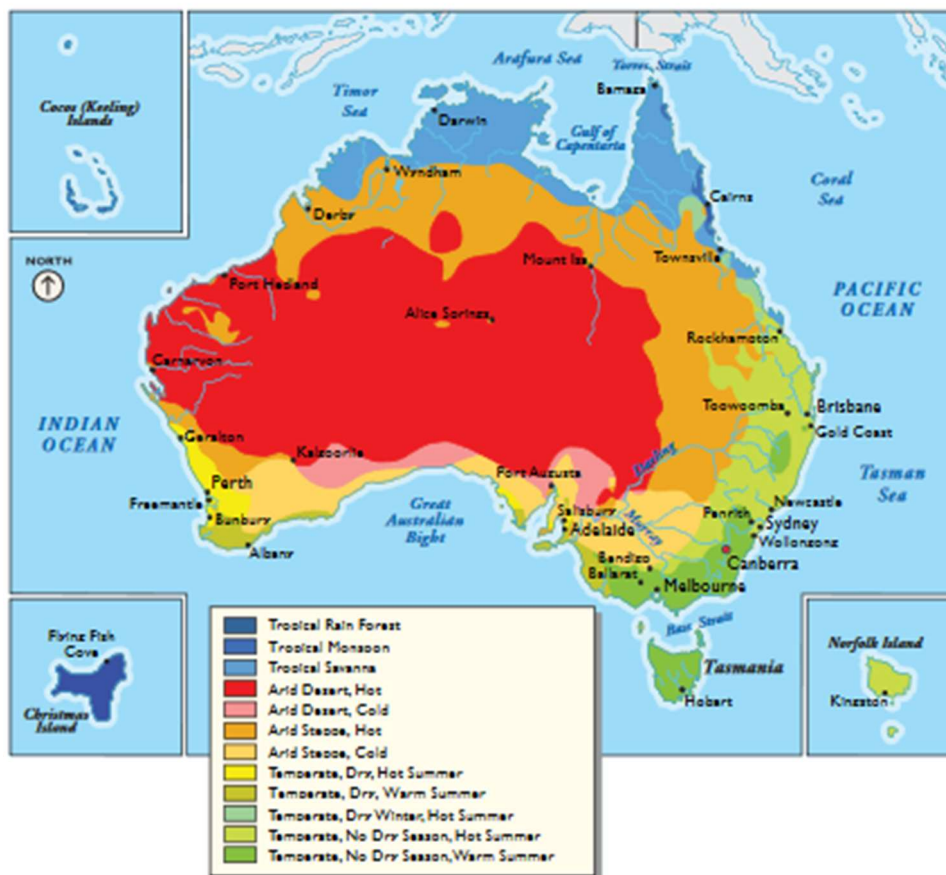


Figure 10: Climate of Australia³⁵³

Australia's various climate zones are shown above in figure 10. The ocean has a strong impact on climate and ecosystems as well.³⁵⁴ In general the climate can be described as arid and semiarid.³⁵⁵ Because of its remoteness and uniqueness as an isolated continent, the Australian ecosystem is highly vulnerable to climate changes.³⁵⁶ In the context of global warming, the climatic harshness

³⁵¹ Lamping., p. 16.

³⁵² Hofmeister, "Australia and Its Urban Centres.", p. 7.

³⁵³ Hamen, *Australia.*, p. 23.

³⁵⁴ Intergovernmental Panel on Climate Change, "Climate Change 2007.", p. 593.

³⁵⁵ Intergovernmental Panel on Climate Change., p. 594.

³⁵⁶ Hofmeister, "Australia and Its Urban Centres.", p. 11.

of the continent becomes a more serious threat to the survival of important flora and fauna species. The average temperature has increased by 0.8 degrees Celsius from 1910 to 2000. Already existent threats through droughts and floods – often in relation to the ENSO phenomenon – will continue to degrade the soil quality and resource availability in the country. This includes the increasing occurrence of decreases in precipitation and floods in some regions and seasons and increases of precipitation and droughts in other regions and seasons of the year. However, there is already strong competition over water resources in some urban areas in Australia.³⁵⁷ In addition to that, salinization of soil and fresh water through irrigation systems and the rising sea level constitute a threat to the Australian population.³⁵⁸ As a result of rising sea levels, recession of coastal zones takes place, especially on sandy beaches.³⁵⁹ Irrigation systems are largely fed by natural water resources like aquifers and rivers. This leads to the fact that even in years of regular precipitation, only one quarter of the Murray River's initial water flow reaches the ocean. The reason for this is a high degree of evaporation and infiltration,³⁶⁰ in addition to the extraction of water for irrigation systems.³⁶¹ Adaptation measures to the growing threat through climate change are not well researched and developed.³⁶²

Heat stress and heat mortality increase because of rising average temperatures and extreme temperatures.³⁶³ The intensification of climate phenomena is threatening sustainable development in Australia, and "climate change will add to existing stresses on achievement of sustainable land use and conservation of terrestrial and aquatic biodiversity."³⁶⁴

Land use is concentrated on forestry and agriculture. About 70% of all Australian territory was dedicated to forestry or agriculture in 1999 already.³⁶⁵

In close relation to climate change and human vulnerability stands the economic focus of the community. Products from agriculture, forestry and fishery are important elements in Australia's industry. However, agricultural production will become more expensive with more difficult production circumstances.³⁶⁶ The most important export products are natural resources, energy, and food in general and wool, meat and wheat in particular.³⁶⁷ The income from export is therefore heavily

³⁵⁷ Hughes, "Climate Change and Australia: Trends, Projections and Impacts.", p. 524.

³⁵⁸ Intergovernmental Panel on Climate Change, "Climate Change 2007.", p. 594.

³⁵⁹ Bird, "Coastline Changes. A Global Review.", p. 147.

³⁶⁰ Infiltration in the context of natural waters means the loss of water that seeps away into the riverbed.

³⁶¹ Lamping, *Australien.*, p. 52.

³⁶² Intergovernmental Panel on Climate Change, "Climate Change 2007.", p. 594.

³⁶³ Intergovernmental Panel on Climate Change., p. 596.

³⁶⁴ Intergovernmental Panel on Climate Change., p. 593.

³⁶⁵ Lamping, *Australien.*, p. 90.

³⁶⁶ Intergovernmental Panel on Climate Change, "Climate Change 2007.", p. 593.

³⁶⁷ Lamping, *Australien.*, p. 215.

dependent on climate variations. This is well represented in the wheat yield of 1993/94 to 1994/95. It was in the years between 1991 and 1995 that Australia experienced a major drought, which led to widespread bushfires in 1994. The New South Wales wheat yield sank from 5 086 000 tons to 764 000 in only one year (from 1993/94 to 1994/95).³⁶⁸ The estimated financial damage of this drought to the Australian economy was 5 billion Australian dollars.³⁶⁹ The occurrence of droughts and bushfires in Australian history is highly interconnected. They have a disastrous impact on the Australian economy and, subsequently, on the Australian community. Not only do droughts and bushfires threaten housing, health and infrastructure, they also destroy resources and income gained from agricultural products. In the 20th century alone, seven droughts, which in most cases led to brought bushfires, have been recorded in Australia, reducing cattle and sheep stocks, as well as agricultural yields dramatically.³⁷⁰

However, the economical prioritisation has changed. While agricultural products made up approximately 13% of the national GDP³⁷¹ and approximately 60% of exportation in the 1960s,³⁷² they make up only 3.6% of the GDP in 2017.³⁷³ The majority (70%) of the GDP comes from services as of 2017.³⁷⁴ Although the importance of agricultural products in the national GDP and in export has decreased in the last 60 years, the agricultural performance under the influence of climate change still has a significant impact on the Australian economy and thus directly enhances human vulnerabilities in the field of household economies, employment security depending on the context of the community and the individual affected. Australia's national GDP growth was reduced by 1 percentage point during the last severe drought from 2002 to 2003, which affected large parts of the continent. The share of agriculture in Australia's national GDP made up 3.6%. In addition to that, one has to consider the collateral damage and negative effects in other fields of economic performance. These multiplier effects add 0.6 percentage points to the negative balance of climate change impact on economic efficiency.³⁷⁵ This example of the recent drought of 2002/3 aims at showing the importance of environmental impacts on one sector of national economic productivity and imply its consequences on human vulnerability, which will be assessed with the help of the Index of Vulnerability.

³⁶⁸ Lamping., p. 215.

³⁶⁹ Lamping., p. 27.

³⁷⁰ Lamping., pp. 26 – 27.

³⁷¹ Maddock and McLean, "The Australian Economy in the Very Long Run.", p. 160.

³⁷² Lamping, *Australien.*, p. 215.

³⁷³ Central Intelligence Agency, "Australia."

³⁷⁴ Central Intelligence Agency.

³⁷⁵ Horridge, Madden, and Wittwer, "The Impact of the 2002–2003 Drought on Australia.", p. 307.

In terms of demography, Australia is a diverse country as well. Approximately 22 million people live on the main island and the other islands which are part of Australia.³⁷⁶ The most important information on the population is its distribution on the continent. As mentioned in the preceding paragraphs, Australia's climate and topography make large parts of the continent inhabitable or at least unsuitable for habitation. This is the main reason for the high percentage of urban population in Australia which lies at 89.7% (as for 2017).³⁷⁷ In contrast to that, the population density is very low.³⁷⁸ From a historical perspective, the centralization of population in urban centres was already present from the beginning of the 20th century – the percentage of urban population being 52% in the year 1901.³⁷⁹ However, as the majority of Australian cities are coastal, the population is highly vulnerable to tropical storms, floods and sea level rise.³⁸⁰ In his 1977 book, Robert Vincent Jackson writes that “no other region of recent settlement was nearly so heavily urbanised as Australia at the end of the nineteenth century.”³⁸¹ Another property inherent to the Australian population and its livelihood is the high average distance between cities and inhabited regions. This fact has to be taken into account when considering health, education, job offers and services, as it increases transportation costs.³⁸² Despite this difficulty, the government offers solutions in the field of health and education services: a good health network and infrastructure are ensured through the supply of “flying doctors” and education by radio called “The School of the Air” for remote villages.³⁸³ Some general information on the political and demographic situation in Australia completes the context of this case study: The population is highly diverse in the context of ethnicity and religious beliefs.³⁸⁴ Approximately 69% of the population is over 25 years old and the median age is 38.7 years.³⁸⁵ This makes the Australian population rather old in average. The Commonwealth of Australia is under the political leadership of Prime Minister Malcolm Turnbull and there is currently no political conflict recorded for the region.

After this introduction into the Australian case, the human vulnerability to and as a consequence of climate change and the link to climate change will be determined. Subsequent to this assessment, the paper aims at linking the findings to migration decisions and flows in the examined case.

³⁷⁶ Intergovernmental Panel on Climate Change, “Climate Change 2007.”, p. 595., The exact population size is 23 232 413 as for July 2017, CIA, The World Factbook.

³⁷⁷ Central Intelligence Agency, “Australia.”

³⁷⁸ Hofmeister, “Australia and Its Urban Centres.”, p. 1.

³⁷⁹ Hofmeister., p. 16.

³⁸⁰ Hofmeister., p. 1.

³⁸¹ Jackson, *Australian Economic Development in the Nineteenth Century.*, p. 94.

³⁸² Hofmeister, “Australia and Its Urban Centres.”, p. 11.

³⁸³ Lamping, *Australien.*, pp. 227 – 229.

³⁸⁴ Central Intelligence Agency, “Australia.”

³⁸⁵ Central Intelligence Agency.

SECTOR	INDICATOR	VULNER- ABLE	LINKED TO CLIMATE CHANGE
Economy			
GDP per capita	\$49,900 (2017)	o	o
Society			
Health expenditures*	9.4% (2014)	o	o
Education expenditures*	5.3% (2013)	o	o
Health/ Resources			
Drinking water sources	100%	o	o
Children under 5 underweight	0.2% (2007)	o	o
Government/ Politics			
Degree of democratisation	9.01 (2016)	o	o
Structure			
Exposure to hazard	x	x	x
Demography			
Rate of urbanization**	1.37% (2015-2020)	x	x
Development			
Unemployment rate youth (15-24)	12.7% (2016)	o	x
Security			
Political conflict	o	o	o

* percent of the GDP.

** annual rate of change.

This information will be evaluated with regard to the evaluation system established in subitem 2.4.3. The factor of vulnerability in the case of Australia is 2, which represents no vulnerability. The degree of linkage to climate change of this factor is 3, which is equivalent to an existent link between human vulnerability and climate change. The link lies in the sectors demography and development in the case of Australia. Although the economic impact of climate change is relatively high in Australia, the financial system and political stability equilibrate this impact to a certain degree. Australia is exposed to climate hazards in the form of a broad coastline and high risk of desertification and drought. Because of the historically dry climate in large parts of the country,

the urbanization has been high for a long time. Thus, an increased rate of urbanization poses infrastructure and resource problems, but they are still manageable as the government can benefit from experience in this context. However, the youth unemployment rate is in parts linked to a loss of employment in the agricultural production because of a decrease in productivity as a consequence of climate change and drought.

However, people living in territories severely affected by the 2007 – 2011 drought, are more likely to migrate. This is the case in the territory of New South Wales, which is the region with the highest number of internal migrants³⁸⁶ and the region most severely affected by the drought.³⁸⁷ The example of Australia shows that the impact of climate change and drought does not have as severe effects because of a stable political democratic leadership, a more diversified economy and a developed infrastructure of social support and services for the population affected. The impact of climate change on migration in Australia is therefore limited. However, the highly vulnerable and affected population will decide to migrate internally.

3 Conclusion

The aim of this master's thesis has been to show the complex links between migration and climate change and how climate change impacts human vulnerability. The importance of human vulnerability in this relation is that it is human vulnerability and incapacity of adaptation to a changing environmental situation that can lead to migration. The topic is of highest relevance, not only as a political matter, but also as a social, as well as a legal matter. It was especially important to me to stress the urgency of an adaptation of legal international frameworks to consider environmental migrants as refugees in a legal understanding. The second goal was to underpin the hypothesis that climate change plays an indirect role in the majority of migratory decisions. This, however, is not meant to decrease the importance of climate change as a contributing factor to the migratory decision. On the contrary, climate change has a crucial impact on a number of factors that can determine the outcome of a decision-making process. Still, the cases of an indirect link between the two phenomena should be distinctively kept apart from the direct link between them. In the case of imminent danger as a result of an environmental disaster, one has to consider climate change not as a contributing but as a provoking factor. To answer the initial question whether or not climate change enhances pre-existing vulnerabilities, it has been central to make a clear assessment on the two phenomena and to consider them individually. Climate change and its different types have

³⁸⁶ Australian Bureau of Statistics, "Internal Migration."

³⁸⁷ Horridge, Madden, and Wittwer, "The Impact of the 2002–2003 Drought on Australia.", p. 304.

been described in chapter 2.1. In chapter 2.2, different migration patterns have been the issue of discussion. At this point of the work, it has been possible to draw first relations between migration and climate change. During my research, I observed that different forms of climate change provoke migratory reaction that can be organized and analysed in generalized patterns. In the approach to the complex link between migration and climate change, it has been important to first tackle paradigms which seem to result from adaptation to various forms of threats. This knowledge has been useful in distinguishing between the two forms of linkage between the two influences: direct and indirect. This topic has been treated in chapter 2.3. As an introduction to this chapter, I analysed the historical evolution of the discussion on this link. The observation of the changing evolution of the term “environmental migrant” has been very helpful in approaching the legal problem mentioned in the introduction as one of the two main issues of this master’s thesis. After having assessed the information on a changing understanding of environmental migration in the public discourse and in the legal understanding in chapter 2.3, it seemed crucial to utilise it in a more applicable scheme. Thus, the Index of Vulnerability has been elaborated on. The hypothesis of the importance of climate change impact on human vulnerability has been proven and demonstrated with two examples. I want to contribute to the work of adapting the legal situation of environmental refugees in making human vulnerability as a consequence of climate change visible and measurable. With the Index of Vulnerability, singular cases can be evaluated with regard to their human vulnerability as a consequence of climate change and this information can be practically used in legal questions. At this point, it is crucial to consider individual information such as age, gender, sexual orientation and others, as well. These factors can have an important impact on the person’s vulnerability and their capacities of adaptation. However, this individual information was not included in the research, as it is not crucial for the presented topic.

All in all, climate change is a process that exacerbates some of the most pressing issues of our time. It does not take place in a vacuum but is closely associated with underdevelopment, inequalities within and between countries, global justice, and the lack of solidarity between States, human rights, or human security.³⁸⁸

The paper and the application examples of the Index of Vulnerability have shown that climate change can have a strong impact on a society’s vulnerability and on the probability of its population to choose migration.³⁸⁹ The evidence has demonstrated that contextual factors play a central role in the population’s resilience and adaptation capacity. Depending on factors like economic

³⁸⁸ Piguet, Pécoud, and Guchteneire, “Migration and Climate Change: An Overview.”, p. 23.

³⁸⁹ Again, it is important to mention that those who are deprived of their possibility to migrate because of a lack of capital – whether human or financial – are the most vulnerable part of a population (“trapped population”). In most cases, they find themselves unprotected and exposed to the consequences of climate change.

capital, social capital, political stability and others, the population has a range of possible alternatives as a response to environmental threat at their disposal. How environmental disasters will shape human vulnerability is therefore highly connected to the general context of the population affected by climate change. In the complex interrelations between politics, economy, social structure and infrastructure, the paper achieved to show the severity of the mistake to assume a mono-causal background in any decision to migrate. It is not possible to achieve an entirely complete assessment of causes and drivers for an individual case of migration. However, it is wrong to commence the analysis with the expectation of detecting one single reason as the cause for migration. With the multi-disciplinary, global and minimalist approach that was used in this master's thesis, the paper succeeded in reflecting on the intertwined relations between climate change, human vulnerability and migration. If the goal is to adapt the legal system that should assure a maximum of international protection for persons affected, then the groundwork of this adapted system should be a maximum amount of empirical data in order to underpin the justification of the adaptation. I hope that the elaboration of the Index of Vulnerability will promote a more holistic view on the topic of the link between migration and climate change and on human movement in general.

Unfortunately, I was not able to include a more in-depth analysis on a micro-level approach in this master's thesis. However, the short study on the three sectors of urbanization, unemployment and political conflict is an opportunity to get closer to a micro-level approach. It might be fruitful to conduct further research from a similar, multi-disciplinary approach, as used in this master's thesis, for a more profound micro-level approach. An analysis on the level of the individual or the household with regard to vulnerability caused by climate change might be an interesting topic for further research in this area. It would be a valuable contribution to the information made available to policy makers to develop a set of policy recommendations. The information gathered in this master's thesis can contribute to the groundwork of such a set of recommendations.

This paper should lead the reader to the insight that over-simplification in the context of migration and climate change leads to false assumptions. It is therefore not recommended to approach the complex topic with a maximalist approach. The researcher should consider the subject with a multi-disciplinary approach and adopt a minimalist position in respect to this matter. Alarmist statements and conclusions can be avoided when the complexity of the subject is fully acknowledged.

Highly related to that is the conclusion that none of the single factors observed in the context of a vulnerability assessment should be considered in isolation. The interaction of every single factor

with other factors is crucial in order to understand the link between climate change and its implications for human vulnerability. Especially in the case of a relevant topic such as migration and climate change, it is important to keep the applicability of scientific research in mind. I hope that this paper has achieved this committed goal.

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5 Appendix

5.1 Abstract in English

The master's thesis wants to determine the link between migration and climate change and how environmental factors influence migration. I proceed from the assumption that climate change enhances pre-existing stress factors that increase human vulnerability and can lead to migration. To examine this assumption, the presented research question is studied and dismantled in four parts. The aim of the work is to render environmentally induced vulnerabilities visible and measurable with the help of the Index of Vulnerability, presented in chapter 2.4 of this paper. It intends to measure human vulnerability within the scope of a community, a nation state or other frame that offers applicable information. The degree of vulnerability and its interrelations to environmental factors is measured with the evaluation of economic, social, political, demographic and other indicators. The degree of vulnerability has a direct influence on the decision of migration.

This link between migration and climate change is the focal point of this master's thesis. The scientific importance of this work lies in two areas: the legal framework and the adaption to existing risks in the context of environmental migration. First, it is important to adapt the legal framework assuring certain fundamental rights for refugees, which under the present international legal situation does not apply to environmental migrants. In this context, it is also crucial to make progress in improving homogeneity in the definition of migrants who are on the move for reasons not addressed by the current international law on migration and refuge. A homogenous definition helps improve progress in research as well as in the implication of adaptive measures and the elaboration of policy recommendations. This master's thesis aims at gaining useful information on the importance of the impact of environmental factors on migration in order to provide a scientific basis for the continuous improvement of environmental migrants and those at risk of becoming one.

To obtain an exhaustive analysis of the discussed topic, the paper treats the subject of climate change in chapter 2.1, defining the term and offering a historical overview of climate change from 1000 to 1800 CE linking temperature changes in this period with migratory movements. The description of three types of climate change – sudden-onset disasters, slow-onset disasters and environmental degradation – helps with providing a foundation for the projected linkage of the two phenomena. Chapter 2.2 defines the term of migration and presents three possible categories of migration patterns, which are linked to phenomena of climate change. The reason for this first

linkage is that there are some correlations between climate change and human reactions and possible adaptations to these changes. This link between the two phenomena is the subject of chapter 2.3. In the beginning, it is interesting to observe the evaluation of the discourse on the link between climate change and migration over the time period between 1960 and 2010. This evaluation can be oriented towards an overview of the changing definition of the term “environmental migrant”. In addition to that, the legal situation is outlined in this context.

With regard to the answering of the research question, chapter 2.3 deals with the link between climate change and migration and distinguishes between the direct and the indirect link. In consideration of the before mentioned assumption that climate change influences migration rather indirectly by aggravation of already existing vulnerabilities, the indirect link and its complex nature is dealt with more in-depth than the direct link. Various fields of vulnerability are determined in preparation of the elaboration of the Index of Vulnerability. This index is meant to be explained and applied to two examples (Syria and Australia) in chapter 2.4. The Index of Vulnerability is the main project of this master’s thesis and wants to underline the assumption that climate change enhances pre-existing stress factors in communities affected. For this purpose, the Index offers ten representative indicators aiming at characterizing the vulnerability to climate change in the first place and the vulnerability caused by climate change in the second place. In addition to that, the link between the assessed vulnerabilities to climate change is worked out by the Index of Vulnerability. It aims at assessing human vulnerability in the context of environmental migration in order to improve the legal situation of persons affected. At the same time, the Index has the objective of underscoring the assumption that climate change enhances pre-existing stress factors and human vulnerabilities.

5.2 Abstract in German

Die zentrale Fragestellung der Masterarbeit ist: Wie kann man feststellen, ob Menschen eine Migrationsentscheidung unter dem Einfluss klimatischer Faktoren treffen oder getroffen haben und zu welchem Grad diese Entscheidung durch klimatische Faktoren beeinflusst wurde? Meine Hypothese ist, dass dies eine Frage der Vulnerabilität der Gesellschaft und des Menschen im Einzelnen als indirekte oder direkte Auswirkung klimatischer Faktoren ist. Der Ansatz, den ich als Antwort auf die Fragestellung präsentieren will, stellt sich in Form eines Index dar, der diese Vulnerabilität sichtbar und messbar machen soll. Dieser hat das Ziel, die Vulnerabilität einer Gesellschaft gegenüber den Folgen des Klimawandels zu messen. Diese Vulnerabilität übt, wie in meiner Hypothese formuliert, Einfluss auf die Migrationsentscheidung aus.

Demnach ist es das Ziel der Arbeit, die Zusammenhänge zwischen Klimawandel und Migration zu analysieren und soweit wie möglich aufzuschlüsseln. Hierbei geht es vordergründig darum, Adaptionmöglichkeiten der betroffenen Gesellschaften zu evaluieren, Risikofaktoren zu eruieren und die Rolle der Migration in diesem Zusammenhang zu beurteilen. Zu diesem Zweck entwerfe ich einen Index, welcher mit Hilfe ökonomischer, sozialer, politischer, demographischer und anderer Faktoren zu einer Bewertung der Vulnerabilität untersuchter Gesellschaften dienen soll. Anhand dieses Index bewerte ich in der Folge die Vulnerabilität der Gesellschaft in Syrien und Australien gegenüber klimatischer Belastung durch Dürre. Die Auswahl ist aufgrund der Vergleichbarkeit der klimatischen Umstände auf diese Beispielländer gefallen. Unterschiedliche gesellschaftliche, wirtschaftliche und historische Umstände sollen den Einfluss dieser Faktoren auf die Vulnerabilität einer Gesellschaft deutlich machen, welcher sich in der Folge auch auf Migrationsentscheidungen auswirkt.

Die Arbeit unternimmt danach den Versuch, Zusammenhänge zwischen Klimawandel und Migration sichtbar und mithilfe des Index messbar zu machen. Dieses Instrument kann in der Folge für die Analyse von Gesellschaften in Bezug auf deren Vulnerabilität gegenüber klimatischen Faktoren im Allgemeinen (Naturkatastrophen und langsame Umweltveränderungen gleichermaßen) angewendet werden. Auch der Zusammenhang zwischen der errechneten Vulnerabilität und dem klimatischen Einfluss soll mithilfe des Index ermittelt werden.

Auch in der rechtlichen Frage nach dem Anspruch auf internationalen Schutz derer, die aufgrund der Folgen des Klimawandels eine Migrationsentscheidung treffen, soll der Index Aufschluss über den Grad des Zusammenhangs der Entscheidung mit klimatischen Faktoren geben. Die Arbeit ist in vier Kapitel eingeteilt. Einleitend sind einige grundlegende Begriffe zu klären. Das erste Kapitel befasst sich mit dem Phänomen des Klimawandels, dessen Definition, geschichtlicher Entwicklung (1000 – 1800 CE) und schließlich der Unterscheidung zwischen den Arten des Klimawandels. Um in der Folge der Masterarbeit zwischen Differenzen in den Zusammenhängen zwischen Klimawandel und unterschiedlichen Formen der Migration aufgliedern zu können, werden in der Folge die drei Formen des Klimawandels aufgeführt.

Der Begriff der „Migration“ wird im zweiten Kapitel definiert. Auch in diesem Fall ist eine Differenzierung der Migrationsformen zentral für die Behandlung der geplanten Forschungsfrage. In diesem Zusammenhang wird im Zuge der Auflistung bereits auf Korrelationen mit klimatischen Faktoren eingegangen.

Das dritte Kapitel verbindet die beiden Phänomene miteinander und untersucht ihre Zusammenhänge. Eingeleitet wird das Kapitel durch einen historischen Überblick (1970 – 2010) über die Entwicklung des wissenschaftlichen Diskurses zu Klimawandel im Allgemeinen und über die Zusammenhänge zwischen Migration und Klimawandel in diesem Zeitraum. Nach der Klärung der

beiden Einzelbegriffe Klimawandel und Migration lassen sich bereits erste Forschungsfragen beantworten. Dafür werden die zwei möglichen Arten der Beziehung zwischen Migration und Klimawandel analysiert und diskutiert. Der Zusammenhang zwischen Migration und Klimawandel kann sich als direkt oder indirekt (induziert durch wirtschaftliche, soziale, politische oder gesundheitliche Faktoren, welche eine direkte Konsequenz des Klimawandels darstellen) präsentieren. Schließlich wird ein Index vorgestellt, dessen Konzept Teil meiner wissenschaftlichen Arbeit darstellt. Ziel des Index ist es, anhand von den bereits genannten Faktoren der Wirtschaft, des Sozialen, des Politischen und der Gesundheit die Vulnerabilität einer Gesellschaft gegenüber den Konsequenzen des Klimawandels zu eruieren.

Die Erforschung dieser Frage ist von besonderer Wichtigkeit, da die rechtliche Situation der Klimaflüchtlinge nicht an die aktuelle Situation angepasst ist. Entgegen der Benennung als „Flüchtlinge“ werden diese nicht von der Genfer Flüchtlingskonvention als Flüchtlinge anerkannt. Meine Forschung soll dazu beitragen, einen Schritt in Richtung der Messbarkeit von Vulnerabilität zu gehen, um in der rechtlichen Frage Klarheit zu verschaffen, welchen Zusammenhang Migration mit Klimawandel in einzelnen Gesellschaften hat.

Nach einer Klärung der Aufgabe des Index und einer kurzen Darlegung der Anwendungsrichtlinien, wende ich den Index auf zwei vergleichbare Fallbeispiele an: Syrien und Australien. Diese Länder sind im 21. Jahrhundert Opfer von intensiven Dürreperioden geworden, welche sich als langsame Umweltveränderungen einstufen lassen. Mithilfe von acht Indikatoren soll der entworfene Vulnerabilitätsindex der australischen und syrischen Gesellschaft darstellen und deren Verbindung zu Klimawandel analysieren. Diese Analyse der Vulnerabilität gegenüber den Folgen des Klimawandels wird eingebettet in eine kurze Darstellung des regionalen Zusammenhangs. Diese Darstellung soll einen Umriss der grundlegenden Informationen zu dem diskutierten Fallbeispiel geben, um die Ergebnisse der Analyse per Index in einen zeitlichen und regionalen Kontext betten zu können.

Abschließend sollen die Erkenntnisse der Arbeit und speziell der Untersuchung der Vulnerabilität der zwei Fallbeispiele gegenüber den Folgen der Dürre besprochen werden und die Möglichkeiten der Anwendbarkeit dieses „Vulnerabilitätsindex“ abgeschätzt werden. Im Beispiel Syrien wird der geschichtliche Kontext auf die Zeitspanne von 1960 bis März 2011 beschränkt, um möglichst klare Ergebnisse in dem betrachteten Feld zu erreichen. Zentral ist in diesem Beispiel die Unterscheidung zwischen interner und internationaler Migration. Durch die Anwendung des Vulnerabilitätsindex kommt man zu der Erkenntnis, dass der Zusammenhang zwischen internen ruralen-urbanen Migrationsbewegungen stark ist; der Zusammenhang zwischen der internationalen Migration aus Syrien ist mit dem Syrischen Bürgerkrieg zu erklären. Dennoch konnte durch die Anwendung des

Index auf eine wichtige Rolle des Klimawandels in der politischen Unzufriedenheit der Bevölkerung hingewiesen werden. Im Beispiel Australiens wird durch die Analyse klar, dass die wirtschaftliche Konzentration auf klimatisch anfällige Produkte aus der Landwirtschaft abnimmt. Des Weiteren bietet sich der australischen Bevölkerung durch einen hohen urbanen Bevölkerungsanteil bereits Anfang des 20. Jahrhunderts und eine niedrige Bevölkerungsdichte in ariden Zonen des Kontinents ein gut ausgebautes Netz an Services und Infrastruktur. Zusätzlich zu Faktoren wie eine stabile politische Struktur und Wirtschaft trägt dies zu einer erhöhten Resilienz gegenüber dem Klimawandel bei. Innerhalb des Landes kommt es dennoch zu internen Migrationsbewegungen.