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# **Poverty and Vulnerability**

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## **ABSTRACT**

This paper describes the concepts of poverty and vulnerability as well as the interconnections and differences between these two. Vulnerability is a multi-dimensional phenomenon, because it can be related to very different kinds of hazards. Nevertheless most studies deal with the vulnerability to natural disasters, climate change, or poverty. As a result of the effects of global change, vulnerability focuses more and more on the livelihood of the affected people than on the hazard itself in order to enhance their coping capacities to the negative effects of hazards. Thus the concept became quite complex, and we present some approaches that try to deal with this complexity.

In contrast to poverty, vulnerability is a forward-looking feature. Thus vulnerability and poverty are not the same. Nevertheless they are closely interrelated, as they influence each other and as very often poor people are the most vulnerable group to the negative effects of any type of hazard. There are also attempts to measure the vulnerability to fall below the poverty line, which is mostly done through income measurements.

This paper therefore reviews the major linkages between poverty and vulnerability. Different measures of poverty, both quantitative and qualitative are presented. The three different forms of vulnerability namely, to natural disasters, climate and economic shocks, are discussed. The paper further evaluates different methods of measuring vulnerability, each of which employs unique and/or different parameters. Two case studies from Malawi and Europe are discussed with the conclusion that poverty and vulnerability, though not synonymous, are highly related. More studies on this subject are recommended to strengthen the arguments raised herein.

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## 1. INTRODUCTION

The world has experienced dramatic environmental and socioeconomic changes in recent decades. Phenomena like population growth, rapid urbanisation processes, increasing poverty but also environmental degradation, climate change, and the increase in natural disasters have affected the social and economic development in many parts of the world. Because of these different factors, which are summarised under the term “global change”, many people have become more vulnerable to the negative effects of very different hazards. Thus the concept of vulnerability has become more and more prominent in recent decades.

Poverty as the other important aspect of this paper is prevalent in large parts of the world and is one of the largest challenges of mankind in the 21<sup>st</sup> century. Therefore the member states of the United Nations decided at the Millennium Summit in 2000 to combat global poverty and to halve the number of poor people by the year 2015. The Millennium Development Goals (MDGs) name quantitative targets and indicators in order to measure progress in the fight against poverty. The achievement of these targets is jeopardised by global change, because poor people mostly have the least possibilities to cope with its negative effects. Therefore it is important to analyse their vulnerability to different risks, and subsequently to enhance their abilities to cope with these effects.

Poverty cannot be reduced to income poverty, but there are other important factors, which determine the well-being of people. As vulnerability is also a multi-dimensional approach, the application of such a comprehensive view might give the chance to get a holistic picture of chances and threats for the livelihoods of people particularly in developing countries.

One objective of this paper is to give an introduction to the terms poverty and vulnerability, and to present an overview about different concepts. This will be done in chapters 2 and 3. Chapter 4 can be seen as the core of the paper, as it shows the interconnections but also the differences between the two concepts. Chapter 5 analyses approaches to measure poverty and vulnerability, which is still quite a challenge because of their multi-dimensional nature. Nevertheless there are also approaches, which are restricted to the measuring of income poverty. Chapter 6 gives a brief overview about vulnerable groups with a focus on vulnerability to poverty. Before we finally draw the conclusions from our analyses in chapter 7, chapter 6 contains two case studies from Malawi in Africa and Europe. These case studies deal with the vulnerability to natural hazards. These examples from a developing as well as from a developed country shall serve as an application to the more theoretical and conceptual approach of the former chapters.

## 2. DEFINITION OF POVERTY

The notion of poverty is determined in different ways by different institutions. The indicators of poverty differ as well. For ease of reference and coherence in global assessments, development agencies often employ quantitative measures of poverty, such as those setting a threshold of one or two dollars a day. Specific indicators relating to certain economic and social factors (such as infant mortality and literacy rates) are also employed. But many aspects of poverty, some of which are crucial to a human rights analysis, are not reflected in the statistical indicators. However, poverty has a number of definitions that have different measuring dimensions.

The United Nations High Commission for Refugees (UNHCR) defines “poverty” as a human condition characterized by the sustained or chronic deprivation of resources, capabilities, choices, security and power necessary for an adequate standard of living and other civil, cultural, economic, political, as well as social rights (UNHCR 2004). Thus, poverty can be described as the state of being without the necessities of daily living, often associated with need, hardship and lack of resources across a wide range of circumstances. Some people see poverty as a subjective and comparative term, while for others it is moral and evaluative or scientifically established.

The Copenhagen Declaration of 1995 describes absolute poverty as "a condition characterised by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information". The World Bank (2001) on the other hand identifies "extreme poverty" as being people who live on less than US \$1 a day, and "poverty" as less than \$2 a day. On that standard, 21% of the world's population was in extreme poverty, and more than half the world's population was poor in 2001.

According to the World Bank (2001), about 1.1 billion humans worldwide (which is 21% of the world population) had less than \$1 in local purchasing power per day. (in comparison: in 1981 there were 1.5 billion humans, which made up 40% of the world population; in 1987, 1.227 billion humans equaling 30%; and in 1993, 1.314 billion humans equaling 29% of the world population).

However, economic deprivation – lack of income – is a standard feature of most definitions of poverty. But this in itself does not take account of the myriad of social, cultural and political aspects of the phenomenon. Poverty is not only deprivation of economic or material resources but also a violation of human dignity. In this regard it is worth to note the phrase by Kofi Annan, UN Secretary General who stated: “Wherever we lift one soul out of a life of poverty, we are defending human rights. And whenever we fail in this mission, we are failing human rights” (UNHCR 2004).

Poverty can be conceived as absolute or relative, as lack of income or failure to attain capabilities. It can be chronic or temporary, it is sometimes closely associated with inequity, and is often correlated with vulnerabilities and social exclusion. Chapter 5 of this paper

reviews the main types and groups of indicators that have emerged over time, highlighting their strengths and weaknesses.

As far as the poverty issue is discussed, it is always closely associated with the poverty line. The poverty line is the minimum threshold level of income (or consumption) below which one cannot afford to purchase all the resources one requires to live. People who have an income below the poverty line have no discretionary disposable income, by definition (CCSD 2001).

Practically, different countries often use different poverty lines. But in general, it is more common to use only one poverty line in order to compare economic welfare levels of countries and regions. When comparing poverty across countries, the purchasing power parity exchange rates are used. They are used to ensure that the poverty levels do not change with the normal exchange rates. Thus, as it was already mentioned, 'living for under \$1 a day' should be understood as having a daily total consumption of goods and services comparable to the amount of goods and services that can be bought in the US for \$1. Self-produced goods and public services are included in this measure.

Poverty is not an exceptional case. Almost all societies have some of their citizens living in poverty. The poverty line is useful as an economic tool with which to measure such people and consider socioeconomic reforms such as welfare and unemployment insurance to reduce poverty. Determining the poverty line is usually done by finding the total cost of all the essential resources that an average human adult consumes in one year. This approach is needs-based in that an assessment is made of the minimum expenditure needed to maintain a tolerable life.

## **2.1 Main Concepts of Poverty**

As a multidimensional phenomenon, poverty is defined and measured in a multitude of ways. This section describes different concepts of poverty and attempts to distinguish them from other closely related concepts.

From the perspective of indicators, these distinctions are important since poverty measurement, and subsequent policy and programme implications depend on what facets or angles of poverty are being addressed. For example, if a national poverty reduction strategy is supposed to address both temporary and chronic poverty, two distinct sets of policies and programmes would be required, along with two sets of indicators for establishing baselines and monitoring progress (Dessalien 2000). Likewise, if the definition of poverty is based on the human capabilities concept, then appropriate sets of indicators would be required to measure it along with corresponding policies and programmes to address it. This would result in poverty reduction strategies that differ from those associated with an income-based concept of poverty (UNDP Poverty Report 2000).

## **2.2 Absolute and Relative Poverty**

Poverty can be seen in absolute and relative terms. Absolute poverty refers to subsistence below minimum, socially acceptable living conditions, usually established based on nutritional requirements and other essential goods. Relative poverty compares the lowest segments of a population with upper segments, usually measured in income quintiles or deciles. Absolute and relative poverty trends may move in opposite directions. For example, relative poverty may decline while absolute poverty increases if the gap between upper and lower strata of a population is reduced by a decline in well being of the former at the same time that additional households fall beneath the absolute poverty line (Dessalien 2000).

Even within so-called absolute poverty, countries often distinguish between indigence, or primary poverty and secondary poverty (sometimes referred to as extreme and overall poverty). Indigence usually refers to those who do not have access to the basic necessities for human survival, while other forms of poverty refer to degrees of deprivation above that threshold. For example, households incapable of obtaining sufficient food for survival are considered absolutely poor. However, the costs and composition of that food basket may vary considerably between households across different groups, regions and countries.

Another facet of absolute and relative aspects of poverty pertains to changes in circumstances. For example, if prices rise faster than incomes, the well being of some households classified as relatively poor may decline to levels formally associated with absolute poverty, without a corresponding change in status since the living standards of the absolute poor have also declined proportionally. A similar situation arises when cultural or status values change over time.

## **2.3 Perspectives of Poverty**

Poverty can be approached from objective or subjective perspectives. The objective perspective (sometimes referred to as the welfare approach) involves normative judgements as to what constitutes poverty and what is required to move people out of their impoverished state. The subjective approach, on the other hand, places a premium on people's preferences, on how much they value goods and services (hence the emphasis on individual utility). Economists have traditionally based their work on the objective approach, mainly because of the obstacles encountered when trying to aggregate multiple individual utilities across a population (Dessalien 2000). Advocates of this approach use the argument that individuals are not always the best judges of what is best for them. For example, most poverty measurement systems focus on nutritional attainments. The main argument under this focus, although all individuals value food consumption, some may place higher value on certain food types or food quantities that are not the best for their physiological well-being. It is conceivable that the subjective approach could both undervalue and overvalue food consumption when compared to the welfare approach, leading to conflicting assessments as to who are the poor.



However, poverty measurement has traditionally been dominated by the objective approach. Only relatively recently the international community as a whole has taken a serious interest in measuring subjective poverty. This is mainly because of mounting recognition of the limitations associated with so-called objective indicators and the value of understanding the perspectives of the poor in shaping policies and programmes. As a result, participatory poverty assessment methodologies have been gaining ground (Dessalien 2000).

Clearly both objective and subjective perspectives bring valuable insights to the measurement and analysis of poverty. They approach the phenomena from different angles and capture fundamentally different aspects of it, neither of which can be said to be categorically right or wrong.

## **2.4 Quantitative and Qualitative Poverty Indicators**

Quantitative and qualitative indicators are sometimes confused with objective and subjective perspectives of poverty. In fact, an objective concept of poverty could be measured with both quantitative and qualitative indicators, and the same applies to subjective approaches. For example, an objective approach to poverty measurement may determine that perceptions of deteriorating academic standards (a qualitative indicator) are the principal cause of declining school enrolment. Likewise, a subjective approach to poverty measurement may reveal that household composition (which can be quantified) is a central characteristic of poverty.

The confusion arises because the main methodologies for obtaining “objective” poverty indicators are survey questionnaires, which generally place a premium on quantitative data. Conversely, the main instruments used to ascertain subjective perspectives of poverty result in generous amounts of qualitative information (although they may also generate quantitative data). Quantitative data can be aggregated whereas qualitative information usually cannot. On the other hand, qualitative information may provide a more subtle picture of reality than quantitative data (Dessalien 2000).

## **3. VULNERABILITY**

### **3.1 Definition of Vulnerability**

The world has experienced dramatic environmental and socioeconomic changes in recent decades. Phenomena like population growth, rapid urbanisation processes, poverty but also environmental degradation, climate change, and the increase in natural disasters have affected the social and economic development in many parts of the world. Because of these different aspects of global change many people have become more vulnerable to the negative effects of very different hazards. Hazard in this context means:

*“A property or situation that under particular circumstances could lead to harm. More specific, a hazard is a potentially damaging physical event, phenomenon or human activity, which may*

*cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity and probability”(UN/ISDR 2004a).*

This broad definition shows the multi-faceted nature of the term, i.e. vulnerability can be related to a lot of different hazards. Households, communities, countries etc. can be vulnerable to any kind of event that may have harmful consequences for them once it takes place. This is one reason, why it is quite difficult to describe or to even measure vulnerability. It is only really displayed when an event takes place. Before December 2004 probably no one in Sri Lanka had the idea that establishing critical infrastructure like hospitals or schools directly at the coastline might be dangerous. Now, after the tsunami had struck the island and caused a huge number of fatalities, we know about that particular risk, and vulnerability assessments are now taking place (Birkmann, personal communication).

Despite this broad approach most studies on this topic deal with the vulnerability to natural hazards, to climate change or to poverty. This particular aspect, the general vulnerability to become poor or to stay poor, shall be dealt with in more detail in chapter 4, which analyses the linkages between vulnerability and poverty. The vulnerability to the impacts of climate change is gaining more and more importance, as it is getting clearer, that mankind cannot avoid some negative impacts of climate change, regardless of the next steps being taken to reduce global greenhouse gas emissions (IPCC 2001).

The frequency and magnitude of natural disasters have increased in recent decades, as it can be derived from figure 1. This encompasses e.g. hazards like floods, droughts, earthquakes, volcanic eruptions, or storm surges. Some of these natural events are indirectly triggered by anthropogenic activities, like land degradation or the combustion of fossil fuels. Global environmental change and especially the anthropogenic interference of the earth's climate system lead to the warming of the atmosphere, which in turn might have a severe impact on the frequency and magnitude of some natural disasters.

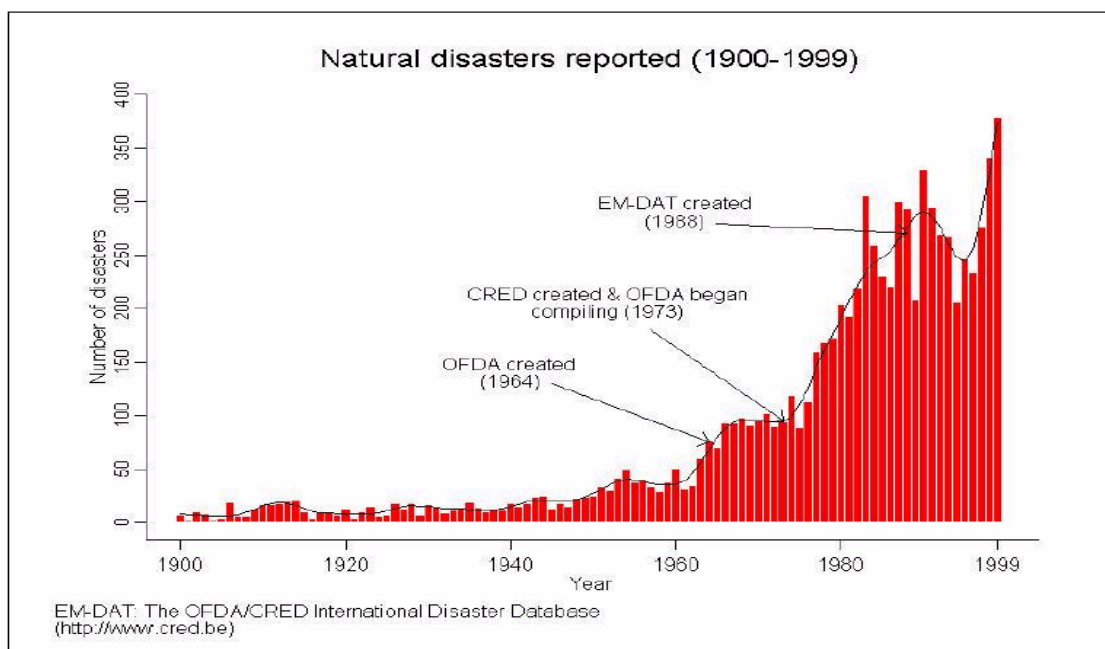


Figure 1: Number of Natural Disasters Reported, 1900-1999. Source: Feldbrügge and von Braun 2002: 21.

These increases in natural disasters as well as other impacts of global change have led the international community to concentrating more on mitigating the impacts of such hazards. By dealing with this topic a paradigm shift (Birkmann, forthcoming 2006; Thywissen, forthcoming 2006) has taken place: while the traditional view focused on the hazard itself and on technical aspects in order to minimise its impacts, in recent decades scientists as well as practitioners switched more and more towards the livelihood of the affected people or communities in order to reduce their susceptibility to such events. Schneiderbauer and Ehrlich state: “The term ‘vulnerability’ was introduced as a response to the hazard-centric perception of disasters in the 1970s. With its growing recognition at the beginning of the 1980s, ‘vulnerability’ was used to express the understanding that the extent to which people suffer from calamities depends on (a) ‘the likelihood of being exposed to hazards’ and (b) ‘their capacity to withstand them, which relates to their socio-economic circumstances’” (Schneiderbauer and Ehrlich 2004: 13). By applying this preventive approach the concept of vulnerability has gained more prominence in recent decades.

This focus on the vulnerability of potentially affected people is i.e. due to the fact, that a natural hazard is not a disaster by itself, but it only becomes a disaster with potentially severe consequences through the presence of people, who are vulnerable to its impacts. (Prowse 2003: 4) This has also been stressed by Kofi Annan: “Natural hazards are a part of life. But hazards only become disasters when people’s lives and livelihoods are swept away.” (Annan 2003).

As many people and disciplines are working on vulnerability, the meaning of the term as well as its influencing factors have become more and more confusing (Thywissen calls it

“Babelonian confusion”; Thywissen, forthcoming 2006): “although practitioners, experts and researchers agreed on the need to further emphasise the socio-economic situation, their view on the concept of vulnerability and the underlying definitions diverged strongly depending on the approach adopted” (Schneiderbauer, Ehrlich 2004: 14).

There are myriads of different definitions for the term vulnerability. It would go far beyond the scope of this paper to list and discuss them all. Extensive work on this topic has been done by Thywissen (forthcoming 2006). Differences in definitions arise from the discipline that looks at vulnerability. A person working in development cooperation will certainly put a different focus than a disaster manager, an economist or a construction engineer.

Two general definitions, which are well-known and which can be regarded as being quite comprehensive, shall be stated here as examples. The International Strategy for Disaster Reduction (UN/ISDR) sees vulnerability as

*“The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.”*

(UN/ISDR 2004)

The United Nations Development Programme in contrast defines vulnerability as:

*“A human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard.”*

(UNDP 2004a)

Both definitions – like many of the other definitions – put an emphasis on the human conditions as a major factor of vulnerability. Therefore UNDP also developed the human-centred Disaster Risk Index, which measures the vulnerability of a community by dividing the number of people killed by the number of people exposed (Birkmann 2005: 2).

Thus vulnerability generally describes the internal risk of being affected by such a harmful event (Cardona 2004: 37). For some authors vulnerability also comprises the ability to cope with such events and to recover after them (Birkmann forthcoming 2006). Determination of vulnerability must always be hazard-specific (Adger 1998: 9), i.e. one must always ask: vulnerability to what? (Cardona 2004: 38). A coastal community in a developing country might be highly vulnerable to floods, but not at all to droughts.

Furthermore the level has to be taken into account, whose vulnerability shall be assessed, as it makes a big difference for the choice of vulnerability indicators, if vulnerability shall be evaluated for a single household or for a whole country. Adger (1998: 6) e.g. differentiates between individual (household) and collective vulnerability.

Apart from the many different approaches, all authors agree that vulnerability is a multi-dimensional concept that comprises physical, social, economic, environmental, political,

cultural and institutional factors. This multi-dimensionality and the focus on non-natural science issues make vulnerability more difficult to measure or just allow a qualitative approach for measuring (Thywissen, forthcoming 2006).

German Technical Cooperation (GTZ) states that “vulnerability is caused by a broad range of political, institutional, economic, environmental and socio-cultural factors such as insufficient knowledge, organisational gaps, lack of personal and financial resource, inadequate legislation, etc.” (GTZ 2005: 13). Thus vulnerability must not be restricted to a simple cause-effect relationship (GTZ 2005: 15).

Many authors also emphasise the dynamic and forward-looking nature of the vulnerability approach (Heitzmann et al. 2002: 1). It is regarded as being dynamic, because the vulnerability of a community or any other element at risk is never a determined factor, but it can change over time, and enhancing the coping capacity of the element at risk can certainly influence its vulnerability (Alwang et al. 2001: 25; GTZ 2005: 13).

Vulnerability does – in contrast to poverty – not only describe a current status of a society, but it contains a predictive feature, i.e. it describes what might happen in the future, if a certain hazard is going to occur. Cannon et al. also focus on its forward-looking nature: “vulnerability should involve a predictive quality: it is supposedly a way of conceptualizing what may happen to an identifiable population under conditions of particular risk and hazards.” (Cannon et al. 2003: 4). Vulnerability is “an intrinsic characteristic of a community” (Thywissen, forthcoming 2006), which is always there and which is only revealed, when a hazard takes place.

### **3.2 Different Concepts of Vulnerability**

This part is intended to give a brief overview of different approaches to analyze vulnerability. Again it is beyond the scope of this paper to give a comprehensive analyse of all approaches, as a lot of different ideas have evolved in recent years.

Bohle for example distinguishes between the “internal” and the “external” side of vulnerability. The external side refers to the structural dimensions of vulnerability and risk, and describes the exposure of the affected people, while the internal side marks the actions of the people to cope with hazards or at least mitigate their negative effects. These coping mechanisms are a highly complex issue, and have so far been neglected in theoretical and conceptual discussions (Bohle 2001).

In his approach to the social and economic vulnerability to climate change in Vietnam, Adger goes into a similar direction, when he describes vulnerability as “a combination of social factors and environmental risk, where risks are those physical aspects of climate related hazards exogenous to the social system” (Adger 1998: 5)

In their report for DFID Cannon et al. concentrate on social vulnerability, which is “much more than the likelihood of buildings to collapse or infrastructure to be damaged” (Cannon et al. 2003: 5). It is a “complex set of characteristics that include a person’s

- initial well being (nutritional status, physical and mental health, morale);
- livelihood and resilience (asset pattern and capitals, income and exchange options, qualifications);
- self-protection (the degree of protection afforded by capability and willingness to build safe home, use safe site);
- social protection (forms of hazard preparedness provided by society more generally, e.g. building codes, mitigation measures, shelters, preparedness);
- social and political networks and institutions (social capital, but also role of institutional environment in setting good conditions for hazard precautions, peoples’ rights to express needs and of access to preparedness)” (Cannon et al. 2003: 5).

This listing again points out the complex, multi-dimensional nature of the vulnerability concept.

Downing et al. (forthcoming 2006: 4) also focus on social vulnerability. They worked out six attributes, which are in parts like a summary of the previous subchapter. According to them vulnerability is:

- the differential exposure to stresses experienced or anticipated by different unites exposed,
- a dynamic process,
- rooted in the actions and multiple attributes of human actors,
- is often determined by social networks in social, economic, political and environmental interactions,
- manifested simultaneously on more than one scale,
- influenced and driven by multiple stresses.

Cardona (2004: 48) analyses the linkages between vulnerability and development. He points out that “vulnerability signifies a lack or a deficit of development” and that “risk is constructed socially”. Therefore he also focuses on the intrinsic susceptibility of a community. In his opinion vulnerability originates in physical fragility or exposure, socio-economic fragility, and a lack of resilience (Cardona 2004: 49). By taking a look at these parameters he tries to get to a holistic view of vulnerability, which covers both physical factors as well as socio-economic aspects.

The Pressure and Release Model (PAR) by Wisner et al. (2004: 49ff.) distinguishes between the processes generating vulnerability and the natural hazard. This model, which is based upon the often used equation, Risk = Hazard x Vulnerability, defines three different levels of vulnerability: the “root causes” describe economic, demographic and political processes that determine the access to power and resources, while the category “dynamic pressure” comprises processes, which channel the effects of the first category into unsafe conditions, like epidemics, rapid urbanisation and violent conflicts. The unsafe conditions form the third

category reveal human vulnerability, for example made up of protection against diseases, or living in hazardous locations.

Birkmann (forthcoming 2006) draws the conclusion that nearly all concepts concentrate more and more on the “internal side of risk”. That means that the focus switches from the hazard itself and technical and engineering solutions to the society at risk and its possibilities to deal with the negative effect of hazards.

Finally Figure 2 shows the “onion framework”, an example of a comprehensive model to analyse the different spheres of vulnerability and the abilities of a community to cope with the effects of a hazard, which in this case is a flood (Bogardi and Birkmann 2004; Birkmann, forthcoming 2006). The circle relating to the social sphere contains different capacities of a society to cope with a hazard. Thus this model also states that “whether a flood event becomes a disaster or not depends almost as much on the preparedness and coping capacity of the affected society as on the nature of the flood event itself” (Birkmann, forthcoming 2006).

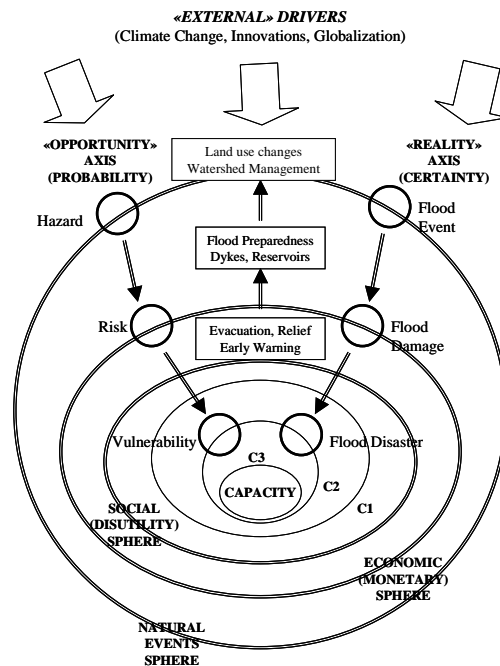


Figure 2: Model of the social response to floods. (Source: Bogardi and Birkmann 2004: 79).

#### 4. LINKAGES BETWEEN VULNERABILITY AND POVERTY

Most authors working on vulnerability see a clear linkage between vulnerability and poverty, regardless of the hazard they are looking at. They also emphasise that vulnerability and poverty are not describing the same aspect, but that there are clear differences (e.g. Hoogeveen et al. 2004: 5).

Vulnerability to poverty, i.e. to fall below the poverty line, forms a particular linkage between the two concepts. It will be described at the end of this chapter.

The previous two chapters have shown that today vulnerability and poverty are both seen as multi-dimensional concepts. Poverty is not only regarded as not having enough income anymore, but also looks at the “well-being” of the people, while vulnerability focuses more on social and economic obstacles than on the hazard itself.

The most striking difference is the dynamic nature of vulnerability, as it has been outlined in the previous chapter. It gives a forward-looking perspective on what might happen, if a certain hazard takes place. Poverty in contrast is a description and measure of current status. This view has been taken e.g. by Alwang et al. (2001) and Cannon et al. (2003).

Furthermore poverty is not hazard-specific like vulnerability, as it has been pointed out by Adger: “Poverty may or may not be a relative term, but there are not varying “poverties” for any one individual or family” (Adger 1998: 9).

The linkages between vulnerability and poverty have been the subject of intensive research and discussion. Depending on the discipline and on the objectives of the study vulnerability is often seen as being a component of poverty or vice versa. As vulnerability is a pretty new concept – especially in comparison to poverty – some authors, particularly those working in the context of development cooperation, see vulnerability as one aspect, which can cause poverty or hinder people from escaping out of poverty. Prowse e.g. mentions a few studies, which describe vulnerability “as being part of the multiple dimensions of poverty” (Prowse 2003: 9). The inclusion of vulnerability into analyses of poverty is supported by the fact that today poverty is not only being measured as income poverty, but also seen within a larger framework of “well-being”, which tries to take a comprehensive view on the livelihood of people.

Figure 3 illustrates an example for the view of the development cooperation community towards the relation between vulnerability and poverty. Here vulnerability is one of several factors determining poverty.



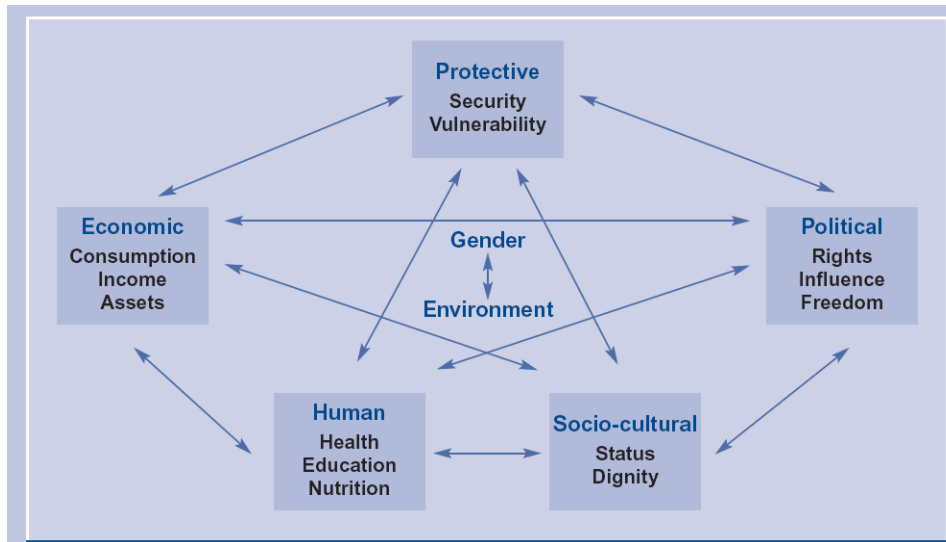


Figure 3: Dimensions of Poverty (GTZ 2005)

Researchers from the vulnerability community in contrast tend to view poverty as one element, which may contribute to an enhanced vulnerability. Thus Adger utilizes (income) poverty as an indicator for analysing vulnerability to climate change and to climate extremes, because poverty correlates with a limited access to resources (Adger 1998: 7). Vogel also emphasises the importance of access to assets (Vogel 2001: 3), while Cardona states: “One example is the case of poverty, which may well be considered a factor or contributing cause of vulnerability but is certainly not vulnerability in itself.” (Cardona 2004: 48). He concludes that the provision of basic needs is an important step towards a reduction of vulnerability.

The majority of works on the linkages between vulnerability and poverty expresses the view that these two approaches are closely connected and influence each other very deeply, while they are at the same time clearly distinct from each other. Particularly German Technical Cooperation (GTZ) points out that “vulnerability can be seen as a cause of poverty, as a reason why the poor remain poor, or as an effect of poverty” (GTZ 2005: 15). Prowse points in the same direction, when he talks about the “mutually-reinforcing nature of poverty and vulnerability” (Prowse 2003: 8).

The paradigm shift concerning vulnerability with a much stronger focus on the livelihood of the people than on the hazard itself implies the necessity to analyse the interconnections between these two concepts, as poverty weakens the livelihood of poor people on many levels: they often live in particularly exposed areas, have less assets to protect themselves, have weak governmental institutions, suffer from a lower health and educational standard, and have less capacities to cope with a disaster once it takes place (Cannon et al. 2003; Heitzmann et al. 2002; Adger 1998). Cardona summarizes these factors, which determine vulnerability under the aspects physical fragility or exposure, socio-economic fragility, and lack of resilience (Cardona 2004: 49).

Thus there is a tenor that poor people are generally more vulnerable, regardless of the hazard, although this is by no means a mandatory interconnection (Adger 1998; Wisner et al.

2004; Heitzmann et al. 2002; Cannon et al. 2003; Feldbrügge and von Braun 2002). The United States as a very wealthy country and the state Louisiana in particular were severely affected by the impacts of the hurricanes Rita, Wilma, and Katrina, which hit the east coast of the United States between August and October 2005. They caused more than 1.000 fatalities and economic losses of several hundred billion US\$. The hurricanes affected all parts of the population, although there are also reports saying that poorer people (e.g. people without cars or black people) were disadvantaged in contrast to wealthier people.

Some authors deal with the special case of vulnerability to fall below the poverty line or to stay there for a longer period (Alwang et al. 2001; Chaudhuri et al. 2002; Prowse 2003). A definition of vulnerability to poverty is given by Chaudhuri et al.: “We define vulnerability, within the framework of poverty eradication, as the ex-ante risk that a household will, if currently non-poor, fall below the poverty line, or if currently poor, will remain in poverty.” (Chaudhuri et al. 2002: 4). These approaches are mostly restricted to income vulnerability and they try to find a common metric for all indicators. Thus they are mostly restricted to money-metric approaches and tend to disregard other indicators that are more difficult to be translated into monetary terms (Alwang et al. 2001: 6; see also Kamanou and Morduch 2002). Chaudhuri et al. (2002: 6) give an example of this narrowed focus: “To estimate a household’s vulnerability to poverty we need therefore to, at a minimum, estimate both its expected consumption and the variance of its consumption.” Chapter 5.2 of this paper will give a more detailed view on attempts to measure vulnerability to poverty by using an economic approach. Generally the introduction of the vulnerability concept into poverty literature shows the recognition of the dynamic nature of poverty, in a way that vulnerability “as an ex ante and forward looking probabilistic measure” (Alwang et al. 2001: 8) gives information on the probability to fall below the poverty line. This introduction of the time reference of poverty is also expressed by the definition by Chaudhuri et al. given above.

## **5. POVERTY AND VULNERABILITY MEASURES**

This section outlines the most frequently used measurements of poverty and vulnerability. It should be pointed out that the discussion is not conclusive as there are other measures, particularly for measuring vulnerability that are still being developed, that are therefore not outlined in the chapter.

### **5.1 Poverty Measures**

There are several methods that are used to measure poverty. We briefly present some of the measures in this section and also highlight the advantages and disadvantages of each measure.

**5.1.1. Poverty Incidence or Poverty Rate, P<sub>0</sub>**

A **Poverty Incidence** or a **Poverty Rate**, usually denoted as **P<sub>0</sub>**, is the share of the population whose consumption (or income) is below the poverty line. This measure quantifies the share of the population that cannot afford to buy a basket of goods. When the unit of analysis is an individual, the poverty rate is also called a **Poverty Headcount Index** since it is the ratio of the number of poor people to the total population.

Mathematically, the poverty rate **P<sub>0</sub>** is given as:

$$P_0 = \frac{1}{N} \sum_{i=1}^N I(y_i < z) = \frac{1}{N} \sum_{i=1}^q 1 = \frac{N_p}{N}, \dots\dots\dots(1)$$

- Where: N = total population
- I(.) = an indicator function taking a value of 1 (poor) if the bracketed expression is true, and 0 (nonpoor) otherwise.
- y<sub>i</sub> = welfare indicator, e.g., consumption per capita
- z = poverty line
- N<sub>p</sub>= number of poor in the population

Besides being simple to construct, the Poverty Rate measure has an advantage of being easy to understand. It also has an advantage of being an adequate measure of assessing the overall progress in reducing poverty. However, the poverty rate suffers from major limitations. First, it ignores differences in well-being between different poor households by assuming that the poor are all in the same situation. Second, the index is not sensitive to changes in the welfare of individuals as long as they remain below the poverty line. The third limitation is that the index does not take the intensity of poverty into account.

**5.1.2. Poverty Gap Index, P<sub>1</sub>**

The second measure of poverty is the Poverty Gap Index, **P<sub>1</sub>**. It is the average, over all people, of the proportionate gaps between poor people’s living standards and the poverty line (as a proportion of the poverty line). It is also called the **Depth of Poverty Index**.

Mathematically the Poverty Gap Index is defined as:

$$P_1 = \frac{1}{N} \sum_{i=1}^N \left( \frac{z - y_i}{z} \right) I(z - y_i) = \frac{1}{N} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right) \dots\dots\dots(2)$$

where the variables are defined as in equation 1.

The *poverty gap index* measures the degree to which the mean income of the poor differs from the established poverty line (depth of poverty). The advantage of this measure is that it reflects the average shortfall of poor people, thereby giving a better understanding of the

depth of poverty. Another advantage of the  $P_1$  measure is that it shows how much would have to be transferred to the poor to bring their expenditure up to the poverty line. It is therefore easy to derive from the index, the *minimum* cost for eliminating poverty with transfers (i.e. the cost to eliminate poverty with perfect targeting of the poor and with no targeting costs or distortion costs). However, the major limitation of the  $P_1$  index does not capture differences in the severity of poverty among the poor and it ignores inequality among the poor themselves.

### 5.1.3. The Squared Poverty Gap Index, $P_2$

The third measure of poverty is the Squared Poverty Gap Index,  $P_2$ . It is the average of the square relative poverty gaps.  $P_2$  is defined similar to the Poverty Gap Index except that the poverty gaps are squared, thus giving the highest weighting to the largest poverty gaps. The *squared poverty gap index* captures differences in income levels among the poor. This measure is also called the **Severity of Poverty Index**.

Taking our previous notations,  $P_2$  can be defined as:

$$P_2 = \frac{1}{N} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^2 \dots\dots\dots(3)$$

The advantage of  $P_2$  is that it takes into account not only the distance separating the poor from the poverty line (i.e. the poverty gap), but also the inequality among the poor. In particular, the need for  $P_2$  arises because  $P_1$  may not adequately capture the distributional changes within the poor segment of the population. For example, if a policy is put in place which has an effect of transferring cash from an individual just below the poverty line to the poorest person, the Squared Poverty Gap Index would be able to reflect this change, which the Poverty Gap Index would not.

The major limitation of  $P_2$  is its lack for intuitive appeal because it is not easy to interpret it and so it is not widely used.

### 5.1.4. The Foster-Greer-Thorbecke Poverty Index

The Headcount Index, the Poverty Gap Index, and the Squared poverty Gap Index belong to a family of poverty measures known as the Foster-Greer-Thorbecke (FGT) Index. These are referred to as *decomposable* poverty measures. A poverty measure is said to be *decomposable* if the poverty measure of a group is a weighted average of the poverty measures of the individuals in a group (Aguirregabiria 2003).

The general formula for the FGT class of poverty measures is:

$$P_\alpha = \frac{1}{N} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^\alpha \dots\dots\dots(4)$$

where  $\alpha \geq 0$

The parameter  $\alpha$  reflects poverty aversion. Larger values of  $\alpha$  put higher weight on the poverty gaps of the poorest people. By setting  $\alpha=0$ , equation 4 reduces to a Head Count Index ( $P_0$ ). If  $\alpha=1$ , the equation 4 becomes a Poverty Gap Index, aggregating the proportionate poverty gap, which shows the shortfall of the poors' income from the poverty line, expressed as an average over the whole population.

### 5.1.5. The Human Poverty Index

While the measures of poverty that have been discussed in this section use income in the calculations, the Human Poverty Index (HPI) is a non-income measure of poverty. The Human Poverty Index is a measure of poverty that is increasingly being used by the United Nations Development Programme (UNDP) in its Human Development Reports. It is related to the Human Development Index (HDI) in that it measures *deprivations* in the three basic dimensions of human development that is captured in the HDI. These dimensions are: first, a long and healthy life and its corresponding deprivation used in the HPI is the vulnerability to death at a relatively early age, as measured by the probability at birth of not surviving to the age of 40. Second, knowledge – and the deprivation derived from this HDI dimension is the exclusion from the world of reading and communications, as measured by the adult illiteracy rate. Third, a decent standard of living – and the derivation used in the HPI is a lack of access to overall economic provisioning, as measured by the unweighted average of two indicators, the percentage of the population without sustainable access to an improved water source and the percentage of children under weight for age (UNDP 2005).

The HPI is calculated as follows:

$$HPI = \left[ \frac{1}{3} (P_1^\alpha + P_2^\alpha + P_3^\alpha) \right]^{\frac{1}{\alpha}} \dots\dots\dots(5)$$

where:  $P_1$  = the Probability at birth of not surviving to age 40 (times 100)  
 $P_2$  = Adult illiteracy rate  
 $P_3$  = Unweighted average of population without sustainable access to an improved water source and children under weight for age.  
 $\alpha = 3$

## 5.2 Measuring Vulnerability

While there is a consensus on the measures of poverty, most vulnerability measures are just been developed and some of them have not been widely adopted. It is also important to know that different disciplines measure vulnerability in different ways. This section presents important measures of vulnerability from the economics discipline, and the environmental science discipline.

### 5.2.1 Measuring Vulnerability: The Economics Approach

In the economics discipline vulnerability to poverty is measured as the probability that a household (or an individual), whether currently poor or not, would find itself poor in the future.

Usually, the concept of vulnerability is understood in the income space to express the probability that a household will become *consumption* poor in the future. In this case, vulnerability is measured with respect to the consumption poverty line.

Mathematically, vulnerability,  $V_{ht}$ , is measured as:

$$V_{ht} = pr(c_{h,t+1} \leq l) \dots\dots\dots (6)$$

where  $c_{h,t+1}$  is the household's per-capita consumption level at time t+1.

Following from the definition of vulnerability in equation 6, the determinants of the household consumption ( $c_h$ ) are used because a household's consumption pattern in any period is influenced by cross-sectional determinants of consumption as well as inter-temporal aspects of consumption. Consumption can therefore be presented in the following reduced form expression:

$$c_{ht} = c(X_h, \beta_t, \alpha_h, \varepsilon_{ht}) \dots\dots\dots(7)$$

where:  $X_h$  denotes a bundle of observable household characteristics

$\beta_t$  is a vector of parameters describing the state of the economy at time t

$\alpha_h$  and  $\varepsilon_{ht}$  represent, respectively, an unobservable time-invariant household-level effect, and any idiosyncratic factors that contribute to differential welfare outcomes for households that are otherwise observationally equivalent.

Substituting equation 7 into equation 6, the expression for the vulnerability can be rewritten as:

$$V_{ht} = Pr(c_{h,t+1} = c(X_h, \beta_{t+1}, \alpha_h, \varepsilon_{h,t+1}) \leq l | X_h, \beta_t, \alpha_h, \varepsilon_{ht}) \dots\dots\dots(8)$$

The expression in equation 8 suggests that a household's vulnerability level derives from the stochastic properties of the inter-temporal consumption stream it faces, and these in turn depend on a number of household characteristics and the characteristics of the environment it operates (Chaudhuri 2001).

Thus, the different types of shocks that households are faced with are incorporated in the measure of vulnerability to poverty. Covariant shocks such as droughts, floods, earthquakes, price rises, worsened terms-of –trade for agricultural products, and other health-related shocks that affect whole communities are represented in equation 8 as  $\alpha_h$ . Household-specific shocks such as job losses, death in the household, death of the breadwinner, indebtedness, illnesses, injury, and birth in the family are entered into the system as  $\varepsilon_{ht}$ . These shocks determine how a household is currently vulnerable to future consumption poverty, as denoted by the subscripts in equation 8.

**5.2.2 Measuring Vulnerability: The Environmental and Development Approach**

Different organizations working on environmental sustainability have developed different measures of vulnerability in order to advance their course. Among them include the Commonwealth Vulnerability Index, developed in 2000.

### **5.2.2.1 The Commonwealth Vulnerability Index (CVI)**

The CVI was developed based on three years of intensive research carried out with the mandate of the Commonwealth finance ministers and endorsed by the heads of government. The index was based on two principles: first, the impact of external shocks over which the country affected has little or no control; and second the resilience of a country to withstand and recover from such shocks. In this framework, therefore, vulnerability means exposure to exogenous shocks over which the affected country has little or no control, and relatively low resilience to withstand and recover from such shocks.

The CVI is a country-level index, which ranks developing countries according to measurable components of exposure and resilience to external shocks. The construction of the index is based on the observation that income growth volatility is the most apparent manifestation of vulnerability (Commonwealth Secretariat 2000). The three sources of this volatility that are used in the index are the lack of diversification (as measured by the United Nations Conference on Trade and Development's diversification Index); The extent of export dependence (as indicated by the share of exports in GDP); and the impact of natural disasters (as represented by the portion of the population affected, reflecting the cumulative frequency and impact of these events over a period of 27 years).

Finally, these sources of vulnerability are combined to form a composite index of the impact of the impact of vulnerability on developing countries. The resulting index is then weighted by average GDP as a proxy for resilience.

### **5.2.2.2 The Environmental Vulnerability Index**

The Environmental Vulnerability Index (EVI) has just been developed by the South Pacific Applied Geoscience Commission (SOCAP) and the United Nations Environment Programme (UNEP). It was developed through consultations with governments, institutions and leading experts throughout the world. According to UNEP and SOPAC (2005) the EVI has been developed to provide a rapid and standardised method for characterising vulnerability in an overall sense, and identifying issues that may need to be addressed within each of the three pillars of sustainability, namely environmental, economic and social aspects of a country's development. The main aim for the creation of the EVI is to promote sustainable development across the world and cooperation on issues relating to the world's natural life-support ecosystems.

The EVI is based on 50 indicators for estimating the vulnerability of the environment of a country to future shocks. These include indicators on weather and climate (6 indicators), geology (4 indicators), geography (6 indicators), ecosystem resources and services (28 indicators) and ecological processes and human interactions (6 indicators).

### **5.2.2.3 Prevalent Vulnerability Index**

The Prevalent Vulnerability Index (PVI) was developed by the Inter-American Development Bank. The PVI estimates vulnerability in terms of exposure in the prone areas, socioeconomic fragility and lack of social resilience. The PVI is an average of these three types of composite indicators. The indicators of exposure and resilience comprise average annual rate of population growth; the average annual rate of urban growth; population growth; the proportion of the population living below US\$1 per day PPP; and the amount of arable land as a percentage of total land area, among others. The indicators of socio-economic fragility are made up of the human poverty index; the number of dependents as a proportion of the total working age population; the concentration of income measured using the Gini Index, as a measure of social disparity; and the level of unemployment as a percentage of total labour force, among others. The indicators of lack of social resilience include the human development index; the gender-related development index; social expenditure on pensions, health, and education as a percentage of GDP; the Kaufmann governance index; and environmental sustainability index (Inter-American Development Bank 2004).

## **6. CASE STUDIES**

This section presents case studies from Malawi in southern Africa, and France and other countries in Europe to ascertain the importance of considering vulnerability in any social, economic and environmental analysis, and to outline the practical linkages between vulnerability and poverty.

### **6.1 The Impact of Drought in Malawi.**

Like many countries in Africa, Malawi regularly experiences severe and persistent droughts. In the past ten years, Malawi has been hit by severe drought for at least four seasons. Such droughts, combined with the devastating impact of HIV/AIDS, continue to threaten the livelihoods of thousands of families who depend on agriculture. It is estimated that the 2004/2005 drought left more than 5 million people (out of a total population of about 11 million) dependent on food aid. The same drought also reduced the food staple harvest to only 37% of the total food requirement.

The impact of the recurrent droughts is of great concern in Malawi, especially because the economy is based on rain-fed agriculture. Almost 85% of the population is employed in the agricultural sector, mostly as subsistence farmers. Drought prevalence makes the majority of these farming households highly vulnerable to poverty. The situation is worsened by the fact that majority of these farmers have no assets at their disposal. The few households with assets (mainly in the form of livestock and bicycles) end up selling the same to supplement their consumption in the face of drought.



The catastrophic consequences of droughts in Malawi are felt more in households that are affected by HIV/AIDS resulting in a reduced ability to cope. The experience of similar multiple shocks leaves such households with no option but to depend on food aid from the government, non-governmental organizations, and international humanitarian organizations. Lack of drought preparedness and mitigation strategies have further aggravated the hazardous effect of drought on the poor households. The presence of a large water body, Lake Malawi, has not been beneficial as the country lacks significant irrigation networks. The majority of the population, most of who lives below the poverty line, is pushed further into severe poverty whenever drought occurs.

## 6.2 Heat Wave 2003 in Europe



Picture 1: A thermometer in Alicante shows an unprecedented temperature of 64°C, which represents a new dimension even for southern Spain. (Source: Munich Re 2004: 26).

The summer (June to August) 2003 was the warmest summer ever recorded on the northern hemisphere, with temperatures being 3.4 °C above the 1961-1990 average in Germany (STARDEX). Temperatures in August exceeded nearly all heat records throughout Europe. This unprecedented event had severe economic and human consequences: it caused economic losses of 13 billion US\$, most of them in agriculture and as a cause of forest fires. Other negative effects were a restriction in inland shipping due to low water, production bottlenecks in industry and power plants because of heated river water, which caused problems in cooling, and a reduction in worker efficiency, which is certainly difficult to measure (Munich Re 2004: 23).

As the most severe effect, the heat wave caused between 22,000 and 35,000 excess fatalities all over Europe, most of them in France, as it can be seen in table 1.

	Fatalities
France	14,800
Spain	2,000
Portugal	1,300
Italy	4,000
Germany	3,500
United Kingdom	900
Netherlands	500

Table 1: Victims of the hot summer in Europe 2003. Source: Munich Re 2004: 25.

The large number of deaths in France was partly due to a higher perceived temperature, which was triggered by the higher humidity in that region. Figure 3 shows a map of the perceived temperature for Europe on August 8, 2003.

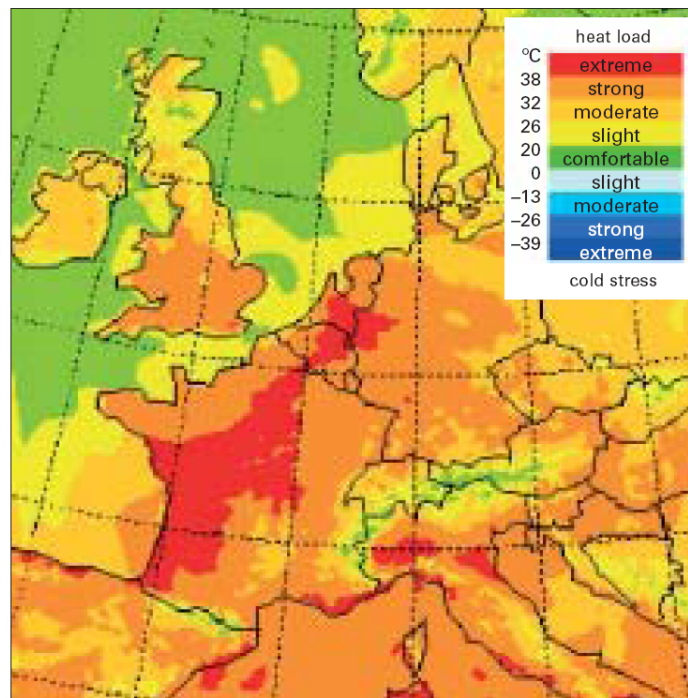


Figure 3: Perceived temperatures in Europe on August 8, 2003  
Source: Munich Re 2004: 25.

Studies for France revealed that particularly older people were affected by the unusual temperatures: “excess mortality in France was estimated at 20% for those aged 45-74 years, at 70% for the 75-94 year age group, and at 120% for people over 94 years” (Pirard et al. 2005). Excess mortality was also higher for women than for men (Pirard et al. 2005; WHO 2004). Infants and children in contrast were not particularly affected. A similar affect on the mortality of older people was also detected for other European countries, e.g. for England/Wales (Johnson et al. 2004) and for Switzerland (Grize et al. 2005).

People living in large cities also bore a higher risk of being affected by the temperatures: “In summer 2003 death rates in Paris were 130 per cent higher than in summer 2002, compared to a 20 per cent rise in rural regions (Milligan 2005). Finally one study found a reciprocal relation between the number of excess deaths and the socioeconomic status of the affected people in Italian cities, although there are doubts concerning the results, because many wealthier people could afford to leave the city during the time of the heat wave (Kosatsky 2005).

Interestingly there were clear differences in fatalities between French regions or cities, with Marseille and Nice being the most evident example: while the death excess was 53% in Nice, it was “only” 26% in Marseille. Apart from the fact that the number of older people is slightly higher in Nice, Marseille had already experienced a heat wave in 1983. Thus the city was prepared in a way that it had risk management plans for hospitals and a public communication strategy (Kosatsky 2005).

According to some studies (e.g. Meehl and Tebaldi 2004) weather situations like the one in the summer 2003 are likely to occur much more often in the future due to anthropogenic climate change. Furthermore there are projections saying that the number of older persons (60 years or older) will globally triple to almost two billion by 2050 (Milligan 2005). Therefore measures have to be developed to help particularly older people in coping with the effects of such extreme events. Needless to say that this is only one example, and similar measures have to be developed for other vulnerable groups and different hazards as well.

## **7. CONCLUSIONS**

The paper has attempted to unveil the complexity and multi-dimensional nature of vulnerability and how it relates to poverty. The discussion has shown that poverty and vulnerability are inherently intertwined. In recent years vulnerability has gained prominence due to factors like population growth, rapid urbanisation, environmental degradation and the increasing frequency and magnitude of natural disasters. As well as poverty is not restricted to income poverty nowadays, the concept of vulnerability also tries to develop a comprehensive picture by taking into account all relevant economic, political, environmental, and cultural aspects.

The three main types of vulnerability- to climate change; to natural disasters; and to economic shocks-all make households at risk of falling into poverty, if currently non-poor, or moving deeper into poverty, if already poor. On the other hand, poor households are more vulnerable to climate change, to natural disasters and to economic shocks. The different approaches of measuring poverty (both quantitative and qualitative) and vulnerability (economics and environmental) by different scientific disciplines clearly demonstrate the diversity of the subject.

The two case studies reinforce the fact that poverty and vulnerability are not synonymous, though highly interrelated. In the case of Malawi, the multiple shocks of HIV/AIDS and drought have greatly perpetuated poverty. The impact of the 2003 Europe heat wave was most severe amongst the elderly.

While this paper has attempted to review the emerging issues and current debate among scientists and the development community, more studies need to be done to clearly demonstrate the many linkages between poverty and vulnerability. Such studies would need to come up with appropriate policies to respective authorities on better coping strategies for vulnerable groups.

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