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Master of Science in Geography

Vulnerability of smallholder farmers to droughts. A case study on root causes and adaptation strategies in Laikipia County, Kenya

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Abstract

Millions of people are affected by droughts every year in the whole world. The 80,000 smallholder households of Laikipia County, Kenya are particularly susceptible to the consequences of droughts. They are living in arid and semi-arid lands (ASAL) and are directly affected by crop losses and death of livestock. Likely, climate change will even increase the frequency and intensity of droughts. Given these prospects, there is a need to build the adaptive capacity of smallholders and to reduce their vulnerability. Following a political economic approach, it is assumed that vulnerability is determined by underlying causes within the political and economic systems which lead to unsafe conditions of the community. If a community is lacking entitlement it is not able to cope with and to adapt to droughts, which in turn can lead to disasters. A case study in four villages in Laikipia County, Kenya has been conducted with the aim to identify root causes of vulnerability and existing adaptation strategies to drought. A livelihood analysis enabled to identify key priorities where action needs to be taken to make the conditions of smallholders safe.

Keywords: vulnerability, drought, adaptive capacity, smallholder farming, entitlements approach, ASAL, Laikipia, Kenya

Résumé

Des millions de personnes sont touchées par des sécheresses chaque année dans le monde entier. Les petit.e.s fermier.ère.s.x des zones arides et semi-arides, tels que les 80 000 ménages du Laikipia County, au Kenya, sont particulièrement susceptibles de subir les conséquences des sécheresses, car ils sont directement touchés par des pertes de récoltes et la mort du bétail. Vraisemblablement le changement climatique augmentera même la fréquence et l'intensité des sécheresses. Compte tenu de ces prévisions, il est nécessaire de renforcer la capacité adaptative des petit.e.s fermier.ère.s.x et de réduire leur vulnérabilité. Selon l'approche d'économie politique, la vulnérabilité est déterminée par les causes sous-jacentes au sein des systèmes politiques et économiques qui produisent des conditions incertaines pour la communauté. Si une communauté manque d'*entitlements*, ces capacités à faire face et à s'adapter aux sécheresses sont moindres, ce qui peut provoquer une catastrophe. Une étude de cas dans quatre villages de Laikipia County, au Kenya, a été menée dans le but d'identifier les causes premières de la vulnérabilité et les stratégies d'adaptation aux sécheresses existantes. Une analyse des *livelihoods* a permis d'identifier les mesures les plus urgentes à prendre afin d'assurer la subsistance des petit.e.s fermier.ère.s.x.

Mots clés : vulnérabilité, sécheresse, capacité adaptive, petits fermiers, approche par les entitlements, zones arides et semi-arides, Laikipia, Kenya

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List of Acronyms

ASAL	Arid and semi-arid lands
CA	Conservation agriculture
CRED	Centre for Research on the Epidemiology of Disasters
DRR	Disaster Risk Reduction
EM-DAT	Emergency Events Database
HFA	Hyogo Framework for Action 2005-2015
IDNDR	International Decade for Natural Disaster Reduction
NDMA	National Drought Management Authority
PAR	Pressure and Release (model)
SDG	Sustainable Development Goals
SFDRR	Sendai Framework for Disaster Risk Reduction 2015-2030
SLA	Sustainable Livelihoods Approach
SLF	Sustainable Livelihoods Framework
SPI	Standardised Precipitation Index
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Reduction
UNISDR	United Nations International Strategy for Disaster Risk Reduction
WRUA	Water Resource Users Association
VCA	Vulnerability and Capacity Assessment

1 Introduction

Climate-related hazards, such as droughts, are happening all over the world year in, year out. Such events can easily lead to a disaster in situations where the population is vulnerable, which is especially the case in Sub-Saharan African countries. Droughts affect an estimated number of 55 millions of people worldwide every year (WHO, n.d.) and it is the natural hazard that has been responsible for most casualties in the last decades (Wisner et al., 2004, p. 3). According to scenarios of the Intergovernmental Panel on Climate Change (IPCC, 2013), the likelihood of climate-related hazards will increase with raising mean temperature of the atmosphere and the oceans. The lack of rainfall, leading to droughts, can perturb agricultural and livestock production. This, in turn, can have severe consequences, in particular for subsistence farmers – amongst other groups – whose main activity to secure their livelihoods is farming. Potential impacts of a changing climate make smallholder farmers highly vulnerable. Also the political economic framework in which the farmers are embedded, shape their adaptive capacity and the vulnerability to droughts.

80% of Kenya's surface is classified as arid or semi-arid zones (Ochieng & Yitambe, 2012). Between 1990 and 2014 46.15 million people were affected by droughts, which makes Kenya the third most affected country worldwide (González Tánago et al., 2016). The study region in Laikipia County is also characterised by arid and semi-arid climate. Sixty per cent of population identifies agriculture as their main source of income (MoALF, 2017). At the same time, almost half of Laikipia's population live below the poverty line (Wiesmann et al., 2016). Droughts exacerbate the pressure on land and water resources, which are already increased in the region due to population growth and the various water users along the rivers, such as large-scale horticultural and floricultural farms (Zaehringer et al., 2018). It is assumed that smallholder farmers are exposed to droughts because they rely on sufficient rainwater supply for their crop production that is mainly used for home consumption. If their cultures or livestock lack of water, the production cannot be maintained and they risk of crop failure and death of livestock, respectively. Such a scenario leads to a deterioration of livelihoods, which has severe consequences for smallholder

households. In many cases, there are not enough funds available to compensate the crop losses with food purchases, which can lead to malnutrition. Droughts are therefore likely to aggravate poverty and increase the risk of food insecurity. This dependence on agricultural production makes smallholders particularly vulnerable to droughts. Not only the exposition makes them vulnerable but also their lack of political power. Smallholders are economically and politically marginalised. This lack of entitlement impedes capacity building to cope with droughts and other shocks. Droughts will always, without doubt, affect agricultural production. Yet, there are dimensions on the institutional and the household level that can be improved to make smallholders more resilient against droughts.

This master's thesis can be located in the context of disaster risk reduction (DRR). In this school, it is assumed that a disaster, such as famine, can only occur when the population experiencing a hazard is vulnerable. To reduce the risk of disasters it is vulnerability that needs to be addressed. Vulnerability is understood as to be shaped by a population's adaptive capacity and by structures and processes of the political, economic and social system this population is living in. This means that there are root causes of vulnerability on a subordinate level, that cannot directly be addressed by the farmers itself, especially when they lack political power. It is necessary to analyse the root causes and to identify priorities of action to reduce smallholders' vulnerability and to improve their conditions in the long term. Measures should improve their adaptive capacity to make them more resilient against shocks, especially with regard to climate change and the future challenges that come with it.

Vulnerability reduction should be a development objective as vulnerability and underdevelopment are mutually linked (Ahrens & Rudolph, 2006). Disasters have severe consequences for entire economies. Especially so-called developing countries, which are struggling with poverty, high national debt, inflation and other challenges, are severely affected by hazards. Droughts, which lead to crop shortfalls, loss of jobs and capital depletion, can even increase these challenges. At the same time, such countries are more susceptible to disasters because they do not have the resources for early warning systems or cannot protect their population (Ahrens & Rudolph, 2006; Morgan, 2011).

1.1 Research objectives

The two main objectives of this master's thesis are the identification of root causes of the vulnerability of smallholder households in Laikipia, as well as the identification of adaptation strategies. The first, as explained, is necessary to tackle the problem at its source. Only by approaching the underlying causes and by building the adaptive capacity of smallholder farmers, vulnerability can be reduced sustainably. The latter is especially important regarding new challenges that will bring climate change. Through their experience over generations, smallholders have developed strategies to help them cope with droughts and adapt to them. The identification and analysis of existing adaptation strategies might help to assess which strategies work better and generate higher outputs. Ideally, this will help other farmers adopt the same strategies. It is acknowledged that the success of adaptation or livelihood strategies is context-specific. Strategies might not work for every household in the same manner, depending on climatic and geophysical conditions, as well as on the socio-economic context and the composition of the household.

In order to attain the two objectives, this master's thesis set the subsequent research questions:

> **What processes and conditions generate the vulnerability of smallholder households to droughts in Laikipia County, Kenya?**
>
> **How do the livelihood strategies of smallholder households in Laikipia County, Kenya influence their vulnerability to droughts?**

This research is based on two perspectives; a perspective that looks at the political economy in which smallholder farmers are embedded, and a livelihood perspective. Using a household survey, a livelihood analysis was carried out to learn about coping and adaptation strategies of the respondents as well as their perception of droughts. Information about the households livelihood assets was used to evaluate the different livelihood strategies and their influence on vulnerability. Expert interviews were conducted to gain another view on the farmers' issues and to learn about political and economic dimensions. The data collection was followed by a mixed methods analysis approach. Simple statistical calculations were used to identify relationships between different indicators. These relationships were then further analysed qualitatively.

It is the small-scale subsistence farmers who are of interest for this research, as they are directly affected by droughts and because they make up a significant part of Laikipia's population. However, neither “small-scale” nor “subsistence” are suitable terms to describe the target group. On the one hand, most of the smallholder farmers also generate an off-farm income and sell parts of their harvests from time to time, which does not correspond completely to the definition of subsistence farming. On the other hand, the scale of the farms can vary considerably and it was not considered to be useful to set limits according to the farm size. The target group in question can be described as rather small farms that produce mainly for their own needs – with or without livestock farming – and that are characterised by low inputs and low mechanisation. In this work, the term smallholder households was used.

1.2 About droughts

Today, the DRR school sees hazards as more or less natural events, phenomena or processes that affect the built and human environment, often causing damage and loss of life. This work is about the hazard drought. Drought cannot be described as one specific event. Rather, it is a gradual process whose intensity is determined by its duration and which can extend to large areas. The effects of a drought can therefore be noticed in different places at different times, as opposed to a landslide for example (UNDRR, 2019). Also the impacts are less direct compared to other hazards. Droughts rarely lead directly to fatalities. It is rather famines or conflicts resulting from droughts that threaten people's lives.

Droughts should be distinguished from aridity, which is a normally dry climate (e.g. desert) and from seasonal dry spells that usually happen between rainy seasons and may be part of the normal climatic conditions of a region (UNDRR, 2019). It is an unusual dryness that occurs in a certain region during an extended period (Smucker, 2012). Three types of drought can be distinguished. (1) Meteorological droughts are characterised by a low amount of rain, often in combination with increased temperatures, over a long period, compared to long-term averages. A meteorological drought does not necessarily lead to a reduction in agricultural production, as the latter is determined by soil moisture and not by precipitation only. (2) Agricultural drought is defined as a period where the soil moisture is insufficient to maintain crop growth. And at last, (3) hydrological droughts occur when

water demand is higher than supply by stream flows and groundwater levels (Smith & Petley, 2009; Smucker, 2012; UNDRR, 2019). In the present master's thesis, it is certainly the agricultural drought which is of importance. However, it is caused by unusual meteorological conditions with too little precipitation and also hydrology plays a role in the present case because farmers partly draw water from rivers to irrigate their fields. It can be seen that a distinction of drought types is difficult to apply in practice and does not appear to be meaningful for this research. More information about droughts in the study region will be discussed in section 5.2.

1.3 Outline of the master's thesis

After this introduction into the research topic, the presentation of the study area follows, where the most relevant aspects of the political, economic and social context, as well as climate-related conditions in the study region are discussed. Chapter three shows the theoretical basis of the applied approach. A presentation of the historical development of the DRR school is followed by a detailed discussion of the concept of vulnerability. Afterwards, it is explained how the Pressure and Release model (PAR) served as a conceptual framework and how it is applied to the case study. The entitlements approach of Amartya Sen forms the theoretical basis of this master thesis and will be discussed at the end of the same chapter. Chapter four explains the different steps of the fieldwork with the data collection and analysis process. Chapter five presents the results of different aspects which are then put in relation to the theory in chapter six. There, also recommendations for action on the identified focal points are given. And finally, chapter seven provides an overview of the conclusions that could be drawn from the analysis.

2 Study area and context

In this chapter the geographical context of the study region will be presented. The study region in the southwestern part of Laikipia County, Kenya, consists of four villages, Mia Moja, Ngenia, Matanya and Naibor (see figure 2.1). The latter two are situated within the semi-arid area, whereas Mia Moja and Ngenia are situated on the border of the semi-humid area (see figures 2.1 and 2.2). The villages are dominated by agro-pastoralist mixed farming systems, in which the farmers practise subsistence farming on rainfed lands (Kohler, 1987; Mutea et al., 2019; Ulrich et al., 2012). Given that Laikipia is dominated by arid and semi-arid lands, it has regularly been hit by droughts (MoALF, 2017). This and the socio-economic structure make Laikipia an ideal study region for this research.

2.1 Geographical situation

The study area is lying in the rain shadow of Mount Kenya in the north-east to the mountain in the centre of the country. This iconic mountain surrounded by a moderate topo-

Figure 2.1: Study region: Location of the four study villages (blue points) within Laikipia county, Kenya
Source: Google My Maps, adapted by the author

graphy leading to rainfall in the otherwise rather dry county and thus provides for different agroclimatic zones within the region (see figure 2.2). Although the windward side in the opposite direction of the mountain receives more rain, the southeast of Laikipia receives up to 1000 mm rain per year. The area on the slopes of Mount Kenya is therefore characterised by a humid to semi-humid climate. The further north, with increasing distance to the mountain and decreasing altitude, the drier it is. In the north of Laikipia, only 400 mm of precipitation per year can be expected (MoALF, 2017, p. 9). As can be seen in figure 2.2, the western part of Laikipia is rather humid as well, influenced by the forested Aberdare range. Nevertheless, the climate in the study area is mainly dominated by Mount Kenya.

Most precipitation normally falls during two distinct rainy seasons; the long rains from March to May and the short rains from October to early December (Wiesmann et al., 2016, pp. 20–24). However, for some years now the beginning and the duration of the rainy seasons, as well as the amount of rain do not correspond to the usual pattern. Lately, rain does no longer tend to fall evenly distributed. Instead, erratic heavy rainfall events are occurring frequently, further endangering already degraded soils and causing floods, as a matter of surface runoff due to the impossibility to infiltrate dry soil (Providoli et al., 2019).

The study region lies on the Equator and is characterised by the Ewaso Ng'iro river and its tributaries, which constitute the largest drainage basin in Kenya in terms of area

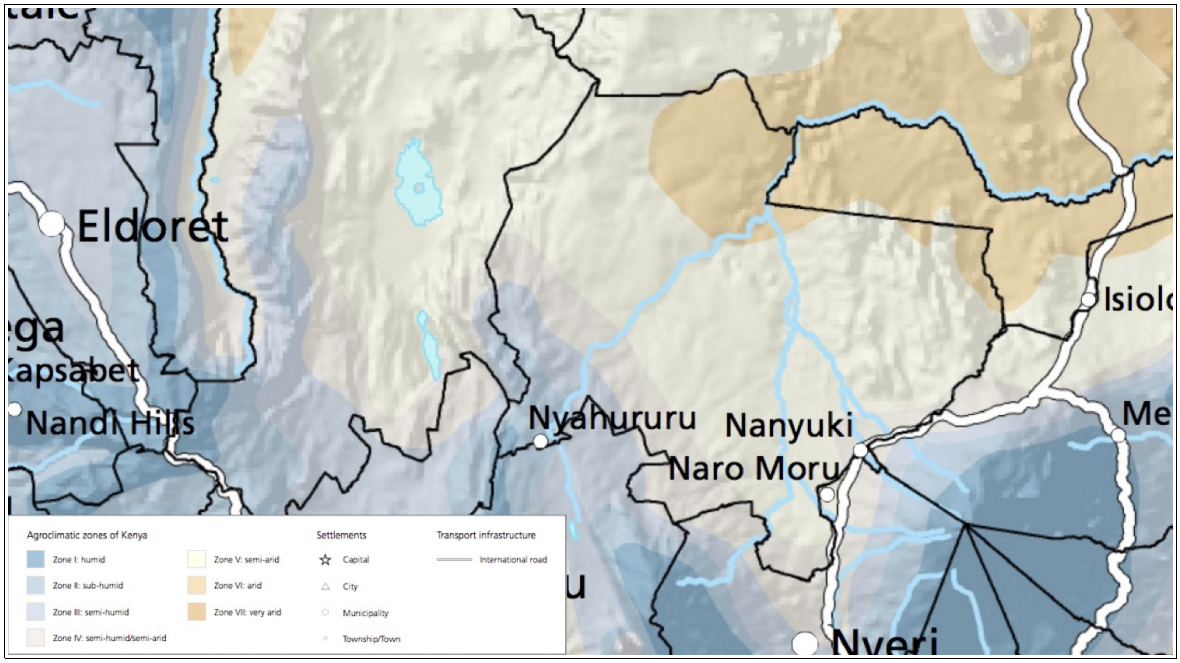

Figure 2.2: Agroclimatic zones of Kenya. The section shows Laikipia County with its capital Nanyuki and the main tributaries of the Ewaso Ng'iro river
Source: Wiesmann et al. 2016

(Wiesmann et al., 2016). Almost the entire surface of Laikipia is part of its catchment area and therefore it is an important resource for the whole region. The Ewaso Ng'iro originates on one side from the Aberdare range and on the other side from Mount Kenya. Its stream leaves Laikipia by the north and continues towards east and southeast before joining the Jubba river in Somalia. Between 1960 and 2000 the monthly mean discharge at Archer's Post, some 120 km after the county border of Laikipia, lies between 7.43 m^3/s and 52.82 m^3/s (Gichuki, 2002, p. 118). Nevertheless, the river has already completely dried out during the dry season (Gichuki et al., 1998; Providoli et al., 2019). As will be discussed in the following section.

2.2 Economy and society

The following indicators about Laikipia County were surveyed by the national census 2009, presented in the Socio-Economic Atlas of Kenya (Wiesmann et al., 2016). At the time of the census, 47.9% of Laikipia's population lived below the poverty line[1], 22.7% were considered unemployed and 42.8% of the working population had an activity in the informal sector. Almost half of the population was younger than 18 years. This translate into a large pressure for the other half of the population to raise and educate the young. It also means increased pressure on subsistence systems, as poorer households and those affected by unemployment are more dependent on their production. 54% of the households had access to safe water, sourcing mostly from piped water of boreholes. The majority of the households without safe water sources obtained the water directly from rivers or lakes. Still 92.5% of the households in Laikipia used either firewood or charcoal for cooking and only 17.7% had access to electricity for lighting.

Laikipia is inhabited by different ethnic groups. Today the population consists of 63% Kikuyu and a considerable part of Maasai. Besides, Kalenjin, Luo, Samburu and Meru also live in Laikipia, especially in the border regions to other counties. Laikipia is dominated by Christian religion; 34.9% belong to the Catholic Church and 59.2% to the Protestant Church or other Christian communities (Wiesmann et al., 2016, pp. 54–57). Laikipia, with its 518,560 inhabitants on 9,532.2 km^2 has a population density of 54 people per km^2 (KNBS, 2019b). However, this figure is distorted by the sparsely populated north. In the

1 In the indicated source (Wiesmann et al., 2016, p. 106), the poverty line was set at 1,562 Kenyan shillings (KSh) mean monthly expenditure per person, which is equivalent to 14.53 US Dollars at today's prices.

Figure 2.3: Different types of vegetation in the semi-humid area (left) and the semi-arid area (right). Mount Kenya in the background on both pictures
Both pictures taken by the author

study region, 67 people per km^2 must rather be counted. This corresponds to the average population density of the sub-county Laikipia East (KNBS, 2019b).

The difference in precipitation discussed above is reflected directly in the vegetation and economic activity within Laikipia (see figure 2.3). Traditionally, the forested slopes and plains of Southern and Western Laikipia are dominated by small-scale mixed farming systems. Smallholder farmers grow various staple foods such as corn, beans, wheat and potatoes, as well as vegetables, mostly cabbage, *sukuma wiki* (a kale-like leafy vegetable) and spinach (Käser, 2018). Of Laikipia's total surface, about 20% (198,400 ha) can be cultivated (MoALF, 2017). In contrast, the savannahs of the north can only provide a livelihood for pastoralists (Kohler, 1987; Zaehringer et al., 2018). Besides, large parts are used for livestock farming and game reserves (MoALF, 2017).

In addition to smallholders, pastoralists and cattle ranches, another stakeholder group has settled in the semi-humid part of Laikipia since the 1990s (Ulrich, 2014, p. 337); i.e. industrial horticulture farms and flower farms, both producing mainly for foreign markets. Today, 60% of Laikipia's population depend on agriculture or livestock farming as their main source of income, contributing for almost half of the county's GDP (KNBS, 2019a, 2019b; MoALF, 2017). The other half stems from the sectors wholesale, transportation, public administration, financial services, construction, and real estate activities each account for 5% to 8% of GDP (KNBS, 2019a). Although tourism has only a marginal impact on GDP, it is present in the region. In Laikipia, there are several game reserves and conservancies, where among other wildlife the last two remaining Northern White Rhinos at-

tract people from all over the world (Ol Pejeta Conservancy, 2019). The numerous hotels in and around Nanyuki are also used as starting points for hikes to Mount Kenya. The county capital Nanyuki with its approximately 72,813 inhabitants is an important economic hub for the region (Käser, 2018; KNBS, 2019c, p. 241). Here, farmers and traders can sell their goods as well as buy seeds, fertilizer and utensils for their farm.

Figure 2.4: Centre of Nanyuki, urban and economic hub, and capital of Laikipia County
Picture taken by the author on 29 January 2020

The smallholders, who live upstream, draw water directly from the river partly to irrigate their fields or for domestic use and their livestock. The pastoralists further downstream rely on the river to supply their cattle with water (Kohler, 1987; Mutea et al., 2019; Ulrich et al., 2012). Also the large-scale farms, however with more sophisticated and efficient systems, do irrigate their fields (Ulrich, 2014). In the 1990s and the beginning of the 21st century, the lower part of the river dried out repeatedly due to increased abstractions of water further up the river during the dry season (Gichuki et al., 1998; Providoli et al., 2019). Especially in times of drought this conflict of use can increase tensions. During droughts, pastoralists are forced to move to more humid areas in the south, which is characterised by small farms and not, as they are used to, by open pasture land. This has led to violent conflicts in the past decades. Conflicts that are also ethnically motivated and that have their origin in the postcolonial history of the region (Providoli et al., 2019).

2.3 Historical context

In 1911 white settlers, searching for grazing grounds for their sheep and cattle, forced the Maasai, who inhabited a large part of Laikipia, to move northward (Laikipia Wildlife Forum, 2012). The fertile soils of the Kikuyu land south and west of Mount Kenya between Nairobi and Laikipia also attracted the interest of the settlers. Hundreds of thousands of Kikuyus had their land expropriated and they were driven into reserves where they had to live in great poverty and in spatially limited conditions resulting in a high population density (Newsinger, 1981). For the Kikuyu, who have always practised agriculture, this meant the deprivation of their basis of livelihood. This and other racial discrimination led to the formation of the so-called "Mau Mau" movement in 1950, led mainly by Kikuyu. The "Mau Mau" started an uprising in 1952 to reclaim their lands and the independence of Kenya, which escalated into a seven-year war and resulted in tens of thousands of dead Kikuyu (Käser, 2018; Newsinger, 1981). Although the uprising was defeated, the colonial government made some concessions regarding land. As a result of negotiations, the native population gradually became more and more involved in political processes, which finally led to the declaration of the independent Republic of Kenya from British East Africa in 1963. After the independence, many of the settlers returned to Europe and sold their land to the state (Käser, 2018). Because of the freed land, the state started to settle Kikuyu people from other regions. As a result, the population in Laikipia increased rapidly (Laikipia Wildlife Forum, 2012; Providoli et al., 2019). Kikuyu traditionally grow vegetables and thus the south of Laikipia changed from acacia-dominated grassland to a mosaic-like landscape of small-scale farms. This land-use change and the strong population growth led to the fact that more and more water was withdrawn from the river and, as a consequence, the river began to dry out (Eckert et al., 2017). Favouritism of the ruling Kikuyu led to ethnic tensions, which came to a head in 2007 with post-election violence. 1,500 people were killed and 600,000 internally displaced. The riots were triggered by the fact that both the sitting president and his opponent claimed to have won the election.

2.4 Political context

The Republic of Kenya is a presidential representative democratic republic, in which the elected officials represent the people and the president is the head of state and government

(Modi & Shekhawat, 2008). From independence in 1963 until 1991 Kenya's politics were organised in a one-party system characterised by corruption and favouritism. Despite the existence of several parties, power in this still young unitary state was very concentrated among a few political elites. The parties followed ethnic lines rather than political ideologies, which eventually laid the foundation for the post-election violence in 2007 mentioned above (Cornell & D'Arcy, 2014).

The new constitution of 2010 aimed to devolve the power to the newly formed 47 counties and to better represent the regional differences within the country. With the new constitution, many powers went from the state to the counties. These include agriculture, health services, transportation, county planning and development as well as the fire fighting services and disaster management (Constitution of Kenya, 2010).

3 Theoretical context and framework

This chapter will present the theoretical framework. Before discussing the theory underlying this work, it is considered important to present various concepts, to better understand the application of the theory in the particular context of this master's thesis. As already indicated in the introduction, this master's thesis is located in the context of DRR. The United Nations International Strategy for Disaster Risk Reduction (UNISDR) defines DRR as

> *"the systematic development and application of policies, strategies and practices to minimise vulnerabilities, hazards and the unfolding of disaster impacts throughout a society, in the broad context of sustainable development"*
>
> (UNISDR, 2004b, p. 3)

Such practices may include "*early warning, risk analysis and management, communications and longer-term recovery*" (Sudmeier-Rieux et al., 2017, p. 2). In the above definition, we can identify three important elements: disaster, hazard and vulnerability. These three elements and others will be discussed in this chapter in different sections. But first, the development of the DRR perspective will be briefly presented.

3.1 Disaster Risk Reduction

Before the 1970s disasters were seen as completely natural and unavoidable, caused by a hazardous event. It was rather the natural sciences that dealt with disasters to gain knowledge about how disasters can be managed (Mercer, 2010; Peduzzi, 2019; Wisner et al., 2004). Over time it has been recognised that disasters are multifaceted events that are determined by the hazard which precedes it, exposure and vulnerability. The influence of social sciences on DRR led to disasters being increasingly seen as embedded in its socio-economic and political context (Mercer, 2010). Vulnerability was further developed in the 1980s by the social sciences and applied to DRR. At the same time, a global understanding was developed that environmental problems do not stop at national borders. The Chernobyl

accident and the discovery of the hole in the ozone layer contributed significantly to this understanding (Peduzzi, 2019). Maybe as a reaction to this development, the United Nations declared the decade of 1990-1999 the International Decade for National Disaster reduction (IDNDR) (Peduzzi, 2019). One major achievement of the IDNDR was the rethinking of top-down approaches. It was recognised that NGOs and communities must be involved in the various processes of DRR (Wisner et al., 2004). In order to continue the work of the IDNDR, the United Nations Office for Disaster Reduction (UNDRR) (formerly United Nations International Strategy for Disaster Risk Reduction (UNISDR)) was founded to support countries in implementing and monitoring measures to reduce existing and prevent new risks (UNDRR, 2020a).

By this time, vulnerability has been integrated in the risk discourse. It was generally acknowledged that risk is made of the hazard and the population's vulnerability. The concept of vulnerability was further developed and there were attempts to measure vulnerability using standardised indicators. The United Nations Development Programme (UNDP) published the Disaster Risk Index in 2004, an approach for quantitative risk assessments. Right after the Indian Ocean tsunami, the Kobe Conference took place where 168 countries approved the Hyogo Framework for Action 2005-2015 (HFA), the first global framework on disaster risk reduction (Peduzzi, 2019, p. 8). The HFA stated that the development of vulnerability indicators are key for risk reduction, as it argues that vulnerability needs to be measured to bring decision-makers to action (Birkmann, 2006). These 168 countries agreed upon five priorities of action:

1. *Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation*
2. *Identify, assess and monitor disaster risks and enhance early warning*
3. *Use knowledge, innovation and education to build a culture of safety and resilience at all levels*
4. *Reduce the underlying risk factors*
5. *Strengthen disaster preparedness for effective response at all levels*

(UNISDR, 2007, pp. 5–13)

Yet, there is criticism that governments did not take enough action on different levels. Building local institutions or providing training and research were left out. Besides, the governments were not able to allocate enough finances regarding risk reduction (Collins,

2017; Wisner et al., 2012). Hewitt (2017) furthermore argues that the implementation of the HFA neglected the inclusion of local knowledge and the '*underlying risk factors'*. In 2015 then, "*three major new agreements were reached to improve the global environmental governance, which all have a clear focus on reducing disaster risk*" (Peduzzi, 2019, p. 9). The first of these agreements is the Sustainable Development Goals (SDGs) with at least 5 targets in which the risk reduction or the strengthening of resilience against hazards are an integral part. These are part of the goals number 1 (No Poverty), 2 (Zero Hunger), 11 (Sustainable Cities and Communities), and 13 (Climate Action) (United Nations, 2020). Secondly, the Paris agreement of the COP21, with the goal of limiting the global warming below 2° C above pre-industrial level, which should mitigate the risk of climate-related hazards (Parties to the UNFCCC, 2015). And thirdly, the successor framework of the HFA, the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR), which contains updated challenges that governments should tackle and which defines four priorities:

1. *Understanding disaster risk*
2. *Strengthening disaster risk governance to manage disaster risk*
3. *Investing in disaster risk reduction for resilience*
4. *Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction*

(UNISDR, 2014, pp. 14–22)

The participation of communities and a stronger emphasis on gender aspects were taken into account in the new framework (Texier-Teixeira & Edelblutte, 2017). This acknowledges the importance of traditional knowledge of communities which have coped with hazards and changes for generations (Mercer, 2012). It also highlights that risk situations are context-specific and that solutions and measures must be adapted to the respective cultural, political, and socio-economic context. Together with a focus on underlying factors, it primarily tries to compensate the neglect during the implementation of the HFA (Hewitt, 2017). Thus, the adoption of the SFDRR represented a paradigm shift from reactionary approaches to prevention (Mizutori, 2020). However, it is questionable whether the SFDRR will achieve its targets, as the governments are still unable to allocate adequate finances to secure implementation and monitoring of DRR programmes (Mizutori, 2020). Wisner (2020) furthermore argues that the targets are not enough ambitious. The issues related to global warming that the world will experience until the end of the SFDRR in 2030 will

already exceed the framework's ambitions. After this historical outline, the next section explains the main concepts of DRR.

3.1.1 Key concepts of DRR

At first, it is important to distinguish disasters from hazards. Since this work is in the context of droughts, the term hazard does not imply incidents triggered entirely by human activities, e.g. the release of toxic substances from a factory. Rather, a hazard is understood as a natural event or process that cannot be influenced or avoided by human action, e.g. an earthquake or a hurricane. However, hazard does not necessarily lead to disaster because the risk of disaster – other than the hazard event itself – can be influenced and reduced by human action. Disasters only occur when a community is not able to bear the impact of a hazard with its own resources. Measures can be taken to mitigate the consequences of a hazard or to avoid a disaster (Estrella & Saalismaa, 2013; Wisner et al., 2004) (see the full definitions of these and other concepts in the appendix, chapter 9). In the context of climate change, it is now assumed that hazards as well are not completely natural events, but that they can be influenced anthropogenically, e.g. the changing climate system due to CO_2 emissions.

In contrast to the UNDRR definition (see appendix), Wisner and colleagues (2004, p. 49) describe disaster risk as a function of hazard and vulnerability, where exposure and capacity are seen as being part of hazard and vulnerability respectively. They argue that

> "*[a] disaster occurs when a significant number of vulnerable people experience a hazard and suffer severe damage and/or disruption of their livelihood system in such a way that recovery is unlikely without external aid*"
>
> (Wisner et al., 2004, p. 50)

Another important distinction to be made is between coping and adaptive capacity. Coping is understood as short-term reactions to overcome an immediate event or shock, while adaptation is rather understood as long-term adjustments of a system to mitigate the impacts of continuous threats or future events (Maachi, 2011). It follows a more detailed discussion of vulnerability and its conceptualisation proposed in the Pressure and Release model of Wisner and colleagues (2004). With the gained knowledge of the context and concepts, it will be possible to understand how the theory – the Entitlement approach of Amartya Sen

(1981) – was applied to the research topic.

3.2 Vulnerability

Vulnerability as a concept has been applied in DRR for half a century, but it has changed a lot since then. In the 1970s until the appearance of the HFA in the mid-1990s, vulnerability was rather used to describe quantitatively the degree of risk or to show countable damages (Romieu et al., 2010). Measures to reduce disaster risk were mostly technical in nature (Wisner et al., 2004), a view that was mostly shaped by natural scientists. With the HFA, social factors were integrated into vulnerability for the first time. This represented a shift – initiated mainly by efforts of the social sciences – away from impact assessments towards the analysis of the systems being at risk (Luers et al., 2003). Approaches to quantitatively measure vulnerability were further developed. It was – or still is – considered necessary that decision-makers dispose of quantifiable data as a basis for action (Birkmann, 2006; Wisner et al., 2004).

The differences between the natural and the social sciences have remained until today. While the natural sciences understand vulnerability rather as the probability of the occurrence of an event and its impacts, the social sciences understand vulnerability as a combination of characteristics that cause communities or individuals to suffer from adverse events (Fuchs et al., 2012). The UNDRR (2020b) defines vulnerability as

"the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards"

This definition acknowledges that vulnerability is not simply the probability of a risk but that it incorporates aspects sourcing from a wide range of systems. However, by this definition, it is still not clear why people or communities are vulnerable, or how these factors influence their vulnerability. The social sciences try to consider this critique by emphasising that the factors mentioned in the above definition shape people's capacity to cope with or to resist the impacts of a hazard (Fuchs et al., 2012; Gbetibouo & Ringler, 2009; Lazarus, 2011; Misselhorn, 2005; Wisner et al., 2004). Climate change research is a third school which has a different view of vulnerability. There, vulnerability is seen as a function of exposure, sensitivity and adaptive capacity (CARE, 2009; González Tánago et al., 2016;

Taubenböck et al., 2008). This represents vulnerability as having two sides – a stressor side (exposure) and a mitigation side (sensitivity and adaptive capacity) (Füssel & Klein, 2006; Taubenböck et al., 2008).

Since exposure is not explicitly accentuated by the social sciences in their definition, there, vulnerability is often presented as having an internal, social and an external, physical part. The internal dimensions concern the insecurity as well as the capacities of the people. On the other side, external dimensions include exposure to risks and hazards (Fuchs et al., 2012; Gbetibouo & Ringler, 2009; Lazarus, 2011). Seen like this, these two types of definitions do not seem very different. However, the definition used in the climate change school rather takes the physical situation as given and looks for possibilities to adapt to change. They ask about *who* is vulnerable (Ribot, 2014). The social sciences are more interested in the reasons *why* people are vulnerable; reasons that are influenced by physical, social, economic, environmental and political factors and processes (Maharjan et al., 2017; Taubenböck et al., 2008). Their goal is to reduce vulnerability by tackling its underlying causes. A perspective which corresponds to the research questions posed in this master's thesis. Accordingly, the definition of vulnerability used in the present work follows this latter political economy perspective. As will be described in the next section, the Pressure and Release (PAR) model by Wisner et al. (2004) is used to conceptualise both disaster risk and vulnerability. In the same publication, they define vulnerability as

> *"the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard"*
>
> (Wisner et al., 2004, p. 11)

They apply the term vulnerability only for humans, in contrast to other authors who also use it for buildings, production systems or markets, for example. Wisner et al. (2004, pp. 14–15) say that the measurement of disaster impacts in terms of the number of deaths and injured persons, or monetary damage devalue cultural, psychosomatic and subjective aspects of a disaster.

The first goal of this research is the identification of the underlying causes of smallholder's vulnerability to drought. Therefore, the characteristics of smallholders and the situation they are living in will be analysed to find the factors that influence them. The second goal is the identification of adaptation strategies. As it is assumed that with a chan-

ging climate drought events will happen with a higher frequency and intensity, adaptation to risk is essential to reduce one's vulnerability. In these times of climate change, it is important to have a prospective view, while not neglecting underlying driving forces of the political economy.

There exist quite a selection of frameworks to conceptualise vulnerability. Before presenting the framework applied in this research, different works are briefly presented in table 3.1.

Table 3.1: Selection of conceptual frameworks on vulnerability or disaster risk

Frameworks	**Objective of the framework**	**Suitability for the case study**
The double structure of vulnerability (Bohle, 2001)	Sees vulnerability from an internal coping side, which includes capacities, and an external exposure side. Exposure is explicitly considered part of vulnerability.	The physical hazard side is missing as a stressor. It does not address the causes of vulnerability sufficiently.
Sustainable Livelihoods Framework (SLF) (DFID, 1999)	Considers that there are transforming structures and processes, which influence the vulnerability context. Emphasising on empowerment to reduce vulnerability.	The understanding of vulnerability is too broad and the role of transforming structures and processes are not clear. However, it was used as a methodological framework in this research as it takes a livelihood perspective.
Disaster risk framework (Bollin et al., 2003; Davidson, 1997)	Disaster risk consists of hazard, exposure, vulnerability, and capacity & measures. Vulnerability is represented by physical, social, economic and ecological dimensions.	Such a distinction is not considered meaningful, as the different dimensions are interrelated and influence each other mutually.
ISDR framework for disaster risk reduction (UNISDR, 2004a)	Again, vulnerability is understood as having four dimensions: physical, social, economic, and ecological. The focus is put on the different phases in DRR, i.e. warning, preparedness and response.	It is not considered that vulnerability reduction can reduce risk.
The onion framework (Bogardi & Birkmann, 2004)	Disasters are seen in the context of different spheres: the economic and the inner social sphere. Damages to the economic sphere can be repaired. A disruption of the social sphere, which represents vulnerability, can lead to a disaster. Capacity is also part of the social sphere.	Such a separation of two spheres neglects that the social and the economic are connected. The economy is also an anthropogenic system and therefore part of the social.
The BBC conceptual framework (Bogardi & Birkmann, 2004; Cardona, 1999)	Tries to link vulnerability, human security, and sustainable development (SD). Vulnerability should follow the principles of SD. It is an attempt at a holistic view of disaster risk. Vulnerability is context and hazard-specific.	The framework does not emphasise enough the question of why someone is vulnerable.

Most of the presented frameworks pay too little attention to the underlying factors of vulnerability. Some are intended to serve as a tool for risk or impact assessment, others try to quantify vulnerability; but rarely the question of why someone is vulnerable is addressed adequately. This research does not intend to contribute to assessments of risk or impacts of an actual hazard event, nor to develop intervention approaches; but rather to identify underlying causes of vulnerability. The PAR model was chosen as the conceptual framework because it is the most detailed way to describe the emergence of vulnerability and at the same time, it puts vulnerability in the context of disaster risk. How exactly, will be explained in the next chapter.

The aim of DRR – and to a modest extent of this work – is to build the adaptive capacity of vulnerable population groups that render them more resilient to disasters. Resilience is an often-used concept in the context of disaster risk reduction and especially in climate change adaptation (Bahadur et al., 2010). By comparing the definitions of resilience (see appendix) and vulnerability (see section 3.2), one can assume that resilience is the opposite of vulnerability. It might be argued that vulnerability puts too much emphasis on negative aspects and that it risks of presenting people as incapable (Wisner et al., 2004). This view is countered by recognising that adaptive capacity is an important factor in reducing vulnerability. The main reason why this master's thesis focuses on vulnerability rather than resilience is that it is considered important to know the causes and underlying factors of vulnerability to reduce it. If only resilience is considered, this may help to build capacity, but the underlying factors do not change, which in essence cannot lead to a sustainable reduction in disaster risk. The problem must be addressed at its roots.

3.3 Pressure and Release model

The PAR model was conceived within the first edition of *At Risk* in 1994 by Blaikie et al., however, reference is made here to the latest edition of Wisner et al. in 2004. The main idea of the model is, that disaster risk is a function of hazard and vulnerability. That means that disasters only occur when both factors are given. There is no disaster when there is a vulnerable population but no hazard, or if a hazard threatens a population that is not vulnerable.

The authors present disaster risk as a pseudo equation:

$$\text{Risk} = \text{Vulnerability} \times \text{Hazard}$$

The risk equation shows that if the hazard factor increases – as it is assumed with regards to climate change – it is the vulnerability that must be addressed and reduced in order to decrease the risk. We already learned that disasters are not perceived as natural events or "acts of god" anymore, but that they are determined by social, political and economic factors. Also hazards can be triggered through human action and are therefore neither necessarily completely natural. Because of this, Ribot (2014) argues that there is also scope for action on the hazard side for reducing the disaster risk. The response rate of the climate, however, is extremely slow so that today's actions would take effect far too late. Therefore, it is important to focus on vulnerability. Even if some hazards are completely natural, e.g. volcanic eruption, it is the social factors, which make the people vulnerable and which result in a risk to disaster (Wisner et al., 2004, pp. 7–9). The natural and the human can not be separated because livelihoods are often provided at places where opportunities and hazards coexist. Also, temporal and spatial dimensions play a role. Human action at one place can trigger an event far away (e.g. deforestation contributing to flooding downstream) or years later (e.g. the introduction of an alien plant species). The temporal dimension is also important in the way that disasters disturb the livelihoods of a community in such a way that they will be even more vulnerable to a future event (Wisner et al., 2004, pp. 7–9).

In contrast to the scientific view on disasters, media and governments still present earthquakes, volcanic eruptions, floods, droughts etc. as "natural" disasters. A reason for this, according to Wisner et al. (2004, p. 7), is because it is easier to blame nature – as an "external" agent – for the caused damages or casualties. If governments would acknowledge that there are economic or social factors underlying a disaster, they would need to present measures to these "internal" issues. Recognising such problems can have unpleasant consequences for a leading government. But it is these root causes that need to be addressed in order to prevent disasters and to improve the situation of the most vulnerable groups. The PAR model (see figure 3.1) allows assessing vulnerability and to identify underlying causes to reduce future disaster impacts.

The PAR model can be imagined as a nutcracker that exerts pressure on people from two sides. On the one hand, the processes and structures that lead to precarious conditions and on the other hand a hazard event. The idea of release is to minimise disaster risk by re-

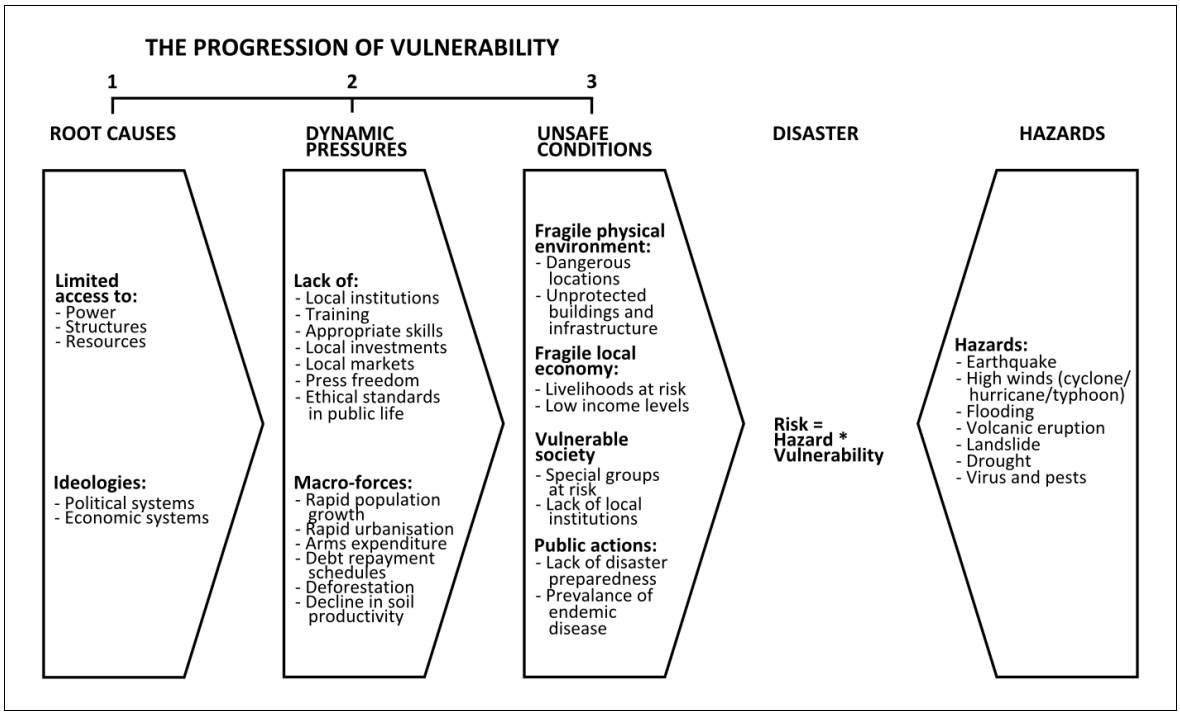

Figure 3.1: Pressure and Release (PAR) model: the progression of vulnerability
Source: Wisner et al., 2004, p. 51

ducing vulnerability (Wisner et al., 2004, p. 50). Vulnerability, at the same time, is explained as a progression of three levels with root causes shaping dynamic pressures, which can then lead to unsafe conditions. This three-level distinction underlines that it is not enough to identify vulnerability just by asking who is vulnerable and to what degree, but that the underlying forces must be examined to explain why someone is vulnerable (Birkmann, 2006). The idea of progression does not mean that individual causes always have the same consequences. Depending on the context, the root causes lead to other processes; and processes can manifest themselves in very different conditions. The three different elements are described in more detail in the following.

Root causes

Root causes that shape vulnerability arise mainly from economic, demographic and political processes. These, in turn, result from the economic, social and political structure or *'ideologies'* of a society. These processes and structures shape access to resources or the power structure within the society and often manifest themselves in marginalised groups that are neglected by those in power and are thus forced to live in unsafe conditions (Wisner et al., 2004, pp. 52–53).

Dynamic pressures

"*Dynamic pressures are processes and activities that 'translate' the effects of root causes both temporally and spatially into unsafe conditions*" (Wisner et al., 2004, p. 53). These are more short-term and direct than root causes which can also be based on historical events (Wisner et al., 2004, p. 53). Dynamic pressures are processes or conditions that have emerged from the root causes and which manifest themselves on the ground (Wisner et al., 2012, p. 25). It should be noted that dynamic pressures do not have negative consequences per se. They must always be seen in relation to the particular hazard people are facing. Furthermore, the historical and spatial conditions must be considered carefully to understand the effects of the pressures (Wisner et al., 2004, p. 54). The authors use capitalism as an example of the distinction between root causes and dynamic pressures. Capitalism has existed as an economic and ideological system for over 500 years. Neoliberalism, on the other hand, as a specific form of capitalism, only emerged during the 1970s and was later established in many countries of the world (Wisner et al., 2004, p. 53).

Unsafe conditions

"*Unsafe conditions are the specific forms in which the vulnerability of a population is expressed in time and space in conjunction with a hazard*" (Wisner et al., 2004, p. 55). They can be manifested by people having to live in a dangerous zone (reference to exposure), or being unable to afford to live in a safe building, being forced to do dangerous work, or having no safe access to food or other resources (Wisner et al., 2004, p. 55). It can also be said that many vulnerable people have insufficient livelihoods (Wisner et al., 2004, p. 55). In the Sustainable Livelihoods Framework (SLF), reference is made to vulnerability by stating that "*a livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets* [...]" (DFID, 1999, sec. 1.1). Wisner et al. (2004, p. 56) furthermore highlight that the different factors influencing insecure conditions should never be considered separately. This might entail the danger of quick fixes which ignore economic or political conditions.

Although it may seem so, poverty must not be equated with vulnerability, even if both often occur simultaneously (Wisner et al., 2004, p. 78). Reasons of poverty and vulnerability can be very similar as both are based on the relationship that people have with the political economy. They can be distinguished in such a way as poverty is a widespread condition, whereas vulnerability, as mentioned above, is very specific (Wisner et al., 2004, p.

55). The difference between vulnerability and poverty can be described with three examples: (1) even if rich people are exposed to a hazard, they can afford measures to secure their situation and to reduce the impact of the hazard; (2) rich people are free to choose their place to live. They choose exposed places because of astonishing views, whereas poor people have no choice and need to live where they can afford it. Often, dangerous places are uninhabited and affordable, which is why poor people are forced to live there; (3) the consequences of a hazard are less severe for rich people because they can afford insurances or because they have financial reserves (Wisner et al., 2004, pp. 12–13).

Leaving the difference between vulnerability and poverty aside, several empirical studies identified specific characteristics that occur more frequently in vulnerable persons. Depending on occupation, social class, ethnicity, gender, disability and health status, age and immigration status, some groups are more subject to damage, loss and suffering of a hazard (Birkmann, 2006; Cutter et al., 2009; Eriksen et al., 2005; Hulme & Shepherd, 2003; Wiesmann et al., 2016; Wisner et al., 2004).

As can be seen from the COVID-19 pandemic – although it is assumed that the virus does not differentiate between different groups of people – not the entire population is equally affected. Socio-economic background, ethnicity, cultural status, etc. have a major influence on how the virus or the disease affects you. Comparison of the numbers of infected persons and deaths among different groups reflects the high social inequality in some countries and it shows on a recent example that some groups are more vulnerable to shocks than others. So we can see, that marginalised minorities like people of colour in the United States[2], Muslims in India[3], or indigenous and black people in Brazil[4] – only to mention a few examples – are much more struck by the pandemic than the class of the population that holds the economic and political power. Vulnerability is deeply rooted in a society's political economy. In the next chapter, this view will be illustrated even more pronounced using the Entitlement approach.

2 https://www.theguardian.com/world/2020/apr/09/america-inequality-laid-bare-coronavirus (accessed on 10.07.2020)
3 https://www.aljazeera.com/news/2020/06/coronavirus-crisis-exposes-india-social-inequalities-200626060045684.html (accessed on 10.07.2020)
4 https://www.theguardian.com/world/2020/jun/09/enormous-disparities-coronavirus-death-rates-expose-brazils-deep-racial-inequalities (accessed on 10.07.2020)

3.4 Entitlement approach

"Starvation is the characteristic of some people not having enough food to eat. It is not the characteristic of there being not enough food to eat. While the latter can be a cause of the former, it is but one of many possible *causes"*

(Sen, 1981, p. 1)

The first paragraph in Amartya Sen's *Poverty and Famines: an Essay on Entitlement and Deprivation,* in which he analyses and attempts to explain the origin of famines, already shows the essence of his work. A famine is not simply caused by a lack of food, but by the fact that people are denied access to food.

Entitlements are context-specific legitimations of ownership. Ownership can be legitimised in various ways, e.g. through a commercial relationship with a consenting party, through the production of goods with raw materials from own property, or through inheritance. One's own labour power also legitimises to produce or trade goods (Sen, 1981, pp. 1–2). Possession alone, however, does not guarantee survival. A wage labourer must first exchange his wages for food. Sen calls the ability to exchange one's ownership for other goods *exchange entitlement* (Sen, 1981, p. 3). There are different ways to obtain other goods, such as food. Labour can be used to produce food crops or, as mentioned above, to earn an income to buy food. Another possibility is the sale or exchange of goods for food, or one is entitled to a pension from the social security system (Sen, 1981, pp. 3–4). These possibilities are manifestations of a broader institutional, political and economic frame of a society and its cultural and social structure, for example, market prices, legal rights on labour or land tenure, or the social security system. This frame is called *exchange entitlement mapping* and represents the relation between the endowments and the exchange entitlement (Sen, 1981, p. 46). Endowment can be understood as the totality of a person's assets[5], as Sen describes: "[...] *his land, labour power, and a few other resources, which together make up his endowment*" (Sen, 1981, p. 46). A farmer has different options on how she uses her endowment. Simply put, she either sells her harvest in order to make money to buy food, or the harvests are consumed directly. These options correspond to the exchange entitlement. According to Sen, starvation is a failure of the entitlement to have enough

5 Assets as it is understood in the Sustainable Livelihoods Framework (SLF), see section 4.2.

food. At the same time, someone's entitlement is shaped by his or her endowment and the exchange entitlement. Therefore, it is the decline of one of these two factors that lead to entitlement failure (Sen, 1981, p. 47). The former might fall due to loss of income, land or livestock, and the latter because of change in market prices or unemployment.

Sen uses the comparison of a landless sharecropper and a landless agricultural worker to show how their exchange entitlements can change differently during a crisis, even if both their entitlements are based on the same, their labour force. Suppose a typhoon reduces the demand for labour in a region. With a certain probability, the worker will lose his job and lose all his exchange entitlements, which might lead to starvation. Even if the sharecropper suffers some loss of exchange entitlements, he will not lose them completely. He will continue to work and receive part of the income in the form of food he produced. Since he produces part of his food, the exchange entitlements of the sharecropper are better secured than those of the worker, who is dependent on the market and much more exposed to rising prices (Sen, 1981, p. 5). This is how Sen explains why there are groups that do suffer starvation and others that do not, even when there is overall food availability. How the deprivation of entitlements might influence vulnerability to droughts is explained in the next section.

3.5 Application of the framework

The entitlement approach can be linked with the concept of vulnerability as the latter can be understood as "*lack of entitlements or lack of sufficient means to protect or sustain oneself in the face of climate events*" (Ribot, 2014, p. 677). At the same time Gbetibouo & Ringler (2009, p. 11) highlight that "*the means of resistance are the assets and entitlements that the individuals, households, or communities can mobilize and manage in the face of hardship*". It is assumed that the vulnerability of smallholder farmers increases when their entitlements are deprived. As explained above, entitlement deprivation is caused by a decline of either the endowments or the exchange entitlement. In the present context, therefore, vulnerability is the situation where the exchange entitlements or endowments of a household are insufficient to cope with a hazard. The endowments are understood as the sum of the five capitals from the SLF; and the exchange entitlement is influenced by structures and processes represented by root causes and dynamic pressures in the

PAR model, as Misselhorn (2005, p. 37) puts it: "*the entitlements framework proposes that people's food security is heavily tied to market forces* [that represent dynamic pressures and] *which in turn are prejudiced by* [root causes like] *the socio-economic and political conditions of the society in which they live*". The PAR model and the SLF will therefore be helpful to analyse the households' entitlements.

Looking back at the PAR model, we see that disaster risk is the intersection of structures and processes creating vulnerability, and the hazard event. The elements shaping someone's vulnerability are the root causes, dynamic pressures and unsafe conditions. In this research these factors are put into context as follows:

Disaster	Food insecurity and starvation
Hazard	Drought event
Root causes and dynamic pressures	Political and economic processes and structures shaping the household's exchange entitlements
Unsafe conditions	Livelihood insecurity shaped by entitlement deprivation

It must be noted that the unsafe conditions are generated by the elements before (root causes, dynamic pressures) and not by the livelihoods itself. Livelihoods per se are not unsafe, but the underlying causes can lead to livelihood insecurity, which in turn leads to inability to cope with, or to adapt to shocks (Ulrich et al., 2012). Wisner et al. (2004) use the term *secure* as the opposite of vulnerable. Other authors use the term capacity as the counterpart of vulnerability. The latter implies that people can adapt their actions to improve their livelihoods (e.g. education or professional skills), which can protect them better from the effects of hazards (Cannon, 1994; Eriksen et al., 2005; Hulme & Shepherd, 2003). The desired state should be access to safe conditions either way (Wisner et al., 2004, p. 111). It is assumed that both improving the underlying processes and structures within the political economy, and building adaptive capacity at the household level are essential to achieve safe conditions.

The scope of the master's thesis did not allow to approach every aspect of the PAR model. It was decided to focus on the left side on the political and economic system, indicated under root causes, as well as on livelihood assets which could help to understand the unsafe conditions. The right side, the hazard event, will also be discussed. Since *political and economic system* are still very broad terms, the questionnaire tried to approach certain aspects, such as land tenure, market access and access to resources, especially water. It is

assumed that these aspects influence the exchange entitlements in Sen's sense and therefore also a household's vulnerability. Chapter 4 explains in detail how the livelihood assets were taken into account in the methodological framework.

4 Methodological approach

The fieldwork for this research took place between 22nd of January and 6th of March 2020 in collaboration with the Centre for Training and Integrated Research in ASAL Development (CETRAD) based in Nanyuki, Kenya. The colleagues from CETRAD were a big support for methodological and operative questions regarding the conduct of the interviews and preparatory tasks. It was also them who helped to organise a research assistant and a driver.

Before the beginning of the data collection, a transect drive together with the research assistant, as well as a researcher and a driver from CETRAD was done to identify the study villages. During this full-day drive, the team of CETRAD provided a lot of information about the region, thanks to their expertise and experience in the region. The goal was to obtain a first image of the landscape, how the farms look like and to see in which way the different agro-climatic zones (semi-humid and semi-arid) are manifested in terms of vegetation and cultivation. This was necessary for the evaluation of which villages might fit for the data collection. It was decided to select four villages, two of which are located in the respective agro-climatic zone. Also the distance from Nanyuki was a factor, due to a limited budget to pay the driver.

The following sections will present how the questionnaires were developed, how the interviews were conducted, and which methods for the sampling and the data analysis were used. Two main types of tools were used to collect primary data; survey interviews with households on the one hand, and on the other hand, structured expert interviews. Due to academic conventions, a distinction is made here between household surveys and expert interviews. The latter refers to the position of the interviewees in relation to the research topic and object, but it should not mean that their information is weighted higher than that of the households. Farmers are also considered experts, as only they are able to report on their experiences and livelihoods. The development of both types of questionnaires was influenced by literature about Vulnerability and Capacity Assessments (VCA) (Maachi, 2011), an approach that combines traditional vulnerability assessments and Sustainable Livelihood Approaches (SLA).

4.1 Vulnerability and Capacity Assessment

The main objective of VCAs is to learn how the study object – mainly a community – is affected by the event or process in question, how it perceives it, and how it copes with or adapts to it. The assessment should also give an answer to the questions of who is the most vulnerable and what shapes their vulnerabilities. Furthermore, a VCA enables to identify existing coping and adaptation mechanisms and to assess them in order to develop recommendations for the community to improve their own adaptive capacity (Maachi, 2011).

Vulnerability assessments within the area of global change appeared at least in the 1960s in three different streams: impact assessments, risk/hazard research, and food security studies. The first two usually treat "*the multiple effects of a single stress*" and the latter focuses on "*the multiple causes of a single effect, namely hunger or famine*" (Schröter et al., 2005, p. 576). In consideration of the presented theoretical framework, it is assumed that vulnerability to droughts, which might lead to food insecurity, has multiple causes anchored in the political economy (Birkmann, 2006; Eriksen et al., 2005; Sage & Majid, 2002; Wisner et al., 2004). VCAs should include social, economic, physical, environmental and institutional dimensions in order to capture the multifaceted nature of vulnerability (González Tánago et al., 2016).

The causes and effects of vulnerability can only be identified and addressed by a strong integration of the people's opinions and views (Fontaine & Steinemann, 2009; Morchain et al., 2015). If these causes are neglected, symptoms of vulnerability will reappear. Likewise, it is suggested to link VCAs with sustainable livelihood analysis (Davis et al., 2004). The focus on the community's livelihood assets and capacities is important as it helps finding ways how to strengthen them to improve the community's resilience and guarantee their entitlements. Following these principles, the results of this research will be shared with CETRAD.

The Framework for Community-Based Climate Vulnerability and Capacity Assessment in Mountain Areas by the International Centre for Integrated Mountain Development (ICIMOD) offers a range of tools used to conduct VCAs (Maachi, 2011). These tools are based on participative rural appraisal approaches and consist of participative methods like focus group discussions, community historical timeline, seasonal calendar among others, as well as in-depth interviews. The framework also highlights the importance of data triangulation. Information from the population should be compared by other information

sources, like experts with a vast knowledge of the region and the community's livelihoods, or through literature review. The limited time during the fieldwork and logistic constraints to gather participants from different villages did not allow to apply participative methods. The information that would have been provided to create a historical timeline and a seasonal calendar was compensated through informal discussions with colleagues from CETRAD and through scientific literature. Consequently, the data collection was limited on interviews with two types of stakeholders: first, survey interviews with 40 smallholder farmers; and second, three expert interviews, two with representatives of public authorities and one with an employee of CETRAD.

The questionnaires were developed regarding the principles and ideas of VCAs described above as well as by taking into account the SLF, which will be described in the next section. The goal of the survey interviews with farmers was to gain information about their livelihood assets, their perception of droughts and to learn about their coping and adaptation strategies. On the other side, the questionnaire for the expert interviews aimed to know about their views of the farmer's situation regarding droughts and to learn about political and economic aspects.

4.2 Sustainable Livelihoods Framework

One part of the survey interviews focused on the household's livelihood assets and the other half on their perception and behaviour regarding droughts. The questionnaire aimed to cover the whole asset pentagon of the SLF (see figure 4.1) to identify factors that influence the vulnerability of rural households following the five capitals. With regard to the scope of a master's thesis and to limit the length of the questionnaire, not all aspects of the five capitals were fully covered. The five capitals were represented in the questionnaire as follows:

Human Capital "*represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives*" (DFID, 1999, p. 19). The household size, i.e. the number of people living in the household, and the household's age structure give an indication of the ability to labour. Questions about the used agricultural techniques brought information about their skills and knowledge.

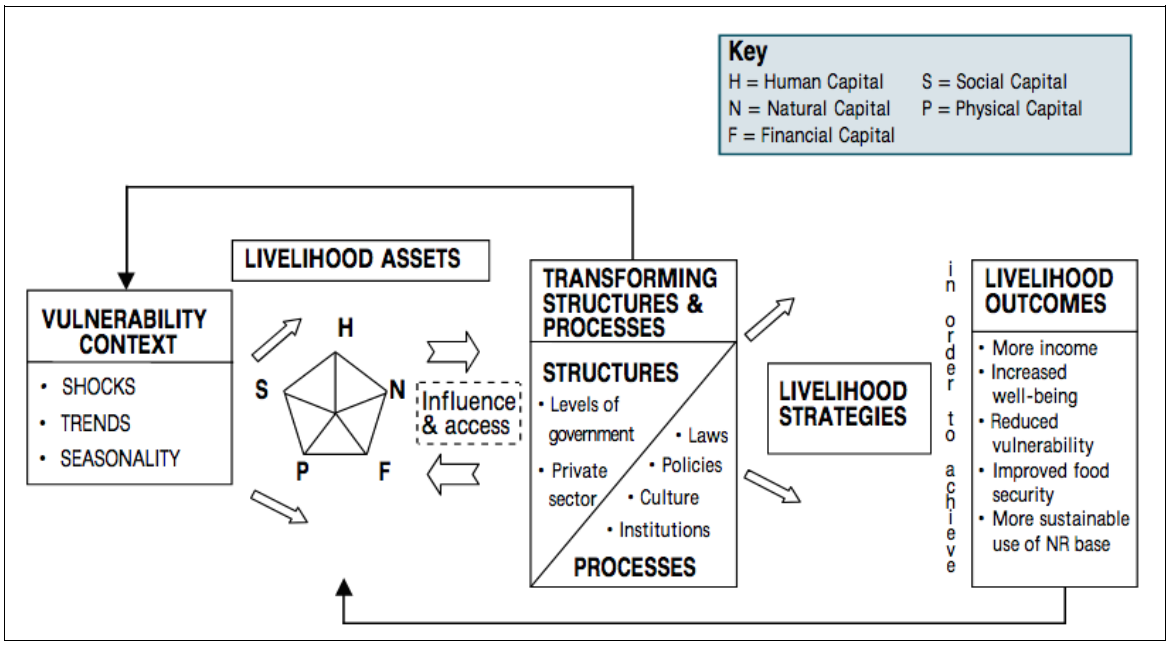

Figure 4.1: Sustainable Livelihoods Framework
Source: DFID 1999, sheet 2.1

Social Capital contains resources that people use to achieve their livelihood objectives. They are characterised by networks and allow people to work together and to grant access to institutions. Social capital can figure as coping mechanisms, which in turn can mitigate the consequences of adverse events (DFID, 1999, p. 21). Information about the social capital was gained via questions about irrigation and the membership in water users associations, as well as about extension services or training programmes. It also became clear that networks with neighbours and brokers are important to maintain commodity sources and the sales market.

Natural Capital is used synonymously for the natural resource stocks and flows used directly for production (e.g. land, trees). Ecosystem services also play an important role by providing intangible goods and services (e.g. water, biodiversity) needed in agriculture and livestock keeping. These assets are directly affected when a drought occurs (DFID, 1999, p. 23). Questions about the land size, the different types of land use, and access to water covered the natural capital.

Physical Capital "*comprises the basic infrastructure and producer goods needed to support livelihoods*" (DFID, 1999, p. 25). With basic infrastructure, they mean transportation, shelter, water supply and sanitation, as well as supply of energy. Access to communication and markets also play an important role to sustain the livelihoods. As regards

physical capital, the main aspect captured by the questionnaire was market access, in particular changes in market access during periods of drought.

Financial Capital refers to the available financial resources that people have at their disposal to achieve their livelihood objectives. This can be stocks like savings in the form of cash or livestock and flows like income or remittances. These resources can be used to invest in other types of capital or they "*can be used for direct achievement of livelihood outcomes*" (DFID, 1999, p. 27). To assess the financial capital, the respondents were asked about their different sources of the household income and their share on the total income.

In the SLF, transforming structures and processes are understood as "*the institutions, organisations, policies and legislation*" (DFID, 1999, p. 29) on different levels, which influence the characteristics of livelihoods. There is a close link to the vulnerability context in the way, as structures and processes can aggravate the impact of external shocks. Looking back at the PAR model, these structures and processes can be understood as the underlying causes of vulnerability. The SLF also highlights that well-functioning processes can help people to cope better with shocks.

The composition of the livelihood assets shapes the possibilities of people to achieve their livelihood objectives. These possibilities of actions are called livelihood strategies. An important notion in the SLF is the choice people have to develop their strategies as they wish. If the factors influencing the choice are known, positive aspects can be reinforced and constraints can be mitigated in order to improve the self-determination and the adaptive capacity. Furthermore, the authors (DFID, 1999) highlight that the access to assets should be improved and that the transforming structures and processes should be more responsive to the needs of poor people to help them improve their freedom of choice. "*The more choice and flexibility that people have in their livelihood strategies, the greater their ability to withstand – or adapt to – the shocks and stresses of the Vulnerability Context*" (DFID, 1999, p. 35). These ideas follow the principles of the entitlement approach presented in the previous chapter.

The last element in the SLF is the livelihood outcomes, which are – simply said – the outputs of livelihood strategies. The differentiation of strategies and outcomes helps to understand what motivates people and what their priorities are, which is essential for the development of supporting activities (DFID, 1999). One possible outcome highlighted in the framework is reduced vulnerability. The authors accentuate that the reduction of poor

people's vulnerability can have a bigger impact to make their livelihoods more sustainable than to maximise the positive aspects of their livelihoods. However, both positive and negative outcomes can imply direct feedback to the asset base in both ways (DFID, 1999).

As mentioned in the introduction, it is assumed that subsistence farmers are vulnerable to droughts. Hence, their livelihoods are not entirely sustainable and they might also generate negative livelihood outcomes. Translated into the PAR model, this means that they are living in unsafe conditions. The unsafe conditions are caused by underlying factors and dynamic pressures (see PAR model, section 3.3), but they are manifested at the household level through the livelihood assets. This is why the SLF was used to assess the unsafe conditions of households, in addition to the analysis of the underlying causes, namely the political and economic context, to understand more about their exchange entitlements.

4.3 Methods of data collection

For the collection of primary data, three distinct groups of respondents had been identified. The first group consist of smallholder households, which represent the actual study object, the second of experts from NGOs, and the third group of representatives from public authorities. Therefore, three different questionnaires were developed. Unfortunately, it was not possible to find interview partners from NGOs in the study region. Consequently, only the two other groups were interviewed. The questionnaire for the farmers consisted of a mix of structured closed and open questions. The questionnaire for the expert interviews contained mainly of open questions. As explained in the previous section, the development process of both questionnaires followed strongly the concepts of VCA and SLF. The templates of the questionnaires can be consulted in the appendix (see chapter 9).

4.3.1 Survey interviews with smallholder households

The first type of data collection was survey interviews with 40 smallholder households, 10 in each of the four villages. The questionnaire consisted of 31 questions, half of which were closed questions on the household composition, the livelihood assets, the land-use system and the used agricultural techniques. The other half was made of open questions on their perception of droughts and their well-being, as well as on the background to the answers of the closed questions, in particular on the reasons of why adaptation took place or not (for details see the questionnaire in the appendix).

Before the actual data collection started, two preliminary interviews were conducted to test the questionnaire. This made it possible to clarify unclear formulations or to remove irrelevant questions. Before each survey, respondents were asked for their consent. They were also told to be free to skip questions. The surveys were led by the research assistant in the languages of Kiswahili or Kikuyu to facilitate the respondents to respond in their mother tongue. The assistant then transcribed the answers in English on the questionnaire form. During the interviews, I was sitting next to the assistant in order to read the answers and to be able to simultaneously ask questions if something was unclear or further information was needed.

Every respondent was asked the same questions. Even if there were some open questions, it was difficult to develop a narrative situation; most of the answers remained quite short. Thus, the result was a mix of quantitative data suitable for comparative analysis, and qualitative data for further in-depth analysis.

4.3.2 Choice of survey participants

This section presents the sampling method used to choose potential survey participants. Right from the start of the research process, it was clear that the focus would be on households. The intention was to study the unit that is most directly affected by droughts. Households were preferred to individuals because their members share not only the livelihood assets, but they also share the impacts of shocks (Wisner et al., 2004). Although vulnerability is an issue for different systems on various levels, the household system is suited to identi-

Figure 4.2: Left: Identification of households on Google MyMaps satellite imagery. Right image: approaching the households in a spiral around a central reference point. Points = identified, households, yellow points = randomly selected households
Source: Google My Maps adapted by the author

fy underlying causes and the coping and adaptive capacities in regard to droughts, as they are shaped by household's livelihood assets (Fekete et al., 2010).

After the transect drive described above, the exact study sites were chosen; two villages in a semi-humid area – Mia Moja and Ngenia – and two villages in a semi-arid area – Matanya and Naibor. For the sampling, it was intended to choose randomly ten households per site by means of satellite imagery. To do that, the Google MyMaps tool was used to identify at least 100 smallholder farms per village, of which ten were randomly selected in the next step (see figures 4.2 and 4.3).

Starting at a central reference point (e.g. the school of that site), the households were then identified by proceeding in a spiral around the reference point. For each identified farm on the satellite image, a point was created and labelled with growing numbers. It was gone around the reference point until a sufficient number of households was identified (between 100 and 200, depending on the site). This was not an easy task because it was challenging to evaluate where a farm has its borders. To reduce errors and also to reduce the risk of not meeting anyone at their homestead, finally 30 households per site were selected. The randomised selection has been executed by means of OpenOffice spreadsheet formula =randbetween(1;*n*), i.e. creating random numbers between 1 and *n*, where *n* is the number of the corresponding total of identified farms.

The household visits were organised following the 30 unsorted numbers of the sampling. The selection of 30 households per site has proven useful because on average per village we approached 4 to 5 farms where nobody was at home. At least 1 to 2 people per village were considered unsuitable to participate. Respondents were rejected, for example, when the person – even the household head – was too young or has been living in the area for a too short time. These persons, especially when they lived in another region before, would not have been valuable for the research due to lack of experience in the study region. In total, only one person refused to be interviewed. Most farmers were very open to talking to us. In such cases, the next farm corresponding to the next number from the sampling list was visited until ten interviews per village were accomplished.

4.3.3 Structured expert interviews

For the second part of data collection, three structured expert interviews were held. Nanyuki is the county capital of Laikipia and thus, home of different county authorities. With

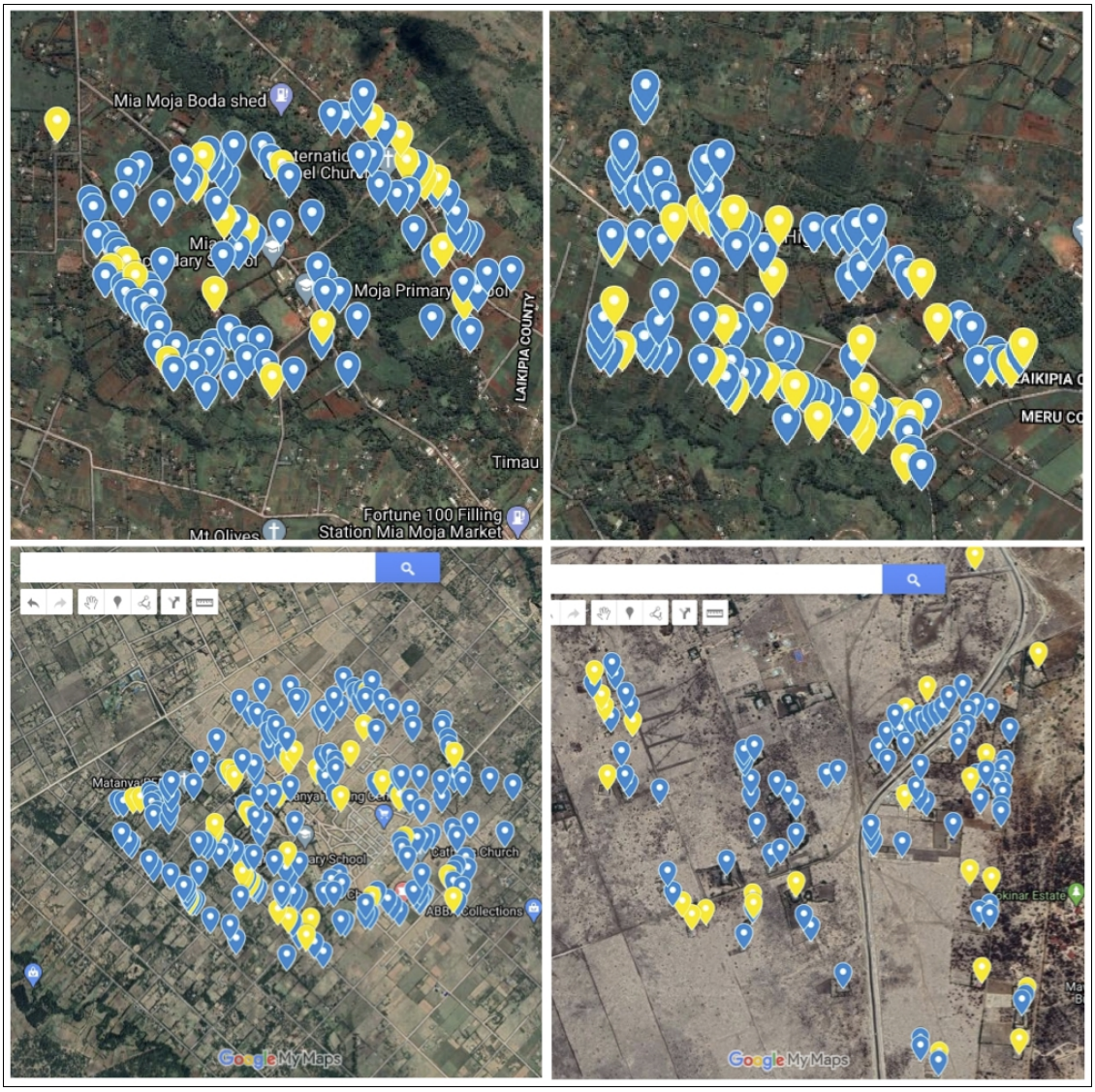

Figure 4.3: Identified households in the four study sites:
left above: Mia Moja, right above: Ngenia, left below: Matanya, right below: Naibor
Source: Google My Maps adapted by the author

regards to the research questions, the Department of Agriculture, Livestock and Fisheries was identified as an important stakeholder to act as an interview partner. In addition, an employee of the National Drought Management Authority (NDMA), which maintains a regional branch office in Nanyuki, could be won for an interview. By the help of CETRAD 's network, interviews were arranged with each of the two authorities. Finally, the third expert interview was conducted with a senior researcher of CETRAD[6].

The expert interviews were held in English and were recorded. Both the research as-

6 As CETRAD is a state-funded organisation, it has not been considered as an NGO.

sistant and I posed questions from the prepared questionnaire. Due to the nature of the open questions, the interviews developed into a narrative by the respondents. For this reason, the questionnaire was used as a guideline or checklist to make sure that all the questions were covered. A word for word transcription has been omitted. After the interviews, accurate notes were made by carefully listening to the audio files to extract the most important information for analysis.

The aim of the structured expert interviews was twofold. On the one hand, the selected persons were able to expand the information needed to answer the research questions because of their expertise and experience in working with the community. They were asked how they perceived the most recent drought event, what provided information from another perspective as the farmers' one. They were also asked how they evaluate the conditions of the farmers during the drought and in general. Furthermore, they were able to answer questions concerning the political and economic context.

4.4 Mixed analysis methods

In principle, the initial aim was to carry out an exclusively qualitative social research in order to analyse the different realities of the respondents and thus be able to identify different causes of vulnerability or formulate theses on them. Due to the research objectives, a qualitative approach seemed most appropriate. However, it then turned out that the survey questionnaire was constructed in such a way that too little narration was created. Some of the questions were formulated in such a way that the answers were rather closed. It was therefore decided to use a mixed methods approach.

Qualitative research is basically not about frequencies, but rather about what and how something was said (Vogt & Werner, 2014). The mixed methods approach used for the present research followed this goal but also included frequencies of statements for the interpretation. In a first step, a descriptive analysis of the quantitative data was carried out to gain a first overview and to guide the further process. The interpretations of the survey interviews were then used to develop the code system of the expert interviews. Finally, the interpretations of the two types of data were contrasted to answer the research questions. The entire analysis process is illustrated in figure 4.4.

The goal of this work is to find potential explanations for the causes of vulnerability,

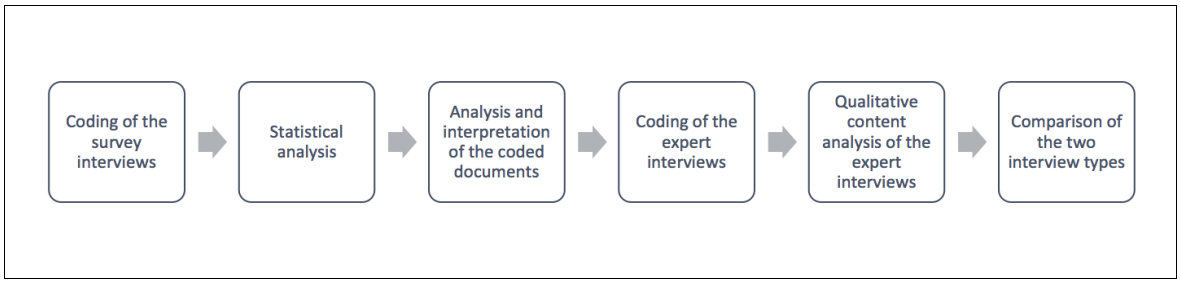

Figure 4.4: Schematic sequence of the analysis process
Own representation

and not to develop representative statements for a whole population. It is acknowledged that the answers from the interviews are individual statements of the respondents and thus represent their personal perceptions. These subjective perceptions were compared with quantitative data of their households to identify patterns. How exactly the steps of the analysis were performed will be explained in the next section.

4.4.1 Coding of the survey interviews

There are two ways of coding qualitative data: deductive and inductive. A deductive approach means that the codes are derived from theory, i.e. the problem statement, the research questions, or also the interview questions. Inductive is, when the codes are developed based on the different answers and statements made during the interview; whereas it is possible to combine both approaches (Vogt & Werner, 2014).

All information from the 40 survey interviews was transferred to an Excel table in a first step, where all the answers were assigned one-to-one to the corresponding question. To simplify the coding and the analysis, the data were imported into MAXQDA[7], a software for qualitative data analysis. Before the data import, some answer categories needed to be transformed into boolean variables, in order to guarantee the comparison of the data. This resulted in the first row of the Excel table consisting of either interview questions or of answer categories for the boolean values. Due to a standard function of the software, the first row of the Excel file was automatically converted into codes in MAXQDA. These codes were then used as main categories of the code system. This automatic allocation of codes was not 100% satisfactory, e.g. because an answer to question X was given, but this answer rather fitted the definition of the question or code Y. That is why, some codes had

7 Version MAXQDA Analytics Pro 2018 (https://www.maxqda.com/).

to be assigned to other answers. After the data import, each document was worked through and new codes were created and assigned to the text segments. The whole list of codes and their definitions can be found in the appendix.

One can say that for the main categories a deductive method was applied, as the codes were derived from the interview questions. The vast rest of the codes, however, were created in an inductive way. Some data was merely coded to allow quantitative evaluation of frequencies, e.g. types of crops cultivated. Other codes have been created to allow easy comparisons and to identify relationships to each other. The open questions were coded following the principles of qualitative content analysis (Flick, 2007; Vogt & Werner, 2014). After the first round of coding, the list of codes was reviewed and similar codes were tried to merge; especially codes that were rarely assigned.

4.4.2 Statistical analysis of the survey data

In addition to the creation of codes, MAXQDA also offers statistical analyses. MAXQDA distinguishes between two types of data: variables (numerical and categorial data) and text segments. The text segments were coded as described above. The variables were imported directly in a different data format and could be viewed and edited in a table.

Once the code system was completed, an exploratory statistical analysis was performed. The first step was to look at the code frequencies and compare them with each other. Then, the numerical variables were analysed by means of descriptive statistics, i.e. mean value, standard deviation and range. This helped to get a first overview of the data and to draw first conclusions from the experiences during the interviews.

In order to identify relationships between the individual factors, a correlation table was generated involving all variables and codes. It was decided to use the Spearman's rank correlation, as it is also applicable to ordinal variables. The correlation table only contains the Spearman's rank correlation coefficient and its significance but does not provide any indication of the data values. Therefore, the correlated factors and potentially interesting relationships were analysed in a second step in a cross table. This allowed the individual values to be closely examined and compared. Among other things, this also made it possible to remove “false” correlations. If, for example, there were many zero values, the system could interpret this as a high correlation. This might be mathematically correct, but was not valuable for interpretation. To find out more about two correlated factors, the cross tables

were used to illustrate all values of two factors. Precise examination and analysis of a cross table containing a big range of values, however, is difficult. To facilitate the comparison of the parameters, groups of values were created in an intermediate step. In doing so, it was tried to form groups of a similar number of entries. This resulted in a much clearer arranged table. By means of the row percentage, it was then possible to show relationships between two factors more clearly. Following this procedure, the correlations that were considered to be meaningful were examined in detail. After the analysis of the cross table, it was evaluated whether a correlation makes sense or is interesting with regard to the research question, to try to explain it in the next step using the qualitative data.

4.4.3 Analysis and interpretation of the survey interviews

If a correlation was evaluated as interesting, an attempt was made to explain it by taking the values into account. Where necessary, a third or fourth factor was included to better explain the relationship. This resulted in a list of relationships between two or more factors. In the qualitative part of the survey analysis, for each identified relationship it was tried to find coded text segments that could be associated with that relationship in order to explain the relationship on the basis of the statements.

4.4.4 Coding and analysis of the expert interviews

The analysis of the second type of data corresponds to the qualitative content analysis according to Flick (2007). Ideally, qualitative research is an iterative process, a going back and forth between data collection and analysis (Flick, 2007; Stewart-Withers et al., 2014). For a master's thesis with only a two-month stay in the field, this principle was difficult to fulfil. However, with three weeks of experience and knowledge from 40 household surveys, the questionnaire for the expert interviews could be adapted accordingly. This allowed to already include certain aspects that were noticed during the survey interviews and to ask the experts for their opinion on them.

With the first interpretations of the survey in mind, the analysis of the expert interviews were then tackled. Each interview was read for a first time, with the first codes already being assigned. In a second round, the previously created codes were checked in all documents; where necessary, new codes were added to the texts. Then, the code system was examined and attempts were made to merge similar codes or to create sub-categories.

This procedure again corresponds more to an inductive approach. The entire code system of the expert interviews can also be consulted in the appendix.

4.4.5 Comparison of the two different data sources (triangulation)

In mixed methods approaches data triangulation can be applied for different purposes (Hussy et al., 2013). On the one hand, to validate the information obtained by one method with another method. For example, qualitative data, like a subjective opinion of one respondent, can be compared with statistical data from the whole sample to better interpret and evaluate the statement. On the other hand, it can be used to give a more comprehensive picture of the object of research (Hussy et al., 2013). For this master's thesis, triangulation was used to bring together different perspectives of the same topic through different stakeholders – farmers and public authorities – and compare them in order to improve the understanding of the problem. Quantitative data were used to better classify and compare the farmers' statements.

The final part of the analysis involved the comparison of the interpretations from the surveys and the expert interviews. Points of agreement underpinned the attempts at explanation, while conflicting aspects were tried to be clarified by literature. The resulting findings were then put into a larger context using the theoretical framework to answer the research questions.

4.5 Limitations of the methods

The fact that NGOs were not interviewed means that an additional perspective on the issue is missing. There are a few examples where the public authorities and the farmers made contradictory statements. It would have been interesting to capture the view of NGOs regarding these contradictions, as their view might have been different from the view of the public authorities. Representatives of public authorities are – without doubt – experts in their field, but it can not be ruled out, that they primarily represent the higher interests of the state and only secondarily the interests of the farmers. NGOs, on the other hand, have a different role. They are also experts in their very field, but would probably have taken a perspective closer to the one of the farmers. Interview data of NGOs would have contributed to a more holistic view of the topic.

The fact that a translation was needed for the surveys, made it more difficult to analyse

the statements qualitatively. Between the answer and its translation, an interpretation by the translator is inevitably added. As a result, the information available for the analysis did not correspond 1:1 to the statements made by the respondents. However, working with a translator was the only way to do this research and the result was satisfactory.

Aside from that, the number of 40 surveys distributed on four sites is quite low to have reliable outcomes from quantitative data. As mentioned above, the research design planned to conduct a qualitative analysis. It was never the intention to establish representative results valuable for a bigger population group, but to learn about individual perceptions and strategies of affected households in the study area. Statistical data were used to compare the different households and to find patterns within the data set, but since no statements are made solely on the basis of the quantitative data from the households, the fact that only 40 surveys were conducted does not play a role with regard to the validity of this research.

5 Analysis

This chapter will present the results of the different analysis steps described in chapter 4. The individual parts of the chapter are based on the aspects of the PAR model discussed in chapter 3. The first section is dedicated to the physical aspect of vulnerability, the hazard, followed by a presentation of the quantitative data about the households' livelihoods. The last two sections then present political and economic aspects that emerged from the two types of interviews. Before discussing the individual aspects, some household indicators are presented.

5.1 Characteristics of respondents and households

The survey contained interviews with 40 persons of smallholder households. Ten of each in the four villages, Mia Moja and Ngenia in the semi-humid area, as well as Matanya and Naibor in the semi-arid area. Thirty-three (82.5%) respondents were female and seven (17.5%) were male. The predominance of women is probably due to the fact that it is more likely to be the men who are engaged in off-farm activities, or that they have just been out in the fields. The gender ratio of the household heads is 26 men against 14 women. The mean age of the respondents was relatively high with 52 years. The youngest person was 22 and the oldest 86. The largest age cohort was the 40-49 years old (25%). Thirty-one (77.5%) respondents were older than forty.

There were also some differences regarding household composition. Seventy-five per cent of the households are composed of 2-5 persons. Three households were smaller and seven were larger. Some of the households were very mixed in terms of generations. In 14 (35%) households there are three or more generations living under the same roof. Nine are composed of only one generation, i.e. the parents whose children left their parental home. The remaining 17 households correspond to the “classic western” family with parents and their children.

5.2 Hazard

In this chapter, the hazard is treated from different perspectives. At first, there will be a short presentation of historic drought events in Laikipia. Secondly, the farmers' perception of droughts were analysed. And finally, the impacts of past droughts on smallholder households are discussed. A deficit in precipitation may not be perceived as drought by every system (UNDRR, 2009). The same period of below-average rainfall might adverse agriculture negatively but not a system that can fall back on a reservoir. Given this and the facts, that the study sites are situated in different agro-ecological zones, or that droughts might be interpreted differently from farmer to farmer, it was decided to ask each of the farmers when they experienced the last drought. The follow-up questions of the survey then referred to the mentioned drought (see questionnaire in the appendix).

5.2.1 Droughts in Laikipia

The different types of droughts discussed in section 1.2 are measured with different indicators. This makes it difficult to find consistent sources on past droughts. The Emergency Events Database (EM-DAT), provided by the Centre for Research on the Epidemiology of Disasters (CRED), recorded 16 drought events in Kenya since 1965 (data downloaded from EM-DAT[8] on 18.07.2020). Six of them could also be registered in Laikipia or in bordering counties: 1971, 1999/2002, 2005/2006, 2008/2009, 2016/2018, 2019. The MoALF (2017, p. 3) seems to have a less strict definition of drought as it states that "*since the 1970s to 2009, the county [Laikipia] experienced droughts in all years except for 1982, 1997/1998 (when there was the El-Niño), 2002 and 2005*". The 2000 and 2009 droughts are marked as severe. By means of the Standardised Precipitation Index (SPI), which is mostly used to measure meteorological droughts (UNDRR, 2019), Huho et al. (2010, p. 38) identified the following droughts for Central Laikipia: 1982-1985, 1987/88, 1991-1994, 1999/2000. According to Karanja (2020), the cycle of recurrent droughts has shortened from 5 to 3 years, so that droughts can occur much more frequently today.

The results of the surveys show that the years 1984 and 2016 are strongly remembered by farmers. In answer to the question when they had experienced the last drought, these two years were by far the most frequently mentioned. Since some respondents reflected

8 https://www.emdat.be/

several drought events, we received a total of 55 responses, with someone unable to give an answer. In total, this resulted in 16 drought events. The mentioned year furthest back was 1982 and the most recent 2019. The most mentioned droughts were 1984 (18 times), 2016/17 (10), and 2015 (6) (see table 5.1). The remaining dates were only mentioned between 1 and 3 times. The answers may contain a certain range of errors, as the respondents could not remember the exact year and only gave an approximation. It is therefore conceivable that the mentioned years of 2015 and 2016/17 might refer to one single drought event over three years. Rainfall data[9] provided by CETRAD from different weather stations around the study villages show that the region experienced below-average precipitation in 1984, 1991/92, 1999/2000 and 2009. In most cases, the drought is characterised by a complete absence of the long rains in spring. Only two of the stations of interest provide data until 2015. That is why the drought from 2016/17 is not covered by the data.

Table 5.1: Perceived years of drought by the smallholder farmers

Year of the last drought	Number of mentions
2019	1
2018	1
2016/17	10
2015	6
2013	1
2009/10	2
2007	2
2003	1
2000	3
1998	1
1996/97	3
1994	2
1992	2
1987	1
1984	18
1982	1

9 Accessible on http://www.wlrc-ken.org/data/timeseries/stations/1. The following weather stations were taken into account: Jacobson Farm, Kalalu NRM, Loldoto Farm, Loruk Farm, Matanya E, Matanya NRM, Nanyuki KAF, Ngenia F, Ngenia NRM.

It can be assumed that there might be some risk that the answers to this question were biased. For example, if the respondents have memories of a very severe drought a long time ago, they might have tended to refer to this one during the follow-up questions, rather than to a drought that happened only a few years ago. Also the age of respondents can influence the response. Obviously, a 40-year-old person can not remember droughts that happened in the 1980s. One respondent, a 23-year-old woman, could not remember a drought that occurred during her lifetime at all. However, while comparing the respondent's age and the year they mentioned, no statistical correlation could be found. Younger people mentioned droughts that occurred a long time ago, and vice versa, elderly people referred to recent droughts. And still, even if an answer was not "correct", meaning that it does not correspond to official data, most of the respondents were able to talk about the drought, how it impacted their household and how they coped with it, which in any case was valuable for this research.

It was astonishing that many people referred to a drought so far back (1984). The reason for this could be that this drought is remembered as one of the worst. Or because since then the consequences have been less severe for most households. For the purposes of this research, however, it may be of particular interest that the drought to which the follow-up questions referred, was some time ago. Thus, in the meantime, adaptation mechanisms could indeed have been established and the respondents can also assess what has worked and what has not. If everyone had referred to the year 2017, the period would have been too short for the effects of adaptations to manifest.

5.2.2 Perceptions of droughts

This research analysed the perception of farmers about droughts. On the one hand, they were asked whether they think that they will be hit by another drought within the next five years. On the other hand, the farmers explained how they evaluate the potential impacts of a future drought on their household.

Apart from the respondents in Matanya, the majority in the other villages said that they feared a new drought in the next five years. Although, when asking how a future drought will affect them, more than half of the sample was rather positive by saying that they will feel less or no effects. Twelve persons fear negative effects. More about the impacts of droughts is examined in the next section.

As reasons why someone expects less negative effects, many respondents said that they were able to store food or fodder for their livestock, or because they have a stable off-farm income. People who do not fear drought in the near future at all referred to the current favourable weather conditions. If they persist, they would have nothing to fear. It should be noted that it rained considerably at the beginning of the fieldwork (see figure 2.4), although January and February are usually the driest months of the year. These answers seem to indicate that there is a certain lack of capacity to take a long-term perspective. This was also shown by informal conversations on climate change. People do notice that the climate has been changing compared to the past. But they are not aware of the danger that climate change will bring for the future, for example, the increased risk of more intensive drought periods, as a respondent in Ngenia said: "*Droughts are seasonal and crop farming is something you can rely on, especially to get food for home consumption*". This lack of awareness influences the ability to anticipate to future crises and their adaptive capacity.

5.2.3 Impact of droughts on smallholders

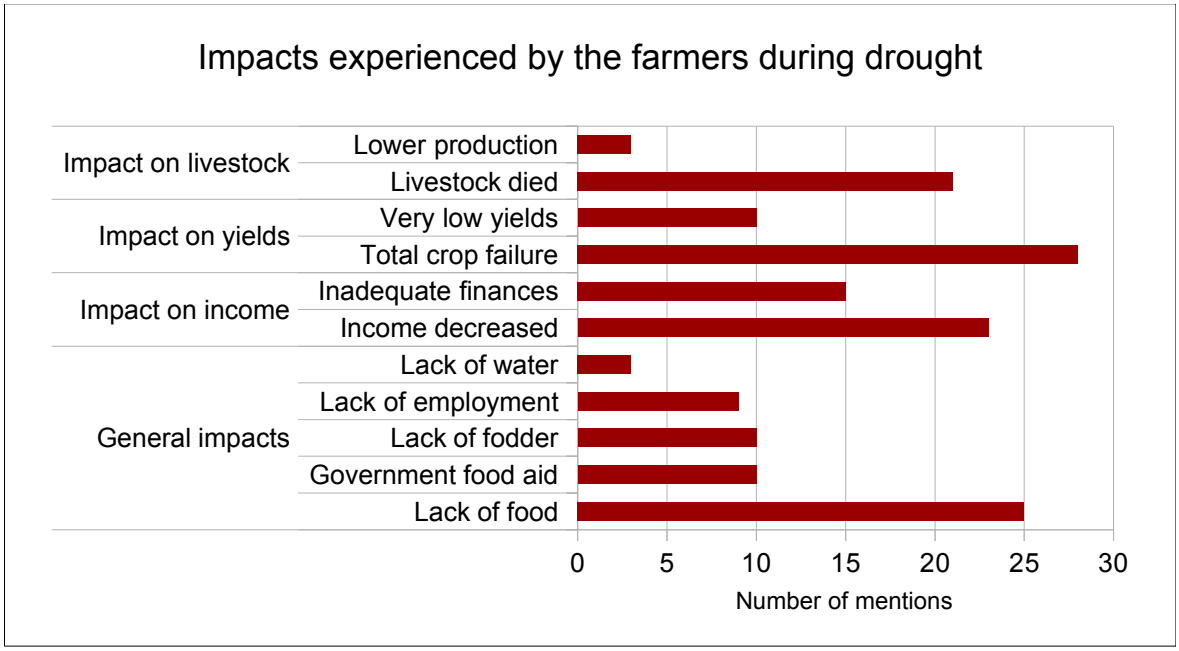

Figure 5.1: Types of impacts mentioned by the farmers during the survey. N=39, as one respondent could not remember a drought.

The respondents were asked both about the impacts of the reference drought and about their reactions to cope with it. Sometimes respondents mixed impacts with reactions. If one is forced to adapt some behaviour in order to cope with the drought, this can be seen as an

impact, but such changes in behaviour were assessed as short-term reactions. Therefore, only aspects that caused a change in a condition were considered to be an impact, while reactions are seen as actions or change of behaviour.

The most significant issue in the region is the effect on agricultural production (see figure 5.1). It is not uncommon that farmers have to deal with a complete crop failure during a drought. Due to the lack of water and feed, the production of animal products also declines – and many farmers even complained about the death of their livestock. In a subsistence system, this inevitably leads to a shortage of food, and in serious cases, households are dependent on food aid. The farmers' finances are also affected, as there are no products to sell and due to a collapse in supply rising food prices are likely. In addition, during droughts, jobs are lacking and employees are laid off.

It was mainly younger people who said that there was a lack of employment. The mean age of the nine persons who mentioned a lack of employment is at 40.3 years, compared to the overall average of 51.5 years. At the same time, a lack of employment was more likely to be associated with droughts that occurred only a few years ago. Since younger people did not necessarily refer to recent droughts, these two correlations are not linked. This could mean that young people are more used to looking for work and therefore have a different focus than older people. Or there were generally fewer work opportunities in the past and people worked less outside their farm, and therefore missing jobs were not noticed. These assumptions would need to be further analysed.

Additionally to the above impacts, the interviewed experts mentioned insecurity. Due to the lack of water, pastoralists from northern regions take their livestock to Laikipia in search of pastures and water, and aggravate the already existing pressure on natural resources. This can lead to violent conflicts, theft and forced displacement of local residents. Such conflicts further affect the economy as out of fear, businesses and public services are kept closed, or employees of large farms are sent home. This makes the situation of the population even more difficult as they no longer have access to health centres, for example. Even without this insecurity aspect, droughts affect the entire economy. There are two reasons for this: First, rising food prices mean that people spend most of their money on food, thus reducing consumption in other sectors; and second, water-dependent industries, as well as horticultural farms, are laying off employees, who often do not originate from the region and return home. These consumers are then missing to the local commerce,

which is why they are also confronted with losses.

5.3 Unsafe conditions

As explained in chapter 3 the unsafe conditions used in the PAR model as part of the progression of vulnerability, are understood as livelihood insecurity. The different elements of the SLF were taken into account for the analysis and the results are presented accordingly.

5.3.1 Natural capital

Land size and land use

The land sizes of the surveyed households range from 0.5 acres to 7 acres[10], while the median lies at 1.82 acres. On this land, the farmers carry out various activities. As can be seen in figure 5.2, crop farming is by far the most important land-use type, followed by livestock keeping and the cultivation of fodder grass. The shares per type of land use, though, vary greatly from household to household. For example, the share of crop farming ranges from 3.6% to 82.5%. With regard to livestock keeping, it should be noted that not all those who keep livestock have designated a separate area for it. This is either because they only

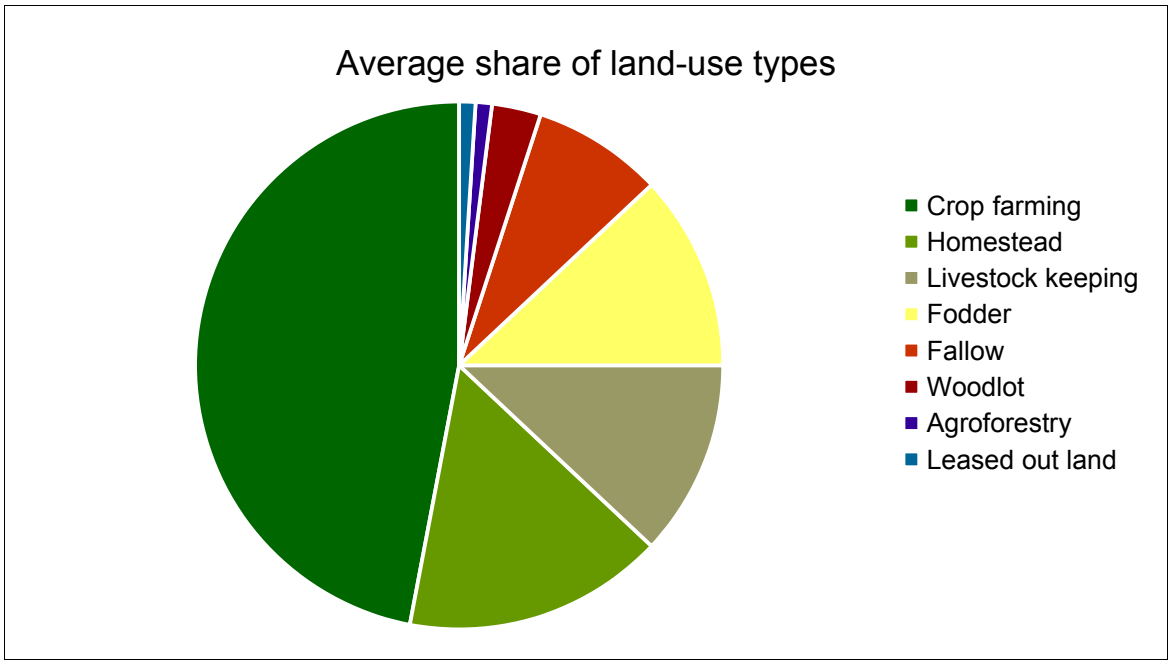

Figure 5.2: The average share was calculated by cumulating the shares of a land-use type in the total area per household and dividing by the total number of households in the sample

10 1 acre = 4046.86 m^2, 1000 m^2 = 0.247105 acre

have some smallstock or chickens that are roaming around on the homestead, or because at night they keep their sheep or goats in stables and during the day they take them to public land for grazing (on the left in figure 5.3). The people who mentioned to have land for livestock use between 0.7% and 85.7% of their land for it. For cattle, two different types of husbandry are practised. Most of the farmers bring their cattle to a grazing ground. Some farmers, however, practise zero-grazing, which means that the cattle are kept in stables and fed there (on the right in figure 5.3). Since these cattle are fed dried grass, they have a greater need for drinking water – a cow drinks up to 120 litres per day.

Depending on the total area of land available, the homestead can make a significant contribution. Additionally, six households maintain a woodlot, four households are leasing out some of their land, three are practising agroforestry and one household has two separate ponds for fish farming, which is marginal in terms of area and therefore not shown in figure 5.2. A certain part of the land lies barren. A respondent said that depending on how much money she has available, she hires someone to work the land. If that is not possible, she leaves a part of the land fallow. In general, households in the semi-humid zone use more land for crop cultivation (on average 1.2 acres and 59.75% of the total land) than the ones in the semi-arid area (on average 0.72 acres and 34.61% of the total land). On the other hand, livestock keeping is more important in the semi-arid villages, as can be seen from the different sources of income discussed below.

Access to water

Thirty-five per cent of all the households do use a water source in addition to rain to irrigate their crops. Among these households, eleven are members of a water project. The water

Figure 5.3: Left: goats grazing on public ground in Nanyuki; right: cowshed in a zero grazing system
Pictures taken by the author

projects are not always reliable as the access must be rationed because many households are connected. Therefore, some of the households do not use this water for irrigation, but only for domestic use. There are still a few households who draw water directly from the river. A respondent in Matanya mentioned that they drilled a borehole, but it turned out that the water was salty and therefore of no use for irrigation.

5.3.2 Physical capital

Within the physical capital, the only aspect that was assessed in the survey was the use of markets by farmers and the way this has changed during a drought. More about market access will be discussed in section 5.4.4. The frequency of market visits among the surveyed farmers varied considerably. Nineteen households go to the market once a week. Fourteen households visit the market less frequently, between three times a month and once every two months. On the other side, six respondents said to go there more often, between twice a week and daily. One household does not go to the market at all as it receives all the food from their children. All villages have their own small market, which is close by and easily accessible for most households. The local market is visited by practically everyone. Three households mentioned that they mainly use the market in Nanyuki at a distance of about 17 km. The farmers mostly buy products in the market that they are not cultivating themselves, such as horticultural crops or cereals. Most of the surveyed households use the market mainly for purchases as they tend to sell their crops to brokers.

During the referred drought, people went to the market more often, on average 1.69 times per week compared to 1.27 times per week in normal times. While looking at the changes within the households, it is visible that 17 went more often and 17 went less often to the market during the drought. The people who had more market visits, went there to compensate for their crop failure with market purchases. They had enough liquid assets to buy food in the market. At the same time, the reason why the other households reduced their market visits, was the lack of money.

5.3.3 Financial capital

Livestock

Livestock is an important source of income and financial asset. All except one household from the sampling are keeping animals. Livestock is primarily used for own consumption

of animal products, such as cow milk, eggs or meat of chickens. The meat of cattle, sheep and goats is not consumed directly, but the animals are sold to slaughterhouses. In return, their meat is bought in the market. A majority of the households mentioned to selling livestock on a regular basis, which is even more pronounced in times of droughts. This is either as a security measure, because there is not enough fodder and they would otherwise die, or as sale of an asset to obtain money.

With regard to cattle, it was noticeable that only persons who own few or no cattle were saying that during the drought they had not enough money to buy food. Although the number of cattle corresponds to today's level, which may have been different at the time of the drought, this indicates that cattle is an important asset that can generate income or be converted into money in times of crises.

Income sources

A variety of different sources of income could be identified, which can have a very different significance for the total income depending on the household. Also on average for all households surveyed, not all activities play the same role. The most mentioned were crop sales and sales of animal products. The 15 households that are not counted in the crop selling households either sell crops only to a negligible extent or they use their harvests only for their own consumption. The importance of crop sales in the total income, how-

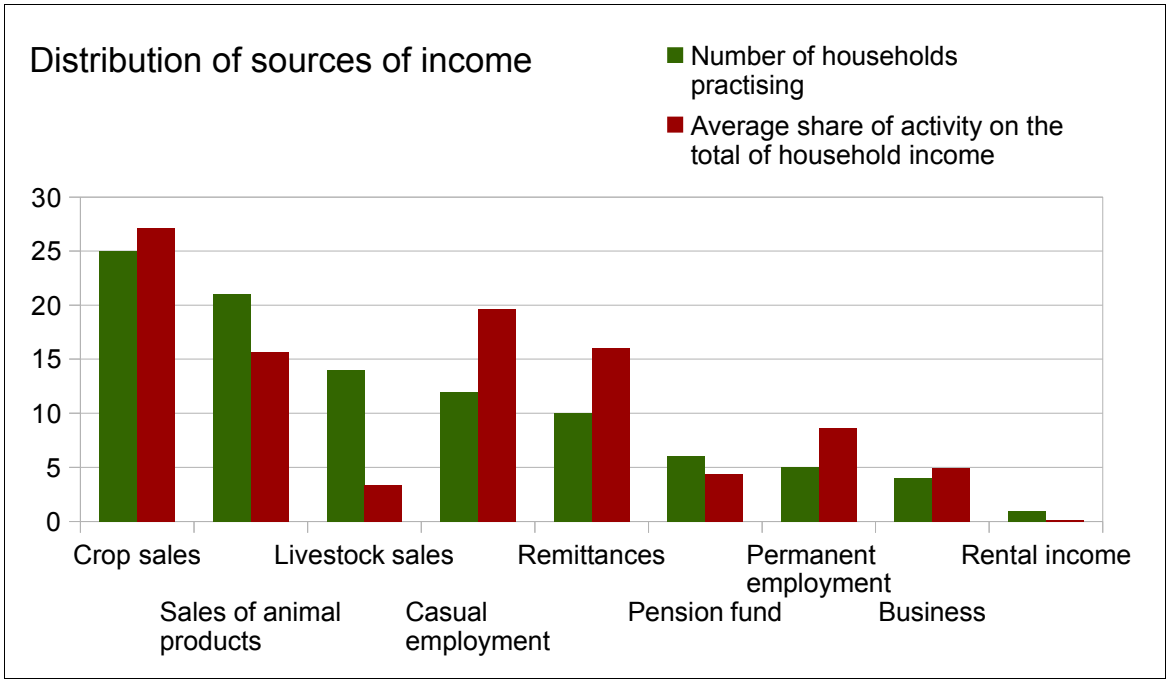

Figure 5.4: Types of income sources practised by the surveyed households and their average share in the whole sample

ever, varies within the households between 5% and nearly 100%; the same applies to the sales of animal products. As already mentioned above, many households sell livestock regularly, but the amount is negligible over the year and does not contribute a lot to the income (as shown in figure 5.4). The second most important income source in terms of share of the household income is casual employment, however, it was mentioned only by twelve respondents. Less significance has permanent employment. Most of the people are employed either on a large horticultural farm or on small-scale farms. Also employment on a flower farm was mentioned a few times. A quarter of the surveyed households receive remittances as a rather significant part of their regular income. Other, less significant, sources of income are rents from the national pension fund for people older than 70, and revenues from small businesses and from leasing out some of the land. When looking at the shares of the various activities in the total income per village, it stands out that in the semi-arid zone less income is generated from selling crops. This reflects the above findings that the semi-humid area is dominated by crop farming whereas the semi-arid area focuses on livestock keeping.

The more total area is available, the more emphasis is placed on livestock farming. By contrast, households with small areas are more likely to earn off-farm income. This is probably due to the fact that the small area is not sufficient to provide for the family, which is why food has to be purchased and therefore an income through employment is necessary.

5.3.4 Human capital

The size of the household seems to have an influence on livelihood strategies, under consideration of the amount of work involved. If a member of a household is employed, this is usually an adult person – often even the household head. Single-generation households never stated to generate part of their income through employment. The latter rather focus on livestock farming. The fact that more crop farming is done in “standard” and multigenerational households than in single-generational households could possibly be explained by the fact that crop farming requires more labour than livestock keeping and is therefore rather neglected by smaller households.

All surveyed households are more or less involved in agriculture, but the smaller a household is, the more the amount of work per capita results. This may be one reason why

smaller households have no capacity for an additional off-farm income. The data show that households consisting of only one or two persons do not generate any income from employment. However, this is also influenced by age. Small households are more likely to be inhabited by older people. Another aspect from the human capital is skills and knowledge. This will be discussed in section 5.6 Adaptation strategies.

5.3.5 Social capital

The memberships in water projects were already mentioned under the paragraph natural capital–access to water in the same chapter. Out of 14 who use an additional water source, eleven are members of a water project. Community water projects are one type of organisations that can be a member of Water Resource User Associations (WRUAs[11]). The more members the WRUAs have, the better they can achieve their goal, which is primarily to reduce over abstractions of river water. The WRUAs help to establish a balance between the water withdrawals of the different stakeholders to guarantee sustainable use of the river water. They represent an important institution for the whole region. However, the value of WRUAs is not perceived positively by all members, as some said that the available water is not reliable.

In the discussion regarding market visits during a drought, it was mentioned that some households preferred to buy food directly from fellow farmers at lower prices. This can provide an alternative to buying food at rising prices in the market. The network among neighbours thus seems to enable to moderate the effects of high market prices to a certain extent. Also inner family assistance during crises or on a monthly basis through remittances has its importance. Apart from that, there exist “merry-go-round” self-help groups. The community establishes a fund of which the members can borrow money for investments.

5.3.6 Livelihood outcomes

Sixteen out of the forty respondents stated that their household's needs are satisfied. However, some said that this depends on the weather and the yields, or that they could only

11 The WRUAs have been established since 1995. Every sub-catchment of the Ewaso Ng'iro system has its own WRUA. They are organised by a management and executive committees with representatives from different stakeholders. According to Providoli et al. (2019) the establishment of WRUAs also led to a reduction in ethnic conflicts in the region.

meet their needs thanks to credits or remittances. Among the 24 households, whose needs can not be met, six said that although their resources are inadequate, *"somehow they manage"*. This formulation was also encountered during informal talks and seems to reflect a generally positive attitude of the population. It was further analysed whether other indicators influence the satisfaction of the household's needs. The analysis revealed the factors presented in table 5.2.

Table 5.2: Factors influencing whether the needs of households are met or not

Determining factors of the level of satisfaction	
Positive factors	*Negative factors*
(Land size) Livestock keeping Cattle	Household size Employment linked with a small land area

Household size: The larger the household is, the more difficult it seems to satisfy the needs. Of the twelve households with five or more people, no one indicated that their needs were met.

Land size: Farms of two or less acres were more likely to be hindered to go to the market during the drought due to a lack of money. These same households now generate a greater proportion of their income through off-farm income. It seems that the more land a household has, the more income is available even in times of crisis like drought, e.g. through sales of livestock. However, there might be some uncertainty, as the size of the area during the drought may have been different than at the time of the survey, and also that the income situation may be different today than it was during the drought. Since respondents who have a large area of land also stated that their needs are not satisfied, a large area is no warranty for well-being. That is why it is only indicated in brackets in table 5.2.

Livestock keeping: A positive attitude is rather shown by people who have designated a larger area for livestock farming. However, there is a source of error here, as not all livestock farmers designate a separate area for the livestock. Though, there is a light connection between the number of cattle per household and the positive attitude. The 15 households, which have no cattle at all, are more pessimistic and fear rather negative effects of future droughts, and eleven said that their needs are not satisfied.

Employment: Of the 15 households that generate a portion of their income through

employment, only four are able to meet their basic needs. This is consistent with the above finding that if a household has only a small area available and is employed at the same time, it is more susceptible to hardship.

5.4 Root causes

The results from the surveys and the expert interviews revealed some aspects that influence the farmers' vulnerability at an underlying level. Factors that influence the access to land, to water, to employment, and to markets are presented here under the notion of root causes. However, it requires more information to identify them as such. Information from the surveys and the expert interviews was assessed through a comparative approach with academic literature to analyse the root causes.

5.4.1 Access to land

Land is one of the most important resources for agriculture. Access to land, therefore, is crucial for the survival of subsistence farmers. Lindoso et al. (2014) furthermore highlight, that land tenure is an important aspect for a household's adaptive capacity. The present research on small-scale farmers in Laikipia confirms that land is a key factor to reduce vulnerability.

All the respondents from the survey said that their land is family-owned. Twenty-two families were given the land by inheritance or they are using land that has not yet been handed over officially from the parental generation. On the other hand, 17 families purchased the land and one household is using land for free through a government scheme. There were respondents who did not grow up in the region. Those who are younger moved to the region because they married here. Older persons, on the contrary, bought land here, in the time when the land was affordable after the settlers returned to Europe after independence. Today, however, it is much more difficult for smallholder farmers to acquire land as the prices grew significantly as a result of settlement schemes and speculation (according to informal conversations and Käser, 2018). The land tenure system in Kenya is based on a freehold system, that grants many rights to the owner. Land can only be acquired through "*willing buyer–willing seller*" principle, and once the property rights are transferred, the owner is protected from eviction (Wiesmann et al., 2016; Zaehringer et al., 2018). In Kenya, family land is traditionally divided among the children. After several gen-

erations and divisions among the offspring, the plots have become so small that in many places agriculture can no longer meet the needs of a family (Laikipia Wildlife Forum, 2012). This and the fact that farmers can hardly afford to buy new land, force them to look for off-farm activities.

5.4.2 Access to employment

Almost half of the household in the sampling is employed, either on a casual or a permanent basis. Practically all of them work in the agricultural sector, be it large-scale horticultural or floricultural farms, or small-scale farms that practise irrigation along the rivers. This means that these jobs are also dependent on water. As it was mentioned during the expert interviews and found out by Käser (2018), this type of labour is not secure, as even the export-oriented farms lay off parts of their staff during droughts. Work on farms might be a preferred source of off-farm income for smallholders, as they do not need any additional skills or specialised knowledge. Employment in non-agricultural sectors could be more secure. On the other side, it was stated that the whole economy is affected by droughts.

5.4.3 Access to water

Apart from land, water is another natural resource without which agriculture and livestock farming would not be possible. Water is the limiting factor for agricultural production in semi-arid regions like Laikipia. Where rainfall is not sufficient, it is necessary to irrigate to guarantee adequate yields. Access to irrigation water, however, is not obvious, and especially in times of drought very limited. We have seen in section 5.3.1, that most of the sur-

Figure 5.5: Left: intercropping system with maize and sukuma wiki (a local type of kale), right: fodder grass cultivated for zero-grazing system
Pictures taken by the author

veyed smallholder households practise rainfed agriculture. Some households do water harvesting, but this is mostly not sufficient for irrigation and therefore only used for domestic needs and for livestock. The difficulty of water harvesting can be illustrated in the following example, as explained by a farmer. In the region around Naibor, many water pans have been dug on farmers' land by the state just a few days or weeks before the surveys were conducted. The government identified suitable households with sufficient land and went to excavate very large water pans, free of charge. However, they do not provide liners, which at that size would cost about 40,000 KSh[12]. The farmers would have to buy them on their own. As this represents a huge amount for a smallholder household, this is probably hardly done. It is questionable how useful such a project is. In a region with so little rainfall, such a large pan will hardly ever fill up with water. Especially if no liner is available. This is more of a "Pflästerchen Politik"[13], which intends to put the state in a good light, but does not really bring any improvement.

Households practising irrigation agriculture differ geographically. In Mia Moja and Ngenia nine and two out of ten households respectively, irrigate their crops. In the semi-arid villages, there is one or two households respectively. This may be due to the fact that access to water is better in Mia Moja because of its geographical setting. It may also be related to the fact that access to water projects is easier in Mia Moja than in the other villages. Or it could also be related to crop farming that is less practised in the semi-arid villages. People who practise irrigation stated more often that their needs are met, compared to the overall average. It is also noticeable that irrigating households referred less often to recent droughts and more often to the 1984 drought, which may indicate that they felt fewer impacts from recent droughts thanks to irrigation. Also, statements from the expert interviews highlighted that water can reduce the vulnerability of small-scale farmers.

5.4.4 Access to markets

All respondents from the survey live quite close to the market and most of the streets that have been observed are passable. The physical access to the markets is therefore not a major issue for the majority of the people in the study villages. However, the discussions showed that the market, in general, is not well developed and functions anything but per-

12 100 Kenyan Shillings = 0.93 US Dollar (https://www.exchangerates.org.uk, accessed on 06.08.2020)

13 Swiss term for political measures which, as pseudo solutions, only address symptoms but do not deal with the cause of the problem. Pflästerchen is Swiss German for plaster.

fectly. One farmer complained that the government was doing too little to regulate the market. Since all farmers are growing the same crops, there has already been an oversupply of tomatoes, which has caused prices to collapse. In addition, the market is flooded with cheaper goods from other regions or even from abroad. A county employee said that an oversupply is often constructed by traders spreading rumours. They want to achieve lower prices in order to increase their margin.

Another aspect in this context is the lack of bargaining power of farmers. Many farmers sell their products to brokers. And since smallholder households often need quick money, e.g. to pay the children's school fees, they are more willing to sell their products immediately and are not able to withstand the price pressure exerted by the intermediaries. As a result, sales prices may not even cover the farmers' production costs. If they sold their goods themselves on the local market, they could charge higher prices. However, they appreciate the potential to save transport costs and accept a loss in the selling price. The situation of farmers within the market could be improved if they organised themselves into interest groups. This could serve, on the one hand, to enable them to coordinate with each other and avoid oversupply, and on the other hand, and more importantly, to strengthen their position in negotiations with brokers. Nevertheless, half of all respondents stated that they sell their products mostly to brokers. Nine sell their goods to fellow farmers and only a few said that they sell directly to consumers. Selling to brokers is still preferred by many, as they come and pick up the goods at the farm gate, thus saving the farmer's transport costs compared to going to the market themselves.

Furthermore, prices increase extremely during droughts. In times of crises, traders buy maize at low prices in rain-safe Uganda and sell it at exorbitant prices in Kenya. They take advantage of the crisis to increase their profits. As an example, the price change of potatoes was mentioned. A normal market price is about 250 KSh per kg. During the drought of 2019, the price shot up to 800 KSh per kg. For households that are used to consume their own food, this becomes a luxury good. Again, this shows that farmers are heavily exposed to the rules of an imperfect market. Therefore, money is the biggest obstacle to market access for smallholder farmers, especially during droughts. If they lack the money to buy food, they are dependent on food aid from the government and have a higher risk of malnutrition. During droughts in the past, however, lack of money was not as much a problem in terms of market access as the availability of food. In the past, markets were not as

interconnected as they are today, where food is brought from unaffected regions or even from abroad. As a result, food is now generally available even during droughts. However, since prices can rise sharply, the lack of money is more of a problem today.

Households that generate a bigger share of their income through crop sales, tended to go more often to the market during the drought. The same correlation, albeit weaker, can be seen in income from the sale of animal products. These households were able to sell more livestock in response to the drought to generate income, even if in some cases they could only sell at "*throw away*" prices. On the other hand, people with a share of their income from employment were less likely to go to the market during the drought. This shows that for households that are normally more dependent on their own production, greater compensation from the market was necessary and therefore went to the market more often. At the same time, it shows that the same people had the financial means to buy food, whereas persons in employment were lacking of exchange entitlements.

5.5 Coping strategies

This section shows the variety of options farmers are able to use to overcome the effects of droughts. Activities that had been done only temporarily during the drought period were distinguished from the adaptation of new activities that are still done today or have been done for a longer period. The former are called short-term reactions or coping strategies, and the latter are discussed below under adaptation strategies.

The NDMA's contingency plan, which is implemented in collaboration with county departments of different sectors, defines measures to be taken at each stage of the hazard. If a drought is predicted or identified, farmers are informed and advised on how to act, e.g. in terms of food shortage, water consumption, or livestock. As short-term reactions, there have been mentions of some sort of new or additional income generation, such as the search for casual work or selling parts of their livestock (see figure 5.6). In times of droughts, farmers are advised to sell parts of their livestock, as they would not be able to satisfy their food and water demand. However, there are always some farmers who do not or who do too late sell their livestock, which was criticised by experts. This can then lead to the death of livestock. Fewer people started an independent activity to add some income, e.g. burning and selling of charcoal, fetching water, or other services. Eleven persons men-

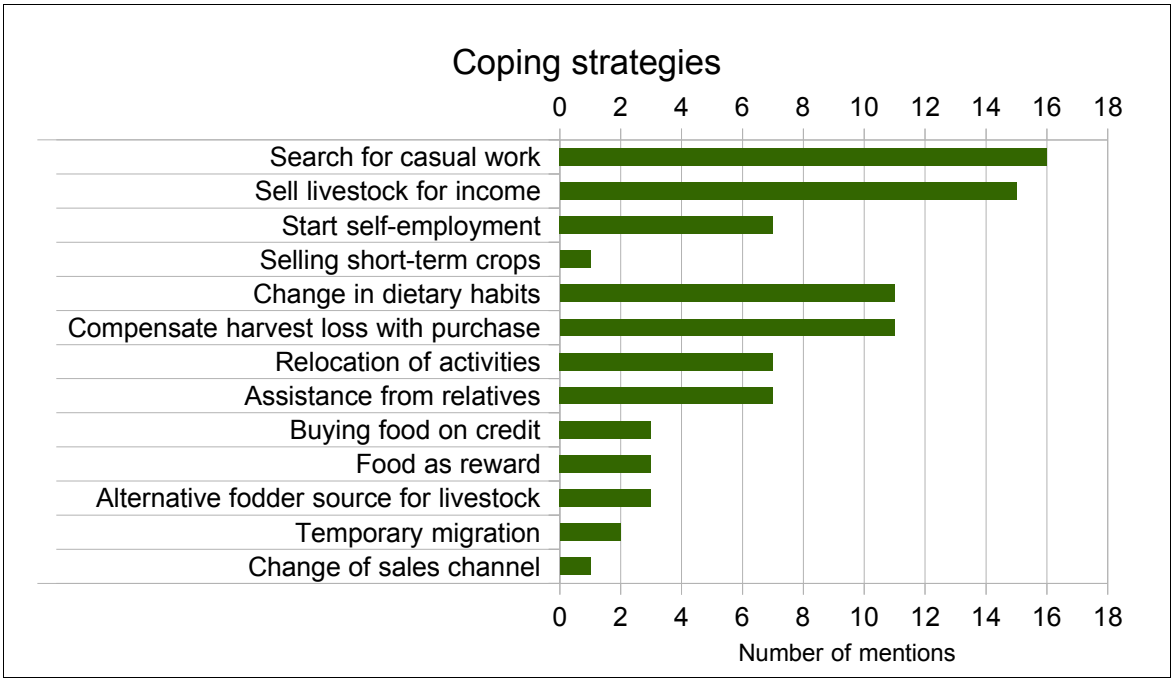

Figure 5.6: Coping strategies applied by households as a response to droughts

tioned a change in their dietary habits, for example, reducing the number of meals per day, reducing the quantity per meal, or reducing the variety of food. Food was bought in the market for a bigger extent than usual to compensate the crop losses. Besides, people went to regions less affected by the drought to search for jobs or to buy food, water, and animal feed. Some households received money or food from relatives, or obtained food instead of money as payment for casual jobs. A few bought food on credit, i.e. they paid it later as soon as they had money again. Other less applied strategies were the use of alternative fodder sources for their livestock, temporary migration in a region not or less affected, or to sell their products themselves in the market instead of selling it to brokers, to achieve a higher margin. In section 5.2.3, we could see that in drastic cases food aid is provided by the public authorities. Other measures taken by the state during droughts are the provision of seeds and other inputs, as well as feed for livestock. These measures are usually demand-oriented. This means that the government first analyses which households need what. They try not to provide comprehensive emergency aid in order not to make the population too dependent on the state.

A few relationships between coping strategies and other indicators could be identified. They are presented in the following:

Income generation: As we have seen in Section 5.2.3, a lack of employment during

periods of drought is perceived by younger people on the one hand, and in combination with recent droughts on the other hand. Conversely, the search for casual jobs as a coping strategy has been more associated with droughts that occurred a long time ago. This could mean that, although smallholders were less employed in the past, they were looking for work in times of crises. However, opening their own business in response to a drought seems to be a more recent reaction.

Sales of livestock: People who sold their livestock during the drought did not mention that they changed their dietary habits. They could probably generate enough money from the sales to buy food, as they tended to go to the market more often during the drought. Of the twelve people who mentioned that they had to sell livestock, five said that they had a shortage of food during the drought, corresponding to only 41.6%, compared to the 62.5% from the overall sample. In addition, only one of the twelve said explicitly that they could not buy food due to lack of money.

Change in dietary habits: Households with a relatively small area of land, that is mainly used for crop farming, and who generate little income from employment, are more likely to be forced to adapt their diet. Because of the small area, they may have lost diversity more quickly. At the same time they have a lower share of income from employment than the average, which does not allow them to buy food with their income. Accordingly, the number of market visits is smaller for these households.

5.6 Adaptation strategies

With regard to adaptation strategies, one of the questions asked whether, following a drought, they had adapted their agricultural activities or farming methods to reduce the risk of future droughts. Prior to the surveys, a selection of potential activities or farming methods had been identified by means of scientific literature. If a respondent did not mention one or more of the identified methods, a second step was to ask why they did not try these methods. Unfortunately, it was not possible to assess a reason of non-adaptation for every option. That is why the number of answers is often lower than 40. After that, they were also asked which of their adaptations were most effective and which were least effective in reducing the risk of future droughts. Again, many were not able to identify neither the most effective nor the least effective method. The results of these questions are presented here.

Figure 5.7: Two water harvesting techniques. Left: rain water collection from the roof top, stored in a water tank, left: a water pan dug on the field
Pictures taken by the author

In table 5.3 can be seen that there were seven agricultural techniques that have been adopted by half or more of the surveyed households. The most popular method is the *cultivation of early-maturing varieties*, i.e. varieties that require less time to mature and thus offer a better prospect of good and more diverse harvests. With regard to *water harvesting* (see figure 5.7) and *agroforestry*, it is interesting that so many respondents mentioned them as an adaptation strategy, although when talking about irrigation and land use they did not come up much. This is because most households do not use the harvested water for irrigation, but rather as drinking water for the family or livestock. Agroforestry has rarely been mentioned as a separate land use because this is necessarily combined with the cultivation of crops (see figure 5.8). Reasons for not harvesting water are based on a lack of finances or on a preference for river water. The most important constraint to do agroforestry is the inadequate rains. On the other side, the people who were satisfied with agroforestry said that it would attract rain, which brings benefits for the whole plot. The *diversification of crops* was also quite popular. This includes for example to grow different varieties of the same crop, to grow other or new crops, or to grow horticultural products in addition to staples. The reasons why the other farmers did not diversify crops are mainly based on two constraints: the climate and consumption patterns. However, two farmers would maybe do otherwise if they had more land available. In any case, it seems to have the potential to increase crop production and food variety.

Table 5.3: Number of households that adopted an identified method and evaluating it as most or least effective

	Number of mentions		
Identified agricultural methods	**Adopted**	**Most effective**	**Least effective**
Early-maturing varieties	30	4	2
Water harvesting	25	1	2
Agroforestry	23	3	0
Diversify crops	22	8	1
Change planting days	22	7	0
Drought-tolerant crops	20	0	0
Fodder conservation	20	0	0
Mulching	17	3	0
No-tillage	12	3	2
Cash crops	1	0	0

Usually, farmers used to sow after the first rains, of both rainy seasons. When the seeds are planted some time before the rains (*change in planting days*), the seed can survive in dry soil, and when the first rains arrive, the seeds start to germinate immediately. This method has been adopted by 22 households. Again, the climate is the most important hindrance not to do it. Either they fear, that rains may fail completely, hence they waited for rains as usual, or that the onset of rain did not actually change, or that the rainfall patterns were uncer-

Figure 5.8: Agroforestry: Young tomato trees (tamarillo) on a field. On the right in the back an avocado tree is overlooking the farm Picture taken by the author

tain. Half of the farms started planting *drought-tolerant crops* after the referred drought. One respondent added that they grow drought-tolerant and conventional maize at the same time since they fear losses if it rains too much with only drought-tolerant varieties grown. Another half of the respondents said, that they started to *conserve fodder* for their livestock. For the other half of the farmers, this seemed to be too labour intensive.

The *diversification of crops* and to *change the planting days* were the methods with the highest approval; 36.4% and 31.8% of those who implemented the respective method also stated that it was the most effective. The other methods are of less importance. Many farmers did not see the need to *mulch* their fields. Either they have enough water or good harvests, or they use the plant residues as animal feed or to sell it. The adoption of a *no-tillage system* requires some specialised know-how and the use of herbicides, which is disliked by some respondents due to the fear of health issues. Furthermore, some farmers fear lower yields. However, the respondents who adopted the methods reported that both mulching and no-tillage increase soil fertility. *Cash crops* must meet high standards, as their production is intended for export. To meet these standards, there is need for irrigation and higher input costs. Therefore, also the climate and the household's finances are a hindrance. If the land is too small it is preferred to grow what is consumed, instead of selling the crops.

Most of the people said that they experienced improved output after having adapted the respective measure. However, a few think that the improvement was not because of the new technique but just because the climate turned better, or that the climate was not favourable and therefore there was no change.

Apart from specific agricultural techniques, there were also adaptations of the main livelihood activities after a drought. The engagement in wage labour and livestock keeping seemed to be an alternative to crop farming for some households. A few started an independent activity additionally to the work on the farm, such as working as a broker or to cultivate and sell horticultural products. Most of them still carry out these activities today. Again, inadequate finances were a hindrance for many to adapt their main livelihood strategy. The main issue is a lack of a constant flow of income which hinders them to venture another activity, like starting a business, as a respondent in Matanya stated: "*for business you need capital and to go to work for little money you would need to pay someone who looks after the children, so we prefer to just keep farming*".

According to the experts, many farmers are unwilling to adapt their cultivation methods, a statement that does not correspond completely to the above figures. They say that often the will to adapt is related to the output that this method can potentially generate. If the farmers do not achieve a better harvest with the new method in one year, it is immediately abandoned. Contrary to this, there were also farmers who abandoned a new applied method although it performed well. We saw above that farmers rated some methods negatively because of the high costs, the high labour demand, or because of fear of reduced yields. Contrary to this, the experts rather see the improper implementation of the methods or lack of awareness and knowledge as an issue. Or it is simply the farmers' conservative attitude towards alternative methods. Some examples were given where farmers act out of habit even though there are simple alternatives that might even be cheaper in the end. Thus, many reject no-till, among other things because of the cost of the necessary herbicides. The experts counter, that the conventional method is more labour-intensive and that workers may have to be hired to work the land. This can quickly become more expensive than herbicides. But one cannot only blame the farmers. One of the experts said that the demand for extension services was too low. In the past, extension officers used to go to the farmers at regular intervals. Today, the system is demand-driven. It can hardly be expected that the farmers come to Nanyuki to get advice.

5.6.1 Two perspectives on potential adaptations

In this section, the adaptations desired by the farmers are contrasted with the recommendations and visions of the experts. When the farmers were asked what they would do differently to overcome future droughts if they had the capacity or possibility, the most mentioned desired adaptation was the improvement of the water source, either for irrigation or for their livestock. The respondents mentioned different types of water sources: installation of a large storage tank, construction of a dam or pan, registration in a reliable water project, drilling a borehole, to practise drip irrigation, or to lease land close to the river. Ten persons would like to open a small business, and there was also a wish to invest in livestock to improve their income. All these prospects are mainly hindered by a lack of money. Some techniques would require specialised know-how or constant water supply. This is why these wishes remain difficult to achieve in the short-term.

The experts mainly agree with the farmers as they find that the availability of water

should be improved. This could be approached, they say, either through the promotion of individual water harvesting or through the generation of a public-private partnership that would supply water and where the farmers could buy the water for irrigation. However, the question is whether farmers can be persuaded to pay for water when they can simply take it out of the river. Furthermore, they find, that subsistence farmers should be encouraged both to store their crops instead of selling them immediately, and to retain seeds. The former can bring them better market prices and the latter makes them less dependent on the market to buy seeds. However, both require know-how and some basic facilities. Smallholders should also grow more drought-resistant crops or varieties. Sorghum, millet, yams or cassava are very well adapted to the conditions in Laikipia. However, they are rarely cultivated, as they are not consumed by the local population and subsistence farmers grow what they consume.

Conservation Agriculture (CA) seems to be seen as a panacea by the experts. With CA methods, they say, you always have a harvest, even with minimal soil moisture. The mechanisation of agriculture can also help, as it allows for faster and more precise work with less labour. Because many of these options are costly and require know-how, there should also be improved access to extension services, said the other two experts opposing the previously mentioned statement about the demand for extension services. Ideally, an extension officer would be responsible for a region and would visit the farmers at regular intervals to advise and support them in the respective methods. In general, farmers need to be made more aware and better informed, both about cultivation methods and about climate and weather. This is also illustrated by farmers saying that they lack the knowledge or know-how required for no-tillage and therefore do not apply it.

Apart from these rather small-scale adaptations, the experts are calling for the implementation of a county or even nation-wide zoning system for land use. Farmers should concentrate on growing crops that are adapted to the climatic conditions in their region. For example, farmers in region X should mainly grow maize. They would sell it to traders and use the money to buy the food they are no longer growing themselves, food which would be produced only in region Y. With such a system, a regulation by the state would be necessary to ensure that the exchange of goods between the regions would work. A weakened form of this could be a state-imposed regulation, as it is done in Tanzania or Uganda. To prevent malnutrition during droughts, every farm must grow drought-resistant

crops such as cassava.

Some of the expert's calls for adaptation do not correspond to the realities of smallholder households, as very often there is no money for any kind of investment. It is also understandable that if someone is dependent on their own production and only a small area of land is available for cultivation, they do not want to take any risks and try out new methods. The state could help here with subsidised programmes, but its scope for action is also limited.

6 Discussion

In the centre of this master's thesis lie two objectives: the identification of adaptation strategies to reduce the impacts of droughts, and the identification of root causes of smallholder's vulnerability to drought. This research was shaped by two perspectives, a livelihood perspective and a perspective that takes into account the political economy; both of which shape the vulnerability of farmers, but also their capacity to cope with or to adapt to droughts. Following these perspectives, the thesis asked 'what processes and conditions generate the vulnerability of smallholder households to droughts', as well as, 'how do the livelihood strategies of smallholder households in Laikipia County, Kenya influence their vulnerability to droughts'. It is difficult to give a conclusive answer to the second question since the livelihood strategies are also determined by the overarching processes and conditions of the political economy. Farmers often have no other choice but to pursue this or that strategy – the political and economic framework forces them to do so. This leads us back to the notion of *choice* – the choice to develop one's strategy – which is highlighted in the SLF. There, it is emphasised that it is important to know the factors that determine the choice to take actions accordingly.

The second research question may be difficult to answer separately from the first. Nevertheless, the livelihood analysis shows, that there are also individual aspects which influence the vulnerability, but more importantly, there are underlying factors that hinder the smallholders to act as they wish. Indeed, the results of the survey indicate that many farmers would do many things differently if they had the opportunity to do so; if they were entitled to do so. Four focal points for action were identified: labour market, land tenure, water supply, and market access. Following the two main objectives of this master's thesis, the discussion is separated into two sections. The first section will discuss the identified adaptation strategies, and the second the underlying causes of vulnerability.

6.1 Identification of adaptation strategies

Smallholder farmers in the study region have diverse livelihood strategies. Practically all

the surveyed households do crop farming and keep some livestock at the same time. Additionally, many of them earn some off-farm income. However, due to the climatic conditions, and the socio-economic context, not all of the strategies allow the households to attain the desired livelihood outcomes, for example, to reduce their vulnerability. Findings from the survey showed that households that raise animals to a larger extent are less vulnerable than households who only farm. Animals seem to be more drought-resistant than crops, and at the same time, they represent an important financial asset that can be divested in times of droughts. Livestock farming is therefore a factor that could lead to safe conditions by improving exchange entitlements. However, to build up the livestock, financial resources are needed in the first place. Lack of finances is an important factor that reduces the adaptive capacity of smallholder farmers.

With sufficient finances, one could buy more land, where it could be grown fodder grass or horticultural products. The former ensures the provision of livestock feed, and when used as silage or simply stocked, it can be fed to the livestock in times of droughts, which in turn secures the household's income during crises. The latter – the cultivation of horticultural crops – can diversify the diet or serve as an additional income. Though, in order to gain fair prices for their produce, there must be a functioning market. Furthermore, good yields from horticultural farming require a secure water supply. The available money could also be used to invest in an irrigation or water harvesting system. However, the results show, that water harvesting is difficult, as there is just not enough rain in the region. It does not help much either, that the government is digging huge water pans for free. Instead, investments should be made in efficient irrigation systems, such as drip irrigation to keep water consumption low. If the groundwater is salty, it will not be of any use to drill boreholes all over the county either. The state should provide for tests carried out by experts to examine the water quality, avoiding useless investments made by farmers. Here, as for river water, attention must be paid to ensure sustainable use of groundwater and to prevent it from being overused. River water stays an important water source. It is therefore important to facilitate its access by controlling abstractions even more strictly and prosecuting illegal abstractions more effectively. The WRUAs are already doing a good job in this respect, but their position should be strengthened.

It is also questionable if river water abstractions of flower farms and large-scale horticultural farms, which produce exclusively for export – mainly for the European market –

are legitimate in a region that receives very little rainfall and is regularly affected by drought. Admittedly, they generate numerous opportunities for employment, which provide an important income for the people living in the region, but they must not exploit the natural resources on which the local population depends, especially the smallholder farmers and pastoralists who have no political power. The use of river water from such companies should be restricted. They have the power and funds to acquire expensive technologies to collect and efficiently use rainwater. Moreover, it is also questionable how much of the added value of these companies remains in the region. The results have also shown that jobs in these farms are very insecure during crises and do not necessarily increase resilience. It is even assumed that households that are in employment are particularly vulnerable, especially if they have little land and are therefore forced to look for work. This assumption based on the analysis can be confirmed by findings of Käser (2018, p. 106) and Zaehringer et al. (2018, p. 88). If the employed farmers lose their jobs during a drought, they lose all their exchange entitlements.

Furthermore, smallholder farmers adopt many different agricultural techniques to prevent future droughts. However, there were often some contradictory statements from different respondents, which make it difficult to develop a clear image of the coping or adaptation strategies. Many factors are influencing the success of one or another strategy. Geophysical conditions of the study site, on the one hand, the application and socio-economic structures of the household, on the other hand, determine if the expected output can be achieved or not. Without doubt, CA methods and other alternative cultivation methods have a great potential to secure or even increase harvests, especially when there is enough land available. However, it was recognised from the survey results that farmers need more support. Access to extension services should therefore be improved. Most importantly, once a technique has been implemented, farmers should be accompanied to ensure that it is maintained over the long term.

There was also discussion of zoning of agriculture, as the climate in the region does not allow to practise subsistence farming sustainably. A strict zoning system, in which the farmers are forced to grow what the state dictates, would mean the transformation of the subsistence economy into a capitalist system and thus a stronger dependence on the market, which today shows big deficits. It is doubtful whether the state would be able to create ideal market conditions. It is also questionable whether a fully market-oriented system

would be able to improve the situation, or whether it would even increase the vulnerability of farmers. As Sen explained with the example of the worker and the sharecropper, a complete dependency on the market and their sales revenues render their exchange entitlements more vulnerable to shocks. Today, their exchange entitlements are also made up of their production and they have the possibility to store parts of it. In a capitalist system, if they suffer crop failures due to drought, they lack both the source of income and the storage capacity.

6.2 Underlying causes of vulnerability

We have seen that the farmers in the study region basically would have different possibilities to shape their living conditions. Though, smallholders can only shape their situation within their scope of action, in order to make their conditions as safe as possible. Yet it is the underlying causes that should be addressed to increase the farmers' scope of action, and to build their adaptive capacity, leading to a reduction of vulnerability.

Smallholders who are in employment in addition to their farm work, are often engaged in the agricultural sector, an economy that is also dependent on water, just like their own farm. Opportunities should be created where farmers can acquire new skills and knowledge to increase the chance that they can find work in other domains. Domains which are less exposed to the climate and droughts. At the same time, water-dependent jobs must be made more secure. Today, casual jobs – which are particularly insecure – seem to be more attractive for farmers to generate an additional income, but only permanent employment provides a secure source of income. Still, even if there were more secure jobs in other sectors, it is not clear whether the farmers would take them because they tend to do what they have always done, farming. Young entrepreneurs could also be encouraged to open or develop their small businesses. However, as the whole economy is affected by droughts, this is no particular guarantee against its impacts.

In recent years, there is usually enough food available during droughts, but this does not mean that there is no starvation. The rising of market prices during droughts means a deprivation of the farmer's exchange entitlement, i.e. their possibility to exchange assets for food. There must be a market regulation mechanism, which absorbs price fluctuation during crises. If the prices stayed on a normal long-term level, there would be less need for

government food aid, as the population would be better able to buy their food. To control and regulate the market during crises would, therefore, mean a rather preventive approach – opposed to food relief – that should also be in the government's interest. Even in normal times, however, there are market mechanisms that should be stopped. The market is dominated by middlemen who exploit their position of power for their own interests and to the detriment of the farmers; a situation which smallholders cannot combat themselves due to their lack of negotiating power. Market prices are very volatile and are partly constructed virtually. Price collapses during normal times and price increases during crises aggravate the situation of smallholder farmers. On the one hand, there should be regulatory mechanisms, and on the other hand, farmers should unite in cooperatives to improve their position. To reduce their dependence on the market, farmers should increasingly build up food stocks and propagate their own seeds. The latter would also reduce their input costs. However, this is only possible when there is enough land available.

Cultural aspects also play a certain role. Two different points emerged: on the one hand the culturally determined dietary habits, which are not entirely adapted to the climatic conditions in the region, and on the other hand the traditional system of land subdivisions among descendants. Cultural dimensions are difficult to adapt by top-down measures. It is therefore questionable whether and how an obligation to cultivate cassava would work if the attitude in the population towards this food is not addressed first. An awareness-raising campaign to draw attention to its advantages and benefits, and to convince farmers to grow it, will certainly take much longer, but it could be more sustainable in the long term than government regulation. Repeated land subdivisions increase the pressure on land. On the political level, measures would be needed to prevent land speculation, to ensure that land purchases remain affordable for farmers.

In summary, the following processes and structures could be identified as root causes or dynamic pressures that shape the vulnerability of smallholder farmers in the study area:

- Multi-stakeholders of the same resource and lack of technology lead to insufficient water supply
- The condition of the labour market and lack of training opportunities lead to insecure jobs
- Settlement policy leads to land speculation and high prices
- Market mechanisms lead to volatile prices and lack of bargaining power
- Cultural aspects such as dietary habits and inheritance of land

- Historical aspects and postcolonial politics

Figure 6.1 shows how these aspects could be represented in the PAR model. Although it was possible to identify factors that can be considered root causes of vulnerability, the exact origins in the political and economic system were not assessed. This would have required a more detailed analysis of the political and economic landscape in Kenya or Laikipia County, which would have gone beyond the scope of this master's thesis. Nevertheless, it was possible to identify areas of focus where a potential for improvement exists and which should be addressed to improve the situation of smallholders in general and to reduce their vulnerability in particular.

6.3 Further research

As just explained, a deeper analysis would be needed to see which policies are behind the identified processes and structures. This would enable action to be taken at a higher level. However, it should be noted that national policies do not necessarily have to be manifested in the same way throughout the country. A deeper analysis would also make it possible to look at the other side of the PAR model, the release side, to take targeted, context-specific measures.

The discussion on the zoning of agriculture has only been related to Laikipia and Kenya. It would be interesting to examine whether other countries have already made such a system change from subsistence to a climate-oriented production system and what experiences have been made, how the situation of farmers has changed and how they perceive the new system.

It would also be interesting to carry out the same or similar research in the context of pastoralists. Their livelihoods are substantially different from those of smallholder farmers and therefore need special consideration. If the pastoralist system becomes more resilient, they would have less need to migrate south during droughts and claim foreign land. This would reduce conflicts and indirectly improve the situation of the smallholders.

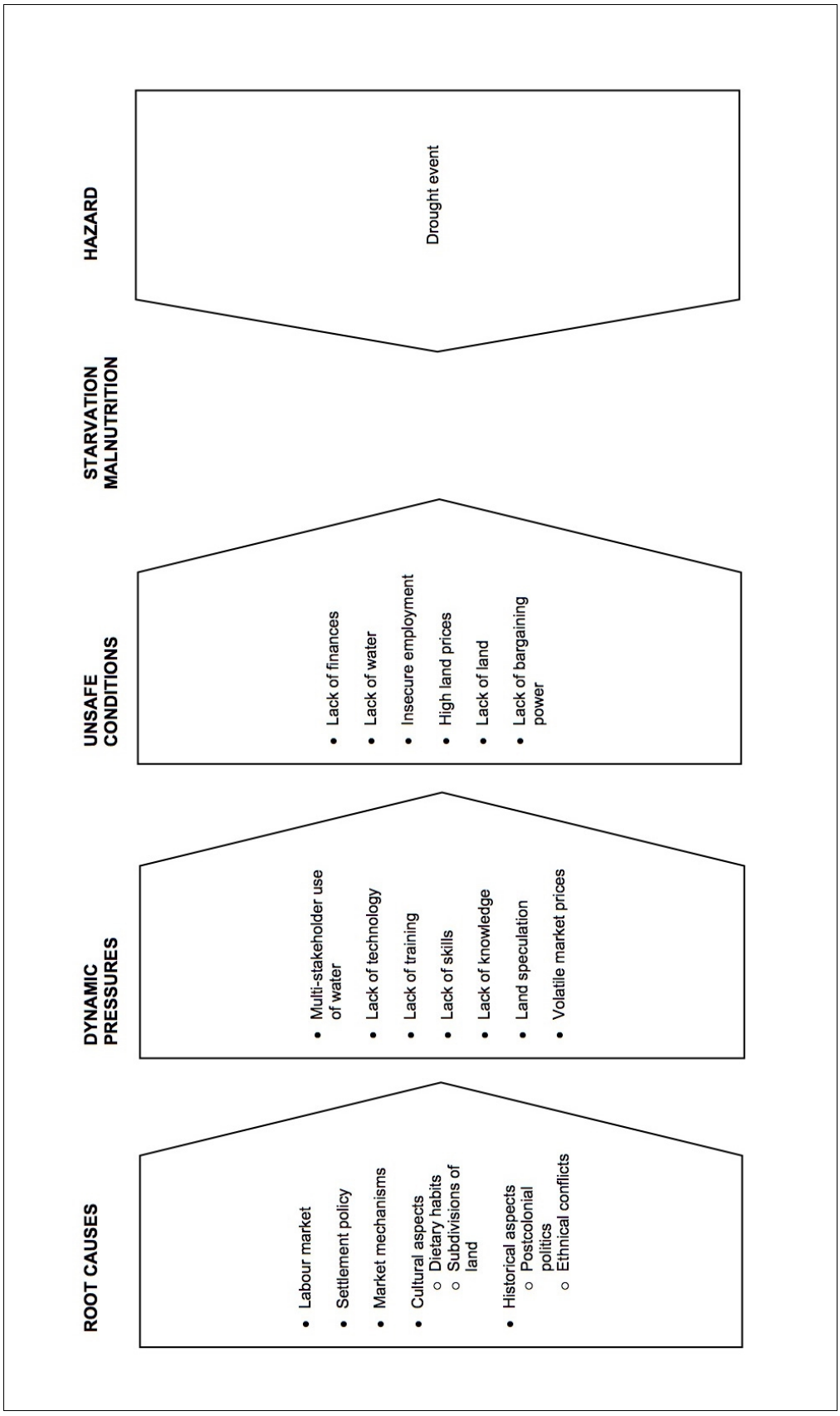

Figure 6.1: Pressure and Release model: adapted to the case study; vulnerability to droughts of smallholder farmers in Laikipia County, Kenya

7 Conclusion

At the beginning of this master's thesis, the assumption was made that smallholder farmers are particularly vulnerable to droughts because they are anchored in a system of subsistence farming and are largely dependent on their production. The results of this study confirmed that, although smallholders today pursue multi-strategies and no longer live on subsistence agriculture alone, they are exposed to various factors that make them vulnerable.

The first research question asked about the processes and structures that determine the vulnerability of smallholder households. It could be shown that the structures of the supply and sales market lead to volatile prices. On the one hand, smallholders cannot make sufficient profits from the sales of their crops, and on the other hand, food becomes prohibitively expensive when food is scarce. Both can lead to financial hardship, which can manifest itself in malnutrition. This is further aggravated by the lack of bargaining power of farmers vis-à-vis middlemen. Besides, the structures of the labour market do not guarantee a secure off-farm income for small-scale farmers. Land tenure policies lead to processes of land speculation which do not allow farmers to buy additional land. The latter, however, would be necessary to increase or secure crop and livestock production and to store food, which in turn could increase resilience during droughts. Finally, farmers lack a constant source of water on which agricultural production depends. Climatic conditions, lack of technology, as well as legal and illegal river water abstractions by various stakeholders, hamper water supply.

All these issues can lead to several pressures on smallholders during a drought, which make their conditions unsafe and thus make them vulnerable. Crop failures, job losses, insecurity, and loss of purchasing power lead to a deterioration of exchange entitlements. Therefore, policies and programs are needed, which would entitle smallholders, increase their adaptive capacity, and make their conditions safe. An intervention in trade and the labour market is necessary. Frameworks must be established to enable smallholder farmers to acquire new skills and knowledge. Also, farmers need to be made more aware of climate change, cultivation methods and alternative crops to increase production for self-consumption. Access to climate-relevant information must be improved so that farmers can anticip-

ate changes and make effective adaptations.

The second research question asked which livelihood strategies affect the vulnerability of farmers. Although the survey results are not representative and cannot be applied to the whole population in the study region, it was possible to identify a few dimensions. It was found that households without cattle – or with little livestock in general – are more vulnerable. If livestock keepers also have sufficient land on which fodder grass can be cultivated, the vulnerability of the household can be reduced. Livestock represents a financial asset and insurance in times of crises. Moreover, the combination of a limited amount of land and an off-farm income through employment has been identified as a factor that increases vulnerability. A small area of land hardly allows the household to produce enough to build up a stock of food, and since employed people are at risk of losing their jobs during droughts, these households become increasingly dependent on food aid.

In this master's thesis, prevention measures and relief were deliberately not dealt with in a more targeted manner. NGOs, the county and state authorities make an important contribution during droughts to help the most affected people to recover. Fortunately, drought-related famines have not occurred in recent years, as was the case in the past. And even though some respondents are very positive and even said that there is enough water and that the harvests are good, it has been shown that these smallholders tend to see the situation of today. As climate change will exacerbate the situation, it is imperative that action is taken. The study was able to show where measures could be taken at the political level to increase the adaptive capacity of the population and thus avoiding the need for disaster relief in the first place. This represents a more sustainable approach, especially with regard to climate change.

This master's thesis applied the Entitlements approach to the context of vulnerability of smallholder farmers to droughts. It was able to explain smallholder's vulnerability by a lack of exchange entitlements, which are rooted in processes and conditions in the political and economic system, and are manifested in imperfect markets, insufficient water supply and access to land. The combination with the PAR model allowed to include livelihood dimensions at household level, which was necessary to identify which measures were most important.

At the beginning of the fieldwork for this master's thesis, the coronavirus began to spread

but was still limited to East Asia. At that time, it was unimaginable that a few weeks later the whole world would be in lockdown. The fieldwork was completed in the same week when stricter measures were taken in Switzerland. When I learned that a lockdown was also declared in Kenya, I was thinking of the many people from whom I bought vegetables on the way home just a few weeks ago. All of a sudden, they were no longer allowed to do their daily work. The consequences of this loss of income are unimaginable for the people in Europe, who can benefit from short-time work arrangements, unemployment insurance and government assistance. Also in such a crisis, farmers who can grow their own food and store some of their crops seem to be less vulnerable, as they do not lose their exchange entitlements.

It should be kept in mind that people in semi-arid areas like Laikipia are exposed to multi-hazards. Just like the frequency and intensity of droughts, the locust plague that hit East Africa in early 2020, and which destroyed the harvests on vast areas, is a result of climate change (Salih et al., 2020). Urgent action is needed to make agriculture more sustainable and to prepare the millions of farmers worldwide for climate change so that they are entitled to meet future challenges and threats, and can adapt accordingly.

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9 Appendix

9.1 Definitions of the key concepts in DRR

Concept	Definition	Source
Hazard	*"A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation"*	(UNDRR, 2020b)
Disaster	*"A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts"*	UNDRR, 2020b
Disaster Risk	*"The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity"*	UNDRR, 2020b
Exposure	*"The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas"*	UNDRR, 2020b
Coping Capacity	*"The ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters"*	UNDRR, 2020b
Adaptive Capacity	*"The potential or ability of a system, region, or community to adapt to the effects or impacts of climate change"*	(Smit & Pilifosova, 2001, p. 881)
Adaptation	*"[The] adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. This term refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate"*	Smit & Pilifosova, 2001, p. 881
Resilience	"T*he ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform 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 through risk management"*	UNDRR, 2020b

9.2 Survey questionnaire

Interview number	
Date and time of interview	
Coordinates/Location of farm	
Gender of interviewee	
Age of interviewee	
Are you the household head? • If not, Relationship to household head	
Community	

Household and land characteristics:

1	Where did you grow up? • If not in the surroundings, when did you move here? • What was the reason for moving?	
2	Which and how many persons make up your household? (mention all people that are financially supported, including children living in the city for education)	
3	How big is the total area of your land?	
4	Since what year do you use the current area of land? • If there was a change in area size, why did it change?	
5	Who owns the land? • If **nobody** from the household, what is the agreement to use the land?	

	• If a household member, how did you acquire the land?	
6	How do you use your land? (e.g. for crops or grazing) How big is the area for each type of use?	
7	What kind of crops do you grow? (including vegetables, fruits etc.)	
8	Do you irrigate your land at times of no rain? • If yes, which water source do you use? • Is there water available all year round?	
9	Do you keep livestock? • If yes, what type? • How many per type?	
Income and provision of basic needs		
10	What are the household's sources of income? (e.g. sales, remittances, services, off-farm activities, employment)	
11	What percentage of your total income is accounted for by farming revenues?	
12	Do you sell crops if you produce more than needed for the own consumption? • If yes, mostly which crops? • Where/to whom do you sell it?	

13	Do you grow crops only for the market (cash-crops)? • If yes, what kind of crops? • Where/to whom do you sell each?	
14	What do you use the livestock for? (e.g. sell, consumption, work on farms)	
15	Do you regularly buy food from the market? • If yes, what products? • Where do you buy it? • How often do you go there?	
16	Is your production and income sufficient to cover your basic needs (food, clothing, schooling, healthcare, housing)?	
Reaction to drought		
17	In which year did you experience the last drought on your farm? (drought=lack of overall water, which affects adversely the crop yields or the provision of fodder for livestock resulting in a food or income deficit)	
18	How did this drought impact your household? How did your income change during the drought? How did the crop yields change during the drought? How did the animal production change during the drought?	

19	How did you react [short-term] to this drought to ensure your basic needs during the drought period? (e.g. temporary off-farm activity, use savings, sell assets or livestock, credit, help from family members, temporary or permanent migration, aid from NGO's etc.)	
20	Did you go more or less frequent to the market? • If so, how much? • For which reasons?	
21	Did you once have problems to buy enough food on the market? • If yes, why?	
22	Did you change anything in your farming activities/techniques after a drought in order to reduce the risk of a future drought [long-term]? *check what is mentioned* □ diversify crops (e.g. different varieties of the same crop, other/new crops, vegetables in addition to staples) □ grow drought tolerant varieties □ grow early maturing varieties □ grow cash crops □ change the planting days □ do agroforestry (planting trees on the same field to provide shadow) □ do mulching □ do no-tillage, or reduced ploughing □ water harvesting □ fodder conservation for livestock	other measures... □ □ □ □ □ □ □ □
23	Have you experienced any changes in production after the adaptation of the mentioned measures?	
24	Which one of the mentioned activities contributed most to the changes in	

	production? • Why?	
25	Which one was the least effective? • Why?	
26	Have you ever tried to *...unchecked activity...*? • If yes, why did you abandon? • If no, why didn't you try it?	
27	Did you adopt your main livelihood/income-generating activities? (e.g. farming, livestock keeping, employment etc.) • If yes, did you change the activities because of the drought? • If no, why didn't you change anything after the drought?	
28	Do you think you will suffer from a new drought within the next five years?	
29	How do you think a future drought will affect you?	
30	If you had the capacity or possibility, what would you do differently to overcome future droughts?	
31	According to you, which is the most important organisation working in the region? (e.g. NGO, CBO etc.)	

9.3 Questionnaire public authorities

Date and time of interview	
Name of institution	
Name of respondent	
Position/role of respondent	

Small-scale farmers and droughts

According to you, what are the biggest challenges small-scale farmers are facing today? What are the causes for this?	
How did the drought of 2016/2017 impact the region as a whole? What has changed for the population during the drought in general? (e.g. migration, employment, availability of resources, conflicts, economy)	
What were the impacts on small-scale farmers in particular? What has changed for them during the drought?	
What were the short-term strategies small-scale farmers used to cope with the drought? To ensure their basic needs during the time of drought.	
What could small-scale farmers do to reduce the impact of future droughts in the long-term? (e.g. a change in their activities)	

Do small-scale farmers actually make these adaptations? • If not, why not?	
Are small-scale farmers aware of how the climate might change? And the effect it can have on their life?	

Policies and institutions

What does the government usually do to support small-scale farmers **during** droughts?	
What is the government doing today to prevent or mitigate negative impacts of future potential droughts? In order to reduce the need for emergency aid.	
What does the government do when a risk of drought is indicated? e.g. according to the NDMA drought early warning bulletin	
What else could be done? What are the limitations/reasons why it is not done?	
Do you think that farmers are hindered in their scope of action to react to droughts by the legislation? Are there rules or laws that constrain farmers possibilities to adapt their activities with regard to droughts? • If yes, in what way?	

Do you think that there are cultural structures and norms that hinder small-scale farmers to adapt? • If yes, in what way?	
Are there specific training programs by the government to train farmers in new techniques with regard to arid climate or droughts?	

Economy

Were people able to buy food on the market to compensate the loss of production?	
How did the prices for staple food change during the drought?	
How else did the drought impact the economy in the region? (e.g. employment, provision of services, provision of resources)	
What are the impacts on non-agricultural employment in particular during droughts?	
Did the government take any measures to mitigate these impacts?	
How long did it take the economy to recover?	
I learned from a farmer that the sales market is insufficiently regulated and that this can lead to an oversupply of individual products. Farmers are not able to sell their products and he wishes more intervention by the government to regulate the markets. How do you assess the market for	

agricultural products like tomatoes, cabbages, or fruits?	

9.4 Questionnaire NGOs

Date and time of interview	
Name of organisation	
Name of respondent	
Could you please describe briefly the main activities of your organisation in the region?	

Small-scale farmers and droughts

According to you, what are the biggest challenges small-scale farmers are facing in the region today? What are the causes for this?	
How did the drought in 2016/2017 impact the region as a whole? What has changed for the population during the drought in general? (e.g. migration, employment, availability of resources, conflicts, economy)	
What were the short-term strategies small-scale farmers used to cope with the drought? To ensure their basic needs during the drought.	
What could small-scale farmers do to reduce the impact of future droughts in the long-term?	

(e.g. a change in their activities)	
Do small-scale farmers actually make these adaptations? • If not, why not?	
Are small-scale farmers aware of how the climate might change? And the effect it can have on their life?	
How should small-scale farmers be supported in their adaptation to droughts?	

The role of the government

What actions does the county government usually take in times of droughts?	
What is the government doing today to prevent or mitigate negative impacts of future potential droughts? In order to reduce the need for emergency aid.	
Do you think that farmers are hindered in their scope of action to react to droughts by the legislation? Are there rules or laws that constrain farmers possibilities to adapt their activities with regard to droughts? • If yes, in what way?	
Do you think that there are cultural structures and norms that hinder small-scale farmers to adapt to climate change?	

• If yes, in what way?	

The role of the economy

Were people able to buy food on the market to compensate the loss of production?	
How else did the drought impact the economy in the region? (e.g. employment, provision of services, provision of resources)	
Did the government take any measures to mitigate these impacts?	
How long did it take the economy to recover?	

9.5 Code system survey interviews

As the frequencies of codes have also been analysed statistically, there are many quite detailed codes. Codes that are considered self-explanatory were not further described under the column "Definitions/Remarks".

Codes	**Sub-codes**	**Definitions/Remarks**
Reasons for moving	Marriage/Join family	Respondents who did not grow up in the village, why did they move here
	Purchase of land	
	Employment	
	Tribal clashes	
HH composition	Norm HH	Households with parents and their children
	3 and more generations	Includes households with more than two generations, but also households where one generation between two are missing, e.g. grandparents with their grandchildren
	1 generation	Households composing of only one generation, e.g. a married couple without their children.
Changes of land size and its reason	Subdivision among family (+/-)	Either parents gave land to their children (-) or children received land by their parents (+)
	Leasing (+)	
	Purchase (+)	

Codes	Sub-codes	Definitions/Remarks
	Sale of land (-)	
	Change in activity (+)	
	Government project (+)	
Cultivated crops		Including staple crops, vegetables, fruits, fodder grass
Water source	Water project	Water source of the households who mentioned to irrigate at some time of the year
	River	
	Dam/Pan	
	Irrigation Canal	
Sold crops		Types of crops that are sold regularly
Distribution channel	Broker	Where or to whom the farmers sell their products
	Fellow farmers	
	Sale on market	
	Miller	
	Large-scale producer	
	Hotels	
Use of livestock	Consumption	
	Sale	
Purchased market products		Types of crops that are bought in the market regularly
Basic needs met?	inadequate	The sub-codes represent the reasons why the needs are met or not. If no reason was indicated for how the needs are met, only "Yes" was coded.
	somehow they manage	
	depending on rains	
	thanks to remittances	
	thanks to credits	
	Yes	
Last experienced drought		Year in which they experienced the last drought.
General impacts	Lack of food	Sometimes respondents mixed impacts and reactions. Under impacts only aspects have been coded that influenced a state of something, while reactions are rather actions. *Lack of food* Have also always been coded when the respondents received government aid, without mentioning separately that they had lack of food.
	Government food aid	
	Lack of fodder	
	Lack of employment	
	Lack of water	
Impact on income		Impacts on income, yields and livestock were coded separately from "General impacts"
Impact on yields		
Impact on livestock		
Short-term reactions	Income generation	Sometimes respondents mixed impacts and reactions. Under impacts only aspects have

Codes	Sub-codes	Definitions/Remarks
		been coded that influenced a state of something, while reactions are rather actions. Activities that have been done only temporary during the drought period, and the adaptation of new activities that are still done today or have been done for a longer period have also been distinguished.
	Sold livestock	
	Change in dietary habits	This includes the reduction of meals per day, reduction of quantity consumed, as well as reduction in variety of food.
	Compensate harvests loss with purchase	Coded when they mentioned an intensification of off-farm labour to compensate crop losses or when they mentioned that most of income have been used to buy food.
	Relocation of activities	This includes searching jobs and buying food, water, and animal feed in other regions not or less affected by the drought.
	Assistance from relatives	This includes borrowing of food and money or assistance in general.
	Bought food on credit	
	Food as reward	When they obtained food instead of a revenue for casual labour.
	Alternative fodder source for livestock	Cactus fruits, tree leaves
	Temporary migration	
	Change of sales channel	Sale personally in the market instead of to brokers, to have better margins.
Reasons of change of market visits	Money was available	Why did the go more or less often to the market during the drought.
	Inadequate income	
	Didn't go at all	
	Depending on availability of income	
	Income was used to buy fodder	
	Bought food directly from farmers	
	Bought food in shops	
	To reduce transport costs	
	No change	
Reasons for restrictions to buy food in the market	High food prices	Distinction between «High food prices» and «Lack of money». In some situations it might be the same but not necessarily. Lack of money can result because of job loss and must not necessarily coincide with high prices. In this cases people usually said, that there was enough food available but too expensive.

Codes	Sub-codes	Definitions/Remarks
	Inadequate food availability	Sometimes people said that there would have been money available to buy food. But food was not available. In some cases it figures as the counter part to «High food prices».
	Lack of money	Distinction between «High food prices» and «Lack of money». In some situations it might be the same but not necessarily. Lack of money can result because of job loss and must not necessarily coincide with high prices.
	Ethnic competition	In-migration of other ethnic groups from other regions, which increased the pressure on the available food.
Adapt: Diversify crops	NO: climate not favourable	If there was adoption of the respective method, only the main code was coded. If no, the respective sub-code was coded representing the reason for no adoption.
	NO: too risky	
	NO: area too small	
	NO: abandoned crop farming	
	NO: no availability	
Adapt: Drought-tolerant crops	NO: lack of interest	
	NO: climate was favourable	
	NO: abandoned crop farming	
	NO: already done before	
Adapt: Early-maturing crops	NO: low yields	
	NO: abandoned crop farming	
	NO: already done before	
Adapt: Cash crops	NO: lack of water	
	NO: lack of money	
	NO: high standards	
	NO: labour intensive	
	NO: lack of market	
	NO: soil not favourable	
	NO: harmful to health due to pesticides	
	NO: abandoned crop farming	
	NO: too old	
	NO: not common in the region	
	NO: area too small	
	NO: lack of knowledge	
Adapt: Change planting days	NO: climate uncertainty	
	NO: lack of interest	
	NO: bad experience	
	NO: abandoned crop farming	

Codes	Sub-codes	Definitions/Remarks
	NO: already done before	
	NO: no need due to irrigation	
Adapt: Agroforestry	NO: lack of water	
	NO: interest	
	NO: already done before	
	NO: bad experience	
	NO: lack of money	
	NO: area too small	
Adapt: Mulching	NO: plant residues used as livestock feed	
	NO: no need/water is available	
	NO: lack of interest	
	NO: plant residues used to sell	
	NO: area too big	
	NO: abandoned crop farming	
	NO: lack of money	
Adapt: No-tillage	NO: lack of knowledge	
	NO: fear of lower yields	
	NO: use of chemicals	
	NO: abandoned crop farming	
	NO: lack of interest	
Adapt: Water harvesting	NO: prefer river water	
	NO: lack of interest	
	NO: no dam or pan	
	NO: lack of money	
Adapt: Fodder conservation	NO: lack of interest	Farms without livestock or only some chickens have not been coded.
	NO: hay not available	
	NO: already done before	
	NO: too labour-intensive	
	NO: area too big	
Adapt: additional		Adaptations that were mentioned by the farmers that were not proposed by the questionnaire.
Changes in production		Effects of the adopted methods on production.
Most effective adaptation	Diversifying crops	
	Change in planting days	
	Early-maturing varieties	
	Mulching	
	Reduced ploughing/No-tillage	

Codes	Sub-codes	Definitions/Remarks
	Agroforestry	
	Water harvesting	
Least effective adaptation	Reduced ploughing/No-tillage	
	Water harvesting	
	Early maturing varieties	
	Intensifying animal farming	
	Diversify crops	
	Use of fertilizer	
Adaptation livelihood strategies	NO: lack of finances	Activities that have been done only temporary during the drought period, and the adaptation of new activities that are still done today or have been done for a longer period have been distinguished. The former case is coded under «Short-term reactions». Under "Adaptation of livelihood strategies" changes of main livelihood activities were coded, in contrast to specific agricultural methods above. With the suffix "NO" the reasons why nothing has changed are coded. If there was a change, the type of change was coded with the suffix "YES".
	NO: preference for continuing farming	
	NO: after drought climate resumed normal	
	NO: after drought climate resumed normal	
	NO: too old to change something	
	NO: area too small to farm for income	
	YES: casual employment	
	YES: keeping livestock	
	YES: acted as a broker	
	YES: permanent employment	
	YES: selling wild vegetables	
	YES: horticulture crops	
	YES: abandoned crop farming	
Future impacts	Less impacts	If there was another drought in the next five years, what impacts do they fear.
	No impacts	
	Negative impacts	
Desired adaptations	Improve water source for irrigation/livestock	If they had the possibility, what would they like to adapt.
	Start/invest in business	
	Invest in livestock	
	Practice sillage	
	Grow horticultural products	
	No need/needs are satisfied	
	Practice drip irrigation	
	Practice zero grazing	
	Have more land	
	Mechanise land preparation	

Codes	Sub-codes	Definitions/Remarks
	Construct houses for rent	
	Cash cropping	

9.6 Code system expert interviews

Codes that are considered self-explanatory were not further described under the column "Definitions/Remarks".

Codes	Sub-codes	Definition/Remarks
Challenges of farmers	Climate (change)	Climatic conditions/weather that impede sufficient agricultural production.
	Market imperfectness	Factors regarding the market that have a negative impact for farmers.
	Human-wildlife conflicts	
Farmer's potential to adapt	Will to adapt depends on output	Reasons why farmers do not adapt methods or livelihood strategies.
	Farmers are willing	
	Farmers are not willing to change	
	Low demand for extension services	
	Lack of finances	
	Financial contradiction	
Impacts of drought	Crop failure	
	Hunger	
	Death of livestock	
	Increased financial pressure	This includes increasing market prices, increase of production costs, decrease of farmers' financial resources because of income loss.
	Stop going to school	As a consequences of lack of money or need of labour force.
	Search of alternative sources	Resources or income sources.
	Insecurity	Social instability due to lack of public safety nets, conflicts over resources, violence.
	Impact on economy	Impacts on employment, on the market, or the economy in general.
Coping strategies	Sale of assets or livestock	
	Search for casual jobs	
	Start a business	
	Social safety nets	Remittances, borrowing from neighbours, buying food on credit.

Codes	Sub-codes	Definition/Remarks
	Dietary change	Consuming less preferred, cheaper food or skipping meals.
Adaptation strategies	Livelihood diversification	Apart from agriculture, many farmers have an off-farm activity or are keeping livestock for milk production.
	Hiring land	Land that can be used for horticulture.
	Small-scale irrigation	
	Top-down zoning	To change the system of subsistence farming to a climate-oriented agriculture where only the crops are grown that fit to the climatic conditions at the respective place. The grown crops are sold to buy other food that is not grown.
	Alternative agricultural techniques	This includes approaches of Conservation Agriculture (CA), climate smart agriculture or modernisation of agriculture.
Government disaster response	Food supply	
	Provision of seeds and other inputs	
	Provision of livestock feed	
	Provision of free extension services	
	Need driven response	Measures are not comprehensive. Beforehand it is analysed who needs what.
Preventive measures by gov.	Information and training	Information to weather trends and possible intervention measures.
	Promotion of water harvesting	Either directly by offering help to construct water pans or to animate farmers to harvest water.
	Contingency planning	Contingency plan of the NDMA.
	Subsidised fertilizer	Registered farmers can obtain subsidised fertilizer.
	Capacity building	
	Planting trees	
Potential measures	More water harvesting	
	Seed and harvest storage	
	Adoption of adapted varieties	Either drought-tolerant varieties or crops like millet, cassava etc. who are drought escaping crops.
	Promotion of Conservation Agriculture	
	Mechanisation of agriculture	
	Improve access to extension services	
	Formation of interest groups	To create a collective bargaining power and to improve access to loans.
	More user-friendly	Information must be easily available and offered in

Codes	Sub-codes	Definition/Remarks
	information	different languages.
Negative view on subsistence farming		
Bottom-up approach		
Government scope of action		
Food availability		
Influence of legal/cultural frame on farmers		