Droughts and famines: The underlying factors and the causal links among agro-pastoral households in semi-arid Makueni district, Kenya

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Abstract

Famines are often linked to drought in semi-arid areas of Sub-Saharan Africa where not only pastoralists, but also increasingly agro-pastoralists are affected. This study addresses the interplay between drought and famine in the rural semi-arid areas of Makueni district, Kenya, by examining whether, and how crop production conditions and agro-pastoral strategies predispose smallholder households to drought-triggered food insecurity. If this hypothesis holds, then approaches to deal with drought and famine have to target factors causing household food insecurity during non-drought periods. Data from a longitudinal survey of 127 households, interviews, workshops, and daily rainfall records (1961–2003) were analysed using quantitative and qualitative methods. This integrated approach confirms the above hypothesis and reveals that factors other than rainfall, like asset and labour constraints, inadequate policy enforcement, as well as the poverty-driven inability to adopt risk-averse production systems play a key role. When linking these factors to the high rainfall variability, farmer-relevant definitions and forecasts of drought have to be applied.

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1. Introduction

Famine has been shown to result from complex interactions of political, social, economic and biophysical factors (cf. Ball, 1976). It is thus not only a question of production shortfalls but also of inadequate access to enough food (Yaro, 2004).

Despite these interactions, most famines in Kenya have been triggered by droughts (Central Bureau of Statistics: CBS, Ministry of Finance and Planning, Kenya, 2001, App. 1–55) and this relation persists (Ifejika Speranza, 2006b, p. 247; WFP, 2006). Due to drought and lack of alternatives to water plants, vegetation in form of pastures for livestock and crops wilt. This can lead to crop loss, reduced harvest, and feeds for livestock, emaciated livestock, hunger and in severe cases livestock and human deaths. These impacts can destabilise rural livelihoods.

The immediate production shortfalls caused by drought and the food crises most often associated with it suggest that rural livelihoods and conditions do not enable people to produce, store and access enough food in non-drought periods, due to lack of rain water for plants, animals and domestic uses.

The foregoing shows that analysing livelihoods and livelihood conditions prior to drought can be a way of exposing the underlying factors that foster vulnerability to food insecurity and their interrelations. Such an approach may provide answers to the question of why droughts almost always develop into famines in semi-arid rural Kenya and reveal pathways of how the tenacious link between drought and famines can be broken.

This study is based on field research in 8 agro-pastoral villages of Makueni district, Kenya. Many households in...
Makueni district are often food insecure during drought periods and in most cases depend on external support, in form of government relief food and food-for-work (FFW) activities, to bridge the food insecure period until the next harvest. The district (Fig. 1) lies between latitude 1°35'S and 3°S and longitude 37°10' E and 38°30' E and is inhabited mainly by the Akambas.

The semi-arid area of Makueni covers an area of 5052 km². Altitudes range from 600 to 1200 m above sea level. The vegetation consists mainly of grassland and shrubs. The mean annual temperature ranges from 20.2 to 24 °C (Jätzold and Schmidt, 1983, p. 152) and evaporation is high.

The district experiences two rainy seasons: the first rains (Long Rains: LR) between March and May and the second rains (Short Rains: SR) between October and December. The average seasonal rainfall amounts range 120–240 mm (LR) and 220–410 mm (SR). The SR is the major farming season, but rainfall in both seasons is highly variable and unreliable.

Although the major perennial rivers have potentials for irrigation, rain-fed agriculture is practised, and together with livestock keeping, are the major sources of livelihoods. According to Jätzold and Schmidt (1983, pp. 159–165), the agro-ecological potential of the area is suitable for growing millet and rearing livestock (Agro-Ecological Zone: AEZ 5), for growing cotton (AEZ 4), and for lowland ranching (AEZ 6). Despite this marginal agricultural potential, the major crops grown by the households are maize, cowpeas, pigeon peas and beans.

Agro-pastoralists in Makueni district Kenya derive their livelihoods mainly from crop production and marketing, livestock keeping and sale, as well as from low-income off-farm and non-farm activities. At least 72% of the households simultaneously engage in crop production, livestock keeping and off-farm activities but the degree of participation in off-farm activities varies with household need for money, availability and access, as off-farm jobs become scarce during drought periods (Ifejika Speranza, 2006b, p. 301); 84% of the households derive part of their income from crops sales, 83% from livestock sales, while households earn off-farm incomes from various activities such as unskilled casual jobs (37%), business (28%), paid employment and pensions (26%), and remittances (20%). Thus incomes from sale of crops, sale of livestock and from off-farm activities are all comparably important but to different degrees at different times, vary from place to place, and are influenced by resource constraints, rainfall variability and drought (see also Government of Kenya/CBS, 1996; Nelson, 2000; Mbogoh, 2000). In terms of importance 39% of the households ranked crop sales as their primary source of income, 21% derive their primary income from casual jobs, 17% from salaries and pensions, 10% from business activities, while only 9% have livestock as their first major source of income, and 4% depend mainly on remittances. Casual jobs are mainly dependent on agricultural activities and are therefore affected by many factors that influence crop production. Poverty is widespread and there are limited opportunities for livelihood diversification hence many, especially men, migrate to urban centres to look for employment.

Although livestock is only the primary source of income for 9% of the households, 54% declared it as their second major source of income (Ifejika Speranza, 2006b, p. 301). This means that livestock sale is used as an insurance buffer, a security against income loss as a result of crop failure. It therefore follows that agro-pastoralists experiencing crop loss or reduced harvest due to drought not only lose their main source of food but also a major part of their income. Since household crop production is a major source of staple food to the markets, a reduction in crop production may lead to a reduction in market food supply. This can cause an increase in prices thereby further constraining access to food in addition to the already constrained access attributed to reduced food production and reduced income due to crop loss.

Thus the scenario whereby rural livelihoods are increasingly being de-linked from farming (see Rigg, 2006) does not hold for the study area. Rather most households depend mainly on own food production for consumption and for income generation, whereby it is the first and second major source of income for 65% of the households. Hence crop farming still remains a crucial part of rural livelihoods. (Ifejika Speranza, 2006b, p. 169; Ministry of Finance and Planning, Makueni District, Kenya 2002).

These elaborations highlight the importance of crop production for rural livelihoods and justify the focus given in this paper. The foregoing also suggests that the actions and strategies of agro-pastoral actors, and their socioeconomic, political and biophysical environment provide the backdrop within which a drought can occur and evolve. Thus the analysis of the underlying conditions prior to drought is crucial for understanding the hows, whys and whens of drought vulnerability.

While acknowledging that famines can develop from food production-, distribution-, exchange- or consumption crisis, this study focuses on food production crisis triggered by drought as the households depend mainly on own food...
production for consumption and for income generation. This does not mean that conditions and factors leading to food insecurity or famine are embedded only within the food production system but this focus allows for an in-depth analysis of the contributions of crop production conditions and strategies to food insecurity and the development of famine.

2. Objectives and methodology

This study, therefore, aims to examine whether and how the crop production conditions and agro-pastoral strategies predispose agro-pastoral households to drought vulnerability and food insecurity. Households’ experiences of food shortages and food insecurity, agro-pastoralists’ perceptions of drought, famine and its causes, and their experiences of factors that constrain crop production are examined. Further, rainfall data are analysed and linked to agro-pastoralists’ strategies. This provides the basis to highlight the interrelations between the above-mentioned factors and how they lead to food insecurity and famine. The analysis and understanding of the underlying factors and causal links between droughts and famines in the semi-arid areas of Makueni district is approached from the concept of vulnerability. Vulnerability has been defined with and recover from drought. This definition has been accepted definition of famine (cf. Howe and Devereux, 2004). While some studies regard famine as an event (e.g. Mayer, 1975). The Akambas differentiate between hunger (Nzaa) and famine (Yua). In the word of the villagers, ‘hunger is when there is no food in the homestead’ (i.e. when a household suffers food shortage) while ‘famine is when there is no food in all the villages, when all granaries are empty (i.e. when all households suffer food shortage), a situation that sometimes result to death of livestock and human beings’. This paper adopts these definitions and focuses specifically on the factors that may lead to a situation whereby ‘there is no food in all the villages’.

A livelihood can be described as a combination of the resources used and the activities undertaken in order to live (DFID, 2001). ‘A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base’ (DFID’s, 2001 adaptation from Chambers and Conway, 1992).

While acknowledging that poverty is associated with ‘deprivations of basic capabilities’ (Sen, 1999, p. 87), this paper adopts the monetary poverty line defined by the Government of Kenya: The poor are those who cannot afford basic food and non-food items whereby their consumption and expenditure are less than KSH1239 (ca. US$ 17 based on 1997 prices) per adult equivalent per month (Government of Kenya, 2000a, b).

These definitions of drought, drought vulnerability, food security, famine, livelihoods and poverty form the framework for this analysis.

Data for this study was collected between January 2002 and March 2003 in a two-tier longitudinal survey of 127 households in eight villages of Makueni district, Kenya. The households were determined using a random sampling and comprise those whose major activities are crop and livestock production, charcoal production, small enterprises, petty trade, wage employment or casual work. However, all households practice crop farming. The male or female household head was targeted. The first survey was on agro-pastoral livelihoods and strategies while the second survey was on drought impacts, vulnerability and coping strategies of households under drought conditions based on the 1999/2000 drought. The reason for carrying out two surveys is to collect baseline data on the agro-pastoral livelihoods and strategies in non-drought periods and based on a second survey, to analyse how these change under drought conditions and the outcomes for the households.

In order to capture the meteorological aspects of drought, daily rainfall records (1961–2003) for Makindu, Kibwezi and Ikoyo stations were collected. The results used to illustrate rainfall variability and drought characteristics in this paper are from the analysis of Makindu rainfall data.
Both qualitative and quantitative (statistics) methods were used to analyse the collected data.

3. Results and discussion

The following analyses are based on data collected from the interviewed households. In many questions, multiple responses were given. In such cases, the sum of the statistics is more than 100%.

3.1. Experience of food shortage and food insecurity

In order to give a picture of the food security situation of these households, we examine the proportion of those that experience food shortages in drought and non-drought periods, those that received food relief or support to access food, those that did not produce enough for own consumption or sold produce and later had to buy food, and households’ own rating of their food security status.

During the 1999/2000 droughts, 91% of the households experienced food shortages, on average of 3 months in 1999 and 5 months in 2000. Usually, in normal years, households experience food shortages in the months of January to February and during various periods between June and December. Hence, in the following non-drought 2001, 46% experienced food shortages of 2 months on average, including 24% that experienced food shortages of at least 3 months duration. By 2002, 27% still experienced food shortages, out of which the duration for 7% of the households was at least 3 months.

During the 1999/2000 drought, 31% of the households received relief food, 6% participated in FFW activities and 17% were at the same time receiving relief food and participating in FFW activities. Taken together, 54% of the households depended on relief food to meet some of their food needs during the drought period. There is a significant relation between participation in FFW and collection of relief food (Chi square \( p = 0.0001 \)). By 2002, those participating in FFW had reduced to 6% while relief food distribution ceased to be regular. However, the school feeding programme whereby school children are fed in school as a measure to increase their nutritional levels continues till date.

Another dimension of food insecurity is production below subsistence levels and the inability to compensate for the shortfall through food purchase. In average seasons (2001/2002, 2002) 15% of the households did not produce enough food for own consumption, as they had to purchase food to supplement own production. Also many households are forced by cash needs to sell their produce at low prices immediately after harvest and have to purchase later at higher prices. This was the case for 26% of the households. Based on the definition of food security adopted for this study, these households are not per se food insecure since they can buy food when they need it, but the fact that they buy at higher prices compared to the prices they sold the same crops earlier, highlights the limited manoeuvring options that they have. Another 15% sold their produce but could not buy food despite experiencing food shortages. The farmers themselves make a further indication of household food security, whereby they rate their households as being completely food secure (20%), slightly food insecure (53%) and completely food insecure (27%).

Firstly, the foregoing shows that in non-drought periods households experience cyclical food insecurity (2001: 46%; 2002: 27%), especially during periods just before crops mature for harvest, and depending on the amounts of previous harvests stored by the households. A key finding is that 24% of the households experienced food shortages in both years (four seasons), on average for 4 months, ranging from 1 to 8 months. Secondly, the majority of the households (91%) experienced various levels of temporary food insecurity triggered by the drought. Thirdly, the food security rating of the households themselves shows that more than three-quarters of the households experience various levels and durations of food insecurity even in non-drought periods—53% rate themselves as being slightly food insecure plus 27% that rate themselves as being completely food insecure. Finally, the continued support received in non-drought periods in the form of FFW and the school feeding programme, and the fact that some households do not produce enough food for own consumption and lack the means to purchase (15%), shows that about one-quarter of the households are chronically food insecure.

3.2. Perception of famines and the crop production system

The farmers’ perception of their own conditions gives a deeper insight into the realities of crop production in a dry environment. The results of our survey of agro-pastoralists’ perception of problems in crop production reveals that the major constraints experienced by most of the households originate from the crop production environment, in biophysical, socio-economic and political terms, (Table 1) and

<table>
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<tr>
<th>Table 1 Multiple answers on factors affecting crop production</th>
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<tbody>
<tr>
<td>Factors that affect crop production</td>
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<tr>
<td>Unreliable rainfall/rapid weather change</td>
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<tr>
<td>Inadequate farming implements/tools/oxen</td>
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<tr>
<td>Poor infertile soils/soil erosion</td>
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<tr>
<td>Crop destruction by pests and diseases</td>
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<tr>
<td>Human–wildlife conflicts</td>
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<tr>
<td>Shortage of seeds for planting/inappropriate seeds</td>
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<tr>
<td>Inadequate farm labour</td>
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<tr>
<td>No extension services offered</td>
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<tr>
<td>Massive selling of farm produce</td>
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<tr>
<td>Small land sizes</td>
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<td>Poor market prices of farm produce</td>
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the inadequate capacities of the households to act within this environment.

For many households, the unreliability of rainfall is a major constraint to crop production (56%), but so also are inadequate farming implements (32%), poor soils (32%), destruction of crops by pests and diseases (22%), human–wildlife conflicts (21%), unavailability of planting seeds (18%), and inadequate labour (16%). Other factors of less concern include lack of extension services, massive selling of farm produce, small land sizes, and poor market prices.

Since they are dominantly subsistence farmers, they also perceive the same factors to cause famine (Table 2).

The two tables are derived from two different questions but a comparison of Table 1 and 2 reveals some matches in the perceptions of the households. If drought is equated to lack of rains, then drought is perceived as the major cause of famine by 41% of the respondents while 73% mentioned it as a cause of famine (Table 2); 56% of the households also perceive the lack and unreliability of rains as a constraint to crop production (Table 1). In addition, Table 2 shows that households perceive and experience various other factors in crop production such as poor farming practices, crop pests and diseases, small cropland sizes, lack of farm implements and inputs as factors that also contribute to the development of famine.

However, there are also discrepancies between the two tables. While 32% of the households perceive poor infertile soils as a major constraint in crop production, this factor does not feature prominently as a cause of famine. If at all, it is hidden under lack of farm inputs (Table 2) and is mentioned by only 11% of the households. Although poor infertile soils can lead to decline in crop production and to food shortages, it does not directly contribute to famine. The link can only be established indirectly, based on the fact that the crop production system is fragile—most households just about produce enough food for own consumption, have little or no surpluses and have limited alternatives to procure enough food. This means that factors that affect the robustness of crop production also increases the vulnerability of the households to extreme forms of food shortages like famine.

The match in perceptions and experiences hints at relationships between crop production and the chain of developments that lead to famine in the study area. Exploring this link may reveal possible ways of how this chain may be broken. Based on their importance to the households as constraints in crop production (Table 1) and as causes of famine (Table 2), we now examine how these factors affect the food and livelihood security of the agro-pastoral households.

### 3.3. Contending with the high spatio-temporal rainfall variability and droughts

The purpose here is to analyse rainfall variability, its effects on crop production and their implications for the agro-pastoral households. At the same time, we will highlight the implications of defining drought based on various time scales and rainfall amounts as well as the problem of differentiating between drought and rainfall variability.

Meteorological drought is used here, as proxy for agricultural drought because meteorological drought is significant for the development of agricultural drought and in the study area crop production is rain fed. Thus, assuming that the farming system is adapted to local average rainfall conditions, the impact of drought (or flood) on the farming system can be approximated as the deviation of the seasonal rainfall from ‘normal’ (long-term average 1961–1990). Drought is therefore calculated as the negative standardised score for seasonal rainfall while abnormally wet years are the positive standardised scores. According to Downing et al. (1985), the drought index (DI) is defined as

$$\text{DI}_i = \frac{X_i - \bar{x}}{s},$$

where $X_i$ is the seasonal/annual precipitation; $\bar{x}$ the seasonal/annual mean precipitation; $s$ the seasonal/annual standard deviation from $X_i$; DI is normalised with a mean of 0 and a standard deviation of 1. Using this definition, drought occurrences for Makindu are displayed in Fig. 2.

Although this definition of drought based on seasonal values captures rainfall anomalies, it does not address the concerns of farmers about the spatial and temporal distribution of rainfall. The onset of rainfall, seasonal amounts and duration vary considerably with dry spells often occurring, and favourable conditions for plant growth range 20–75 days (Jätzold and Schmidt, 1983, p. 152).
Thus, of utmost interest to the farmer are the rainfall distribution characteristics, the question of whether or not a rainy day or a series of rainy days will follow the day on which s/he planted her/his crops and the duration of rainy phases. Hence we shift the focus to the rainfall distribution characteristics by analysing rainfall variability and unreliability (of the onset of rains), and moisture availability within the time scales important to the farmers.

From experience farmers expect the rains by mid-March (LR) and by mid- to second half of October (SR), but these dates can vary. A rainy day is defined for this study as a day whereby at least 1 mm of rainfall is recorded. In terms of stages of crop growth (e.g. local maize) and rainfall variability, dry spells of more than 10 days have been found to be potentially harmful to maize (Zea mays, L.) the major crop grown in the semi-arid area and in particular for soils with low water holding capacities (Barron, 2004, pp. 21–22).

Based on daily rainfall records, the following conditions define the meteorological onset of the farming season:

1. A possible onset/start of the rains is defined as a period of at least 5 consecutive days, from 1st of February (LR) and 1st of September (SR) within which at least 20 mm of rainfall has been recorded (modified from Berger, 1989). These dates have been chosen in order to include periods preceding the onsets of farming activities according to the local farming calendar as prior rains soften the soil, increase soil moisture and trigger the activities of micro-organisms.

2. If another 20 mm is recorded within the following 10 days, the first day of the pentad in condition 1, marks the successful onset of the rainy season.

3. A failed start is when condition 2 is not met.

In comparison to the local farming calendar, a successful start is further characterised as early or late:

4. An early onset is a successful start that occurs before the usual period (LR: 11th–20th March; SR: 16th–25th October) that farmers expect the rains. An early onset in the intermediate period (January–February) between the SR and the LR, when many farmers are busy with harvesting crops of the SR, means that the farmers may not be able to quickly adapt and plant for the LR, as crops have not all been harvested.

5. A late onset is defined as a successful start that occurs after the usual period that farmers expect the rains (LR: 11th–20th March; SR: 16th–25th October). Since rains are generally expected to start by March to mid-March, and by mid- to second half of October, many farmers dry-plant.

Based on the above definitions, an analysis of the daily evolution of rainfall for the seasons from 1994–2003 (Table 3) shows that onset varies significantly. It can be early, late, might be totally missed as rains fall without break between seasons, or it can be a false start with dry spells occurring early after the onset. Above all, onsets tend to occur later than expected by the farmers.

Another significant characteristic of rainfall in the study area is the high temporal variability portrayed by the high coefficient of variation (Makindu LR: 0.54; SR: 0.57), the wide range between the minimum and maximum seasonal values recorded (Makindu LR: 19–511 mm; SR: 99–829 mm), the high seasonal rainfall variability and the fact that a few rainfall events account for much of the seasonal rainfall totals.

The foregoing highlights the highly variable nature of rainfall in space, time and amounts, even in the absence of drought. Rainfall variability and unreliability makes it difficult for the farmers to predict precisely the timing of their cropping calendar, a crucial factor of successful crop production in the study area. This impacts greatly on those farmers who are not able to plant before or immediately after the onset of rains because of the lack of ploughing implements (ox-plough and oxen) and seeds to plant. As will be shown later (see Section 3.4), this has remained one of the main challenges because only a few farmers are able

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<th>Table 3</th>
<th>The characteristics of onsets for Makindu station (1994–2003)</th>
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<tbody>
<tr>
<td>Onset based on daily rainfall records</td>
<td>Affected long rains season</td>
</tr>
<tr>
<td>Successful start (LR: 11th–20th March; SR: 16th–25th October)</td>
<td>2001</td>
</tr>
<tr>
<td>Successful but early onset compared to the farming calendar</td>
<td>1999; 2002</td>
</tr>
<tr>
<td>No break between seasons/early onset</td>
<td>1998</td>
</tr>
<tr>
<td>Failed onset</td>
<td>1995</td>
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to quickly adapt to the situation as the rainfall patterns evolve. To contend with this variable rainfall distribution, 62% of the households plant their maize once before the rains, 25% immediately after the onset of rains, while 13% plant at least twice, usually before and after the start of rains.

Since dry spells of more than 10 days are potentially harmful to a maize crop (Barron, 2004, pp. 21–22), a definition and monitoring of drought based on a long-term (1961–1990) quartile index of dekadal rainfall (Ambenje, 2000) reflects the time phases important for the farmer.

Based on the scheme in Table 4, an analysis of the 1999/2000 rainfall for Makindu reveals that meteorologically the 1999/2000 drought started during the SR of 1998 with dry conditions in dekad-2 of November alternating with dekads of near normal conditions lasting until dekad-3 in December. Rainfall distribution was not only highly variable, but also the total seasonal rainfall for Makindu and Ikoyo stations were the lowest ever recorded. Thus, the drought of the 1998-SR was the severest SR drought since 1961.

The 1999-LR was near normal with dry conditions occurring in dekad-1 in March and dekad-1 in May. For the 1999-SR, dry conditions occurred in dekad-1 of December. The 2000-LR again had dry conditions from dekad-2 in April to dekad-1 in May, a dry period of 30 days. The 2000-SR had dry conditions in dekad-1 of November. Thus, meteorologically and based on dekadal time scales, there was drought in the 1998/99-SR, the 2000-LR, 2001-LR and 2003/2004-SR.

The coincidence of a dry spell with a period when crops require lots of moisture can lead to reduced crop yields or loss. In terms of rainfall amounts, the total seasonal rainfall of the 1998/99-SR was not sufficient for crop growth. Further, the time lag in the effects of droughts/dry spells of 1998 indicate that the impacts were experienced in 1999 in form of reduced yields/crop loss and loss of income from crop sales. The 1999-LR and the 1999/2000-SR, which also had their dry spells, could not compensate for the variations and impacts of the 1998/99-SR-drought.

However, if a 10-day phase of dry conditions is regarded as drought then apart from the 1999-LR and the 1999/2000-SR, 1999 in form of reduced yields/crop loss and loss of income from crop sales. The 1999-LR and the 1999/2000-SR, which also had their dry spells, could not compensate for the variations and impacts of the 1998/99-SR-drought.

3.4. Factors of crop production and vulnerability

The conclusion that the high temporal rainfall variability in the semi-arid Makueni is a crucial factor in crop production and poses a major risk to rural livelihoods, is confirmed by the outstanding weight given to it by farmers as cause of food shortage and famine (see Tables 1 and 2). If the farmers’ answer that famine is ‘Gods plan or wish’ is interpreted as another expression for the unpredictability of rains, this weight becomes even more pronounced.

However, Tables 1 and 2 show that other factors than rainfall variability also pose a risk to the crop production system and may trigger food shortage and famine. In the following sections we focus on these factors and their relevance in determining vulnerability of livelihoods to food shortage and famine. We thereby follow the sequence of importance given to them by the households highlighted in Table 1.

### 3.4.1. Farm implements, ownership and level of mechanisation

The type of farm implements available to the farmer is critical in determining the manner of farm preparation, ploughing and weeding. Taken together, these activities form important processes of crop production. Furthermore, farm implements determine also the level of farm mechanisation in the rural areas.

Farm implements in the study area are predominantly draught power with 75% of the households ploughing their land by use of oxen. Others prepare their land manually by use of hoes (23%) while 6% use tractors. While the use of draught power is quite prominent in the study area, only 45% own oxen, others borrow (16%), hire (14%) or exchange with labour, food or pasture for the oxen (8%). Although further data analysis (Chi square) did not reveal a significant relation between cropland size and mode of ploughing, ownership of ploughing tools has strong implications for crop production on the backdrop of the high spatio-temporal rainfall variability characteristic of the study area. Farmers without the tools and implements are likely to plough and plant late, as those who have, take first priority over their use. Those without are therefore exposed to the risk of missing the first rains which are

<table>
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<th>Quartile ($Q$) range</th>
<th>Interpretation/description</th>
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<tr>
<td>&lt; Minimum</td>
<td>Driest on record</td>
</tr>
<tr>
<td>1–3 $Q$</td>
<td>Near normal</td>
</tr>
<tr>
<td>3–Maximum</td>
<td>Wettest on record</td>
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Table 4

Dekadal drought severity index based on quartile range (adapted from Ambenje, 2000)
crucial for crop growth, thereby already jeopardising the harvest prospects for the particular season in question. These elaborations highlight the central role of poverty in constraining agro-pastoral activities.

3.4.2. Poor infertile soils, soil erosion and soil management practices

According to Jätzold and Schmidt (1983, pp. 166–169), the sandy soils (mainly Ferralsols and Cambisols) in the central parts of the district are generally of low to moderate fertility while the black cotton soils (Vertisols; cracking clay) in the southern parts are of moderate to high fertility, but are easily waterlogged and very difficult to plough when wet.

Given adequate rains, 83% of the households perceive the soils to be suitable for their major crops although the afore-mentioned limitations are echoed by 32% of the agro-pastoralists who perceive poor infertile soils and soil erosion as major constraints to crop production. With regard to the sandy soils, the conjuncture of high temporal rainfall variability and poor infertile soils suggests that the farmers would adopt approaches that conserve soil moisture and improve soil fertility. However, available data reveal a considerably low level of adoption of some of the prominent soil and water conservation methods: manure application (66%), terracing (51%), rainwater harvesting (46%), runoff harvesting (9%), and use of chemical fertilisers (1%). Mulching is practised by very few and used only for planting fruit trees. Farmers expressed different constraints for this low level in the adoption of soil and water conservation methods; some of the constraints are related to specific methods of conservation, while others are general such as lack of labour, high costs of labour and materials, and lack of appropriate tools and implements. Those that relate to specific conservation methods are as follows: terracing reduces the land available for crops or cannot be practiced due to tenure conditions; chemical fertiliser is expensive to buy, destroys soil quality if discontinued, requires lots of water, and is therefore inappropriate for use in dry areas as it ‘burns’ crops; organic manure is not available in adequate quantity in most homesteads and has to be purchased. Interestingly, there were farmers (15%) who did not manure or fertilise their farms because they perceived the soil to be fertile. There is competition between the use of crop residues for mulching and as fodder for livestock. Besides, the household find mulching tedious, time and labour consuming, liable to attack by ants, and 48% mentioned that they do not have knowledge on how to mulch effectively.

This constellation of factors adversely affects productivity and provides the initial recipe, which a drought event converts to a disaster. In other words, low (or lack of) application of soil and water conservation measures leads to impoverishment and exhaustion of most croplands. This can, in turn, lead to decrease in crop yields, thereby increasing the vulnerability of the households to food and livelihood insecurity.

3.4.3. Incidence of crop pests and diseases and their management

Crop pests and diseases are perceived by 22% of the households as a major constraint in crop production. During the 1999/2000 drought, 24% experienced unusual insect infestation of crops by worms (army worms), aphids and weevils as well as some unidentified red ant. The Larger Grain Borer (LGB) (Prostephanus truncatus) beetle continues to cause huge and widespread losses in stored grain. However, out of those that reported infestation, only 7% combated the infestation by spraying crops with insecticides. The major reasons for not combating the infestation were lack of information and technique on how to do so, as well as financial constraints preventing them from purchase of required chemicals and equipment. Given that yield may be high in an average season, the implications of inadequate pest control is that produce may be completely damaged by pests as was the case for many households during the 2002/2003 season.

3.4.4. Human–wildlife conflicts

Wildlife also inhabit areas outside the three national parks in the district: the Chyulu hills, the Tsavo East and Kiboko game reserves. The fact that birds feed on millet and sorghum has been given as one reason for not growing millet and sorghum which are more drought resistant than maize. Households report that animals such as squirrels, dik-dik, monkeys, baboons and elephants destroy crops. While squirrels eat the seeds that are dry planted, other animals feed on the green crops (like maize cobs) in the farms. However, the farmers do not have any effective methods to deter the animals from feeding on crops in the farms, since government law protects the animals and people can be persecuted if caught killing animals.

3.4.5. Cropping patterns and choice of maize seed varieties

The main crops grown in the study area are maize, cowpeas, pigeon peas, beans and green grams. All households intercrop on average a mix of 6 crops, either throughout their farm plots (94%) or in sections (6%). The area of cropland covered by maize was estimated by selecting two sample areas of each household’s cropland and counting the number of maize plants relative to other crops and averaging the derived values.

In the context of high rainfall variability, the logical strategy would be to grow drought resistant crop varieties. However, maize is the most dominant crop grown, (all households grow maize) accounting for about 82% of the area under crop production, with the high yielding but less drought-resistant Kikamba/Kinyanya as the preferred seed variety (86%). Other maize varieties grown include the early maturing but low-yielding drought resistant Katumani composite variety (23%), Makueni hybrid (3%), Pioneer and Kitale breed (1%) according to 1999/2000 situation. The local (Kikamba/Kinyanya) maize varieties are not drought resistant when compared to improved varieties (e.g. Katumani and Makueni hybrid) developed
for semi-arid areas and Kikamba requires a longer period to mature (Table 5). However, the Kikamba variety has higher yields than the Katumani variety.

This dominance of maize can be explained by the fact that it is the staple food and households sell maize to generate income. On the one hand, the implication of the dominance of maize in crop production is real: maize generally needs more water compared to traditional crops like sorghum and millet, hence it is easily affected by drought. In addition, pest or disease infestation of the maize crop can lead to loss of the greater part of the harvest since it covers much of the cropland.

On the other hand, although, the number of crops grown may suggest a diversification strategy, in reality, this masks the fact that the area devoted to maize is high, and therefore defeats the essence of the strategy of risk minimisation or avoidance in terms of crop loss as a result of drought, pests or diseases infestation.

Another suitable strategy would be to diversify risks by growing both local and improved varieties. However, an examination of the maize variety mix in non-drought seasons, reveals that 80% grow only the Kikamba variety, 9% only Katumani, 2% only Makueni hybrid, while only 9% mix the varieties. This strategy indicates that farmers attempt to maximise crop yields in the expectation that the next farming season will have adequate rainfall. It also indicates that farmers accept the risk of crop failure and hope that in the long run the crop losses will be out-weighed by the few good harvests. In addition, in case of widespread crop loss due to drought, they can expect to receive relief supplies and support from relatives.

Combinations of the following four factors seem to influence the choice of maize crop variety: the prospect of high yield, drought resistance, early maturity and easy accessibility in terms of cost and distance. The farmers associate the Kikamba variety with these characteristics and this explains why Kikamba dominates. However, no difference in yield has been established between those that use local seeds and those that use improved seeds. This may be explained by the fact that due to farmer experimentation through adaptive selection and crossing, that the local varieties now contain some strains of Katumani due to Katumani’s open pollination characteristic (Tiffen et al., 1994, p. 229; Mbogoh, 2000). Thus, the high-yield characteristic of the local varieties has been combined with the drought-resistant characteristic of Katumani composite.

Although the households employ multiple strategies to access maize seeds, such as through purchase (74%) and own seed preservation (32%) as was the case after the 1999/2000 drought, none of them purchased ‘certified seeds’ packaged by seed producing companies, to guarantee the authenticity of the contents (Ifejika Speranza and Wiesmann, 2006). By not purchasing ‘certified seeds’ those farmers that grow hybrid varieties expose themselves to the risk of planting unsuitable varieties and experiencing crop failure.

### Table 5

<table>
<thead>
<tr>
<th>Maize variety</th>
<th>Cobs per stalk</th>
<th>Growing period (days)</th>
<th>Average seed price (KSH/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Katumani composite</td>
<td>1</td>
<td>75–78</td>
<td>130.–</td>
</tr>
<tr>
<td>Kikamba/Kinyanya/</td>
<td>2</td>
<td>90–120</td>
<td>15.–</td>
</tr>
<tr>
<td>Kinyalili</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Makueni dryland</td>
<td>1</td>
<td>75–90</td>
<td>130.–</td>
</tr>
<tr>
<td>composite (DLC1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Makueni hybrid (Dryland hybrid 02)</td>
<td>1</td>
<td>90–120</td>
<td>130.–</td>
</tr>
<tr>
<td>Pioneer</td>
<td>3</td>
<td>120–140</td>
<td>200.–</td>
</tr>
<tr>
<td>Kitale 614</td>
<td>2–3</td>
<td>+ 150</td>
<td>200.–</td>
</tr>
</tbody>
</table>

3.4.6. Labour requirements and availability

A major concern for 16% of the households is labour constraints on crop production. In the semi-arid lowlands of Makueni district, the farmer must work roughly three times as much as their counterparts in other areas of higher agricultural potential (Jätzold and Schmidt, 1983, p. 177) to get the same harvest quantity.

The average household size is 7 persons but this varies considerably depending on household organisation. The average demographic dependency ratio per household is 120 dependants for 100 working persons, whereby for 24% of the households this ratio ranges from 200:100 to 400:100. However, the ratio of dependants to income earners (including farmers working in subsistence production) is higher, namely 149 dependents to 100 income earners per household whereby for 38% of the households this ratio ranged from 200:100 to 500:100 (Ifejika Speranza, 2006b, p. 167).

Labour is shared between household work, farm- and off-farm activities. Due to the dry conditions, many households diversify their income sources by taking on off-farm activities. The advantage of this strategy is that the household is insured against total income loss and food consumption collapse in the event of drought and crop failure. Since most households depend solely on their members for labour, the withdrawal of labour to off-farm activities contributes to labour constraints in farm work. In order to overcome labour constraints, individuals organise themselves in self-help groups (Mwethya/Mwilaso) to work on each other’s farm (Tiffen et al., 1994, p. 135; Ifejika Speranza, 2006a, b, p. 270).

There is no significant correlation (Spearman’s r) between number of persons active in farm work and harvest quantity of maize. However, qualitative analysis reveals that due to the fact that many men are engaged in off-farm activities, there is always a shortage of labour during the peak farming periods in February/March—harvesting, planting and weeding; and in July/August—harvesting, digging terraces and manuring (Ministry of Agriculture, 1999; Ifejika Speranza, 2006b, p. 270).
Another effect of withdrawn male labour is that the adult married female members who are mostly active on-farm have to take on additional workload to compensate for shortfalls in labour requirements both in the farm and in household work. The lack of family labour unfavourably affects timely harvest, proper preservation of produce and the preparation of the farm plot for the next season, especially in the period between the end of the SR season (January/February) and the beginning of the LR season (February/March). This problem of insufficient labour becomes more intense after good harvests. In order to prepare the land for the next season before the onset of rains (especially periods before the LR), and due to labour constraints, the harvested produce is not immediately threshed and prepared for storage, but are temporarily stored until time permits for proper preservation steps to be taken. However, not properly threshing and preparing the grains for storage immediately after harvest creates conducive environment for pests to infest or further damage harvested produce. This adversely affects food availability within the homestead.

3.4.7. Government extension services and crop production

A major concern of 8% of the households in crop production is the inadequate support from crop extension services. From fieldwork and qualitative analysis carried out, the crop extension services at the individual farmer level are based on a request basis. At community levels, extension officers organise group meetings (Barazas) where issues affecting crop production are discussed and the farmers advised. However, extension workers mentioned that they have inadequate transport facilities to visit all villages.

For individual needs, a farmer has to contact and request for the services of the crop extension officer and also has to partly pay for this service. However, this effort is not forthcoming from the farmers either because they lack awareness of the procedures or they are unwilling to pay for such services. This is in contrast to livestock production whereby farmers actively consult, engage and pay for the services of livestock extension officers and village para-vets. This indicates that farmers value livestock as a basic asset more than crops and are therefore more willing to invest.

3.4.8. Massive crop sales and poor market prices

While 6% of the households attributed constraints in crop production to massive selling of crops, another 3% attributed it to poor market prices. This can be explained by the fact that many households sell too much of their produce and do not leave enough for own consumption and as seeds for the next season. Ifejika Speranza and Wiesmann (2006) found that many households consume the stored seeds, especially after seasons affected by drought and have to purchase seeds at the beginning of the next season. However, the ability to acquire seeds depends on the availability of cash and if a household delays planting as a result, the maize seeds miss the first rains. Delays in planting have been shown to decrease maize yield (Dowker, 1963). The poor prices derived from sale of crops implies that households are compelled to even sell more of their produce to access cash to meet other needs and because of the poor prices they are unable to invest in crop production to the extent they planned. The 29% that experience massive selling of crops as a cause of famine can be explained by the fact that households have to sell crops to access cash thereby leaving a proportion in the granary that is not sufficient to meet household consumption needs. Further, the low incomes derived from crop sale means that households have to spend more money later in the year to purchase the same crops, which they had sold earlier in the season at poor prices. These factors and their temporal dynamics increase the potential to suffer various levels of food insecurity.

3.4.9. Land holding and cropland

Small cropland size is a major concern for only 3% of the households while only 7% rank it as a major factor contributing to famine. This low proportion can be explained by the constraining conditions that inadequate labour, lack of capital, inadequate planting seeds, and access to and level of mechanisation pose on the farmers to increase their cropland as most households farm only a fraction of their total land holdings.

The average farm size is 2 hectares (ha), which is below the average farm sizes for Makueni District (2.5ha; Ministry of Finance and Planning, Makueni District, Kenya, 2002). There is a wide range in the size of area under crops from 1 acre (0.4 ha) to 23 acres (9 ha). The median farm size and land holding is 4 acres (1.6 ha) and 10 acres (4 ha) respectively. There are various clusters of cropland size, namely 0.8 ha (17%), 1.2 ha (13%), 1.6 ha (18%), 2 ha (11%), 2.4–3.2 ha (21%) and 4 ha (6%). Only one household has a cropland of 9.3 ha. In addition, only 10% fallow their land.

The total land holding of the households ranges from 0.4 to 32.4 ha further revealing the wide range in land distribution. There is a significant positive correlation (Pearson’s \( r = 0.51 \) at \( p = 0.01 \), 2-tailed) between area cultivated and size of land holding per household. However, this relationship does not hold for those households that have land holdings of more than 16.2 ha.

Land is a basic factor of crop production and under normal rainfall conditions, the size of land cultivated positively correlates with yields. For the maize crop there is a significant positive correlation between maize yields and cropland sizes. Thus, the larger the cropland the higher the maize yields (Spearman’s \( r = 0.48 \) at \( p = 0.01 \), 2-tailed). However, under drought conditions, there is no correlation between cropland size and maize yields.

3.4.10. Other factors

All the factors listed in Table 1 and some of the factors listed in Table 2 have been analysed. Other factors in Table 2 like lack of financial resources and high dependency ratio
have been partly touched upon in the forgoing elaborations. Very few households regard lack of water for irrigation as contributing to famine. Irrigation can only be practised in some small parts of the dryland areas of the district. Even so, only 7% of the households grow crops like vegetables and fruits under some form of irrigation, mainly by furrows. Others who live beside rivers and wish to practice irrigation lack physical access to land near the river, which are occupied either by large-scale plantation farms or absentee owners. The farmers perceive these other stakeholder as constraining their access to a food production factor (river water) and by extension to access to food. Besides obtaining the permit to abstract water, such households also lack the resources to pump water in an effective manner to their farm plots.

4. Factors reducing vulnerability

Given the results and discussions above we can formulate factors that reduce vulnerability to various forms of food insecurity in average seasons and seasons affected by drought if represented in the production system and the livelihood strategy of households.

Households are less vulnerable if the following conditions are met:

1. Cropland: if the cropland is larger than 2 ha.
2. Labour: if at least one-third of the household is partially or fully active in the farm.
3. Maize crop: if the dominance of maize crop is reduced and if drought resistant maize or mixes of maize varieties are cultivated.
4. Mechanisation: if the land is prepared using oxen (or tractor) and if the household itself owns these oxen.
5. Planting: if planting is done before the onset of rains or if staggered planting schedules (before and after onsets) are applied.
6. Conservation: if rain-water/run-off harvesting and other water conservation technologies are used.

The absence of these factors implies higher vulnerability. This is confirmed by a drought vulnerability index developed by Ifejika Speranza (2006b, pp. 274–275) based on a scheme of scores for the positive and negative effects of the analysed factors on crop production, and in effect on household food- and livelihood security.

5. Policy implications

Given the above results we turn to the question whether the current policy environment in Kenya adequately responds to the highlighted problems of vulnerability to food shortage and famine in drought exposed semi-arid areas.

The Kenyan food security policies cover many of the points discussed in this paper—see for example the National Food Policy (NFP; Government of Kenya, 1981), the Development policy for Arid and Semi-Arid Lands (ASAL; Government of Kenya, 1992), and the Interim Poverty Reduction Strategy Paper 2000–2003 (IPRSP; Government of Kenya, 2000b). It is important to note that the NFP and the ASAL policy have recently been reviewed and are before parliament for approval. Thus the following elaborations are based on the approved versions of NFP (Government of Kenya, 1981) and the ASAL policy (Government of Kenya, 1992). The NFP aims to ‘maintain broad self-sufficiency in the main foodstuffs’, ‘achieve a calculated degree of security of food supply’, and ‘ensure foodstuffs are distributed in a manner that every member of the population has nutritionally adequate diet’ (Government of Kenya, 1981, p. 2). The central objective of the food security policy, which is part of the NFP, is to ‘ensure that an adequate supply of nutritionally balanced foods is available in all parts of the country at all times’ (Government of Kenya, 1981). The objective of the ASAL policy is to ‘improve the standard of living of the ASAL population by integrating them into the mainstream of the national economy and social development in an environmentally sustainable manner’ (Government of Kenya, 1992). The IPRSP aims to facilitate sustained and rapid economic growth, to improve governance and security, the quality of life of the poor, equity and participation, and to increase the ability of the poor to raise their incomes (Government of Kenya, 2000b).

Activities foreseen to achieve food and livelihood security are numerous. Going by the major constraint of unreliable rainfall (Table 1) all three policies plan to improve drought early warning systems. While the NFP and the ASAL policy supports activities that emphasise drought resistant and indigenous crops, the ASAL policy in addition, aims to strengthen district capacities to deal with drought. The NFP aims to ensure access to agricultural inputs like fertiliser, seeds, and livestock, and to improve cultural practices. These activities address many constraints to crop production (Table 1) and factors that households perceive as contributing to famine (Table 2). Also the IPRSP focuses on the inspection and quality control of farm inputs through improved legislation and empowerment of farmers’ associations and the improvement of farm technology. All three policies foresee activities to control crop and livestock pests and diseases, to support research and extension, food processing and marketing, and to increase rural employment opportunities. In order to ensure food availability the policies support the establishment of strategic grain reserves. Thus the policies address important issues and do not lack knowledge on these issues. The policies also adopt a multi-sectoral integrative approach and foresee such integration in implementation activities.

However, data analysis and field work at household and district levels suggest that many of the planned activities are weakly implemented. The major reasons for ineffective implementation include inadequate government financial capacity and subsequent financial cuts in budgetary...
allocations, the widespread poverty of the population (which limits people from contributing to development activities through cost-sharing, self-help activities and investments), the poor infrastructure, and the limited access to credit services and to information. These limited resources still pose a major challenge even to the recently revised policy documents.

It seems that the magnitude of the development problems to be solved and the high costs of implementation make it difficult for government to simultaneously allocate resources to all areas of need. Hence the government-set high priority on education, training and health (Government of Kenya, 1992), and budgetary cuts implies that other important areas like agricultural production and support of small-scale enterprises may be receiving too little allocations. One way to circumvent these budgetary constraints has been to direct bilateral and NGO resources to these sectors. However, activities based on bilateral and NGO resources may be effective in the short term but are scattered and sporadic and therefore may not guarantee long-term financial support for development activities in the ASALs.

Interview data also show that although the implementation of policy to integrate sectoral activities at the district level is slow, the principle is increasingly gaining acceptance among the concerned officials in the respective sectors. However, the resources to make the ‘integrative approach’ like the foreseen ‘multi-disciplinary extension teams’ operational are still largely lacking. Most government departments lack adequate financial and logistical resources to implement integrative activities, rendering extension workers unable to perform their duties effectively. In the case of Makueni district, like in other ASAL districts, extension work depends to a large extent on the resources of institutions financed by bilateral agreements (e.g. the Makueni Agricultural Project of the Danish Development Agency). Other NGOs active in the district co-finance several other so-called government projects to a substantial extent. There is therefore need to increase resources allocated to district level activities like the extension services, and infrastructure development.

As a measure to reduce the costs of extension, government introduced the farmer-driven-extension service approach. Yet interview data shows that this approach has rather excluded the poor farmers from most extension services, since they now have to travel to demand for the services; and are at times supposed to pay for logistics—such were hitherto provided free.

The lack of access to credit constrains investments in farm activities and small-scale enterprises. Alternative conditions of granting credit by financial institutions need to be established, as people are unwilling in most cases to use their land title as collateral due to their cultural attachment to land. Fieldwork data shows that there is need for information campaigns to highlight the modalities of obtaining credit and to correct the perceptions of people on sourcing credit and the fear of losing land. This will ensure that financial institutions start to accept other collateral other than land titles that the people will also be interested to apply.

It was reported during the transfer workshops that many decision makers are increasingly using relief food as a tool to solicit political support. This compromises the genuine desire by the government to provide effective interventions towards food security.

There seems to be a lack of effective policy dialogue between the various administrative levels and the households. Households report that several of their expressed needs are either not met by the extension or government in general. For example, households reported in interviews and discussions that they asked for support to improve the marketing of their produce but that the immediate answer of the decision makers involved was to provide them with land-title deeds. In the eyes of the villagers, this action (provision of title deed for lands they have occupied for generations) is important but not as important as the pressing need to improve produce marketing. Other studies (cf. Nyangito, 2003) indicate that the implementation of international agreements and policies may worsen the conditions for rural producers (crops and livestock) as government continues to remove subsidies in agricultural and livestock production. There is therefore need to improve policy dialogue to ensure that constraints to crop production and food security are addressed in a timely manner.

6. Conclusion

This study in the agro-pastoral areas of semi-arid Makueni District in Kenya revealed important insights on the relations between rainfall variability, productions systems and livelihood strategies that have to be considered when addressing the interplay between droughts and famines.

Foremost, one has to recall that already under non-drought conditions more than three-quarters of the studied household face various forms of food insecurity and about one-quarter have to be rated chronically food insecure.

Against the background that rainfed agriculture with a significant portion of subsistence production forms the backbone of food supply, the most important factor causing this situation is the high spatio-temporal variability of rainfall (cf. Misselhorn, 2005). Thereby it is important to note that the unreliable onsets of rains, their duration and intensity, as well as the frequent occurrence of dry spells during the growing periods play an as important role for the farmers’ production systems as the amount of rainfall itself.

If several of these risk factors of rainfall cumulate or aggravate in a season, drought occurs. In addition, if such risk events accumulate over seasons, farmers may face drought conditions even if the respective season does not qualify as such from a meteorological point of view. Under drought conditions famine may occur, meaning that not
only the chronically food insecure households face a food crisis but the large majority of all households. This is reflected in the local Akamba language where a difference is made between ‘hunger’ that affects certain households and ‘famine’ that affects the village or community.

When addressing the interplay between drought and famines, these findings imply, on the one hand, that a drought definition has to be applied that includes those rainfall characteristics that are highly relevant to the agro-pastoral production system. Besides rainfall amounts these mainly include onsets of rains, duration and dry spells. On the other hand, they imply that other conditions than rainfall characteristics of the production system and the household strategies play a key role in predisposing households to food insecurity which may then cumulate to famine under drought conditions. In their combination they characterise the drought vulnerability of households.

Major conditions that may trigger food crisis are first of all other risks affecting production than the risks related to rainfall. These mainly include problems of soil fertility and soil water retention, crop pests and diseases in pre- and post-harvest times, as well as human–wildlife conflicts. When assets, labour, capital and laws (in the case of wildlife) do not enable to effectively address these risks, they can cause food crisis even under favourable climatic conditions and under drought conditions they will provoke a cumulative effect.

A second group of constraining conditions relates to assets and in particular to labour. If assets like oxen are missing or labour is limited due to unfavourable dependency ratios or due to diverting labour into other sectors of the household strategy (livestock, off-farm, migration), farm work has to be confined to small sizes of cropland. And even more important, farm work like ploughing, harvesting or weeding may not be timely, thereby not only affecting the current but also the following agricultural seasons.

However, very crucial is also a third group of conditions that is related to the production strategy of households. The cropping pattern of maize as the dominant crop does hardly show aspects of risk aversion like mixing varieties or using lower yielding but drought-resistant varieties. It is rather laid out to cater for good or bumper harvests in good seasons. This is caused by the need for cash from crop production and the hope to get assisted during food crises. This approach is also observed with the very poor and vulnerable households that own no or very little livestock, the traditional means of banking cash. In other words, the cash needs are competing with food security concerns in maize production. This is also expressed in low-price sales just after harvests, which then have to be later, compensated for at higher prices. This means that the high poverty disables households to afford risk-balanced production systems, thereby leading into a vicious circle of increased vulnerability to drought.

The analysis of the policy environment that addresses semi-arid regions, poverty and drought effects reveals differentiated strategies, regulations and laws that basically touch on the conditions forming drought vulnerability. However, policy implementation and transforming goals into action is strongly limited and shows very minor effects on the level of the vulnerable households. Besides being a result of generally limited capacities and resources, governmental priority setting in the health and education sector withdraws resources and attention from farming sector policies. Although improvements in health and education will also reduce drought vulnerability in the long run, interventions geared at the farming system and the conditions forming drought vulnerability require significantly more attention, else dealing with the interplay between droughts and famines will be reduced to humanitarian aid, i.e. in form of relief food that is—as confirmed in this study—not decreasing but increasing drought vulnerability.

This study implies that promising intervention approaches to reduce drought vulnerability can be identified when household capacities to deal with constraints in crop production in the context of high rainfall variability and poor socio-economic conditions are targeted. This includes refining drought definitions and forecasts with those rainfall characteristics that are crucial and pose a major risk to farmers. But even more important, it includes understanding and targeting aspects causing food insecurity under non-drought conditions because these are decisive for drought vulnerability. In other words, mitigating famines related to drought implies dealing with factors of food insecurity in non-drought periods.

Finally, it is important to note that there are a number of other constraints to the food security of agro-pastoral households that are outside the scope of this study, which focuses on crop production, drought and famine. These other livelihoods and factors need to be addressed in order to strengthen household food security.

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