



## Effect of 2009 Drought on Household Livelihoods in Laikipia West Sub-County, Kenya

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**Abstract:** Prolonged and severe drought has affected many parts of sub-Saharan Africa, resulting in increased cases of disease, hunger and destruction of habitats. This study assessed effects of drought on household livelihoods in Laikipia West sub-County in Kenya through a survey and in-depth interview. The study utilized household surveys (N=180) and Key Informant Interview (N=8) data and descriptive data analyses tools were used for data analyses. The 2009 drought led to reduced crop yields (32.5%) and crop failure (12.6%). With respect to cropped area and livestock, 26% of the respondent reported that about 75% of their crop area was impacted by drought while 78% of respondents reported few livestock death during the drought. The study recommends enhanced social programs to support households when they suffer losses due to drought as a coping mechanism. Policy on compensation by the Ministry of Environment and Natural resources and the county government of Laikipia will enable the affected households meet their basic needs just like those who are able to harvest crops.

**Key words:** Severe drought, drought impact, household livelihood, enhanced compensation.

Climate variability is expected to impact agriculture, potentially threatening established aspects of farming systems (Clark *et al.*, 2010). Drought effects are often measured in terms of economic losses such as crop failure, livestock losses associated with decreased levels of employment, income, nutrition, and health (Changnon, 2000; Glantz, 1994; Vogel, 1995). A more recent analysis (UNISDR, 2012) has reiterated that drought sets a vicious cycle of socio economic impacts beginning with crop failure, unemployment, erosion of assets, decrease in income, worsening of living condition, poor nutrition, and subsequently, decreased coping capacity of the poor to subsequent drought.

Large scale ocean-atmospheric interactions, now known as the El Niño-Southern Oscillation (ENSO), have received considerable worldwide attention since the mid 1970s (Allen, 1996). ENSO (often called El Niño) events have shown to be associated with many global climatic anomalies such as floods and droughts. El Niño-related droughts, when coupled with high temperatures and abnormal rainfall distribution, produce lower than average yields of rice, maize, wheat and other agricultural products (Allen, 1996). Holmgren and Oberg (2006) argued that people

at high risks in time of climatic variability are the ones living on floodplains, coastal areas, mountains as well as those having no means of adapting to changes. Consequently, Africa is likely to be affected more severely by drought than any other continent (Yanda and Mubaya, 2011). This is due to greater vulnerability of Africa's economy that is dependent on crop production, livestock and tourism (Collier *et al.*, 2008). This adversely affects the wellbeing of the population. Increasing rainfall variability and frequent extreme climatic events especially droughts and floods disrupt agricultural production leading to famine and severe loss of livelihoods. Prolonged dry years have reduced the ability of African societies to cope with droughts (Muthui, 2007). These impacts are compounded by numerous factors such as poverty, high population density, and human diseases. This is expected to rise to alarming level with respect to demand for water, food and forage for livestock in this region in the next thirty years (Okoro *et al.*, 2014).

Droughts in Kenya adversely affect rain fed agriculture, water resources, hydropower generation and ecosystems. The agricultural sector which contributes more than 51% of the gross domestic product (GDP) in Kenya (Mwangi *et al.*, 2013) has been critically affected by frequent droughts. The recent droughts

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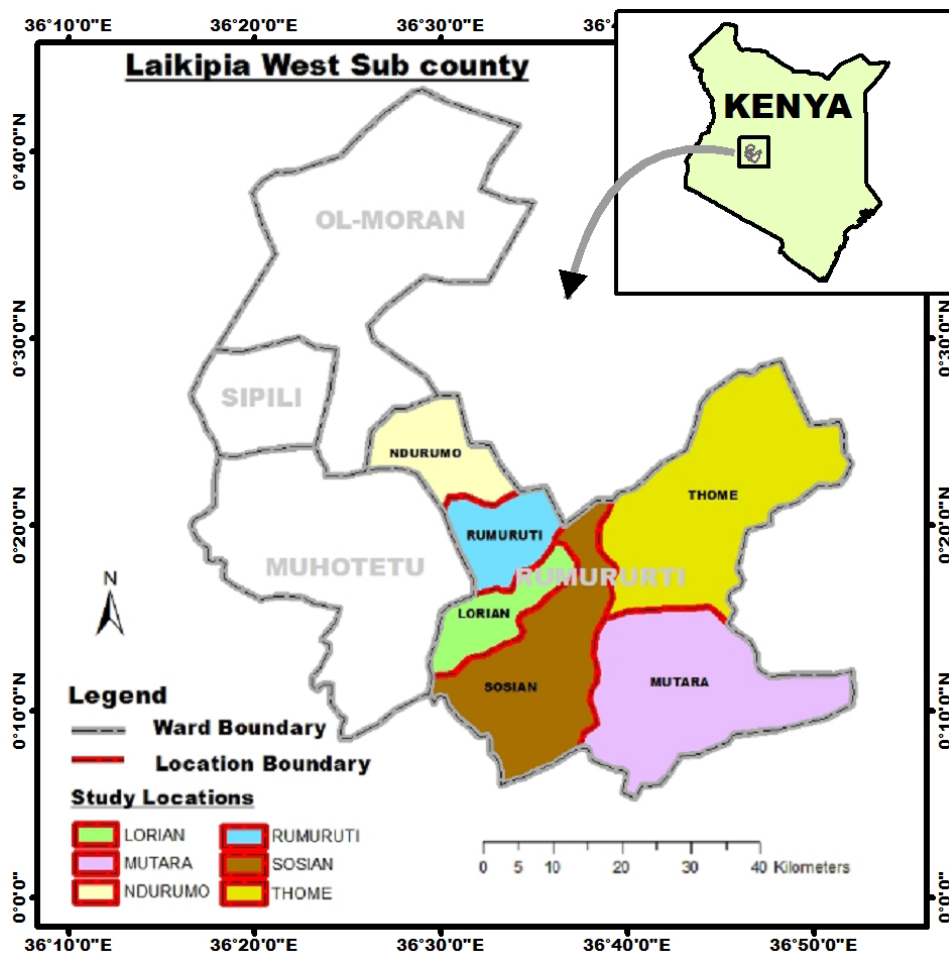


Fig. 1. A map of Laikipia West sub-County showing the sampled sites  
(Source: Independent Electoral and Boundaries Commission - 2012).

(2008/2009 and 2011) caused devastation in Kenya's dry lands including loss of beef cattle, camels, and sheep (KFSSG, 2011). The situation in Kenya is worsened by the presence of over 450,000 refugees who are victims of civil unrest (KCCAP, 2013). Laikipia West sub-County is more vulnerable to drought due to its location on the leeward side of Mount Kenya and over reliance on rain-fed agriculture and natural pasture.

### Materials and Methods

Study area was Laikipia West sub-County in Laikipia County, Kenya that is located to the north west of Mount Kenya. The sub-County lies between latitude 0°15' and 0°43' North and between longitudes 36°30' and 36°5' East and an area of 3,188.8 km<sup>2</sup> as shown in Fig 1. The altitude of the sub-County varies between 1,000 m above sea level and 2,600 m (Thenya *et al.*, 2011). Laikipia West sub-County has

four administrative wards namely; Rumuruti, Muhotetu, Sipili and Olmoran (KNBS, 2010). Laikipia means *treeless plain* in local Maasai language (CDIDP, 2013).

### Climate and Agro-ecological Zones

The study area is located in the rain shadow of Mount Kenya making the area dry. The agro ecological zone of the sampled ward (Rumuruti) is LH 4, LH 5 and UM 5 (Jaetzold *et al.*, 2011). Laikipia West sub-County is classified as 50-85% arid and semi-arid land with an annual rainfall varying between 500 and 800 mm (Jaetzold *et al.*, 2011). It is comparatively dry despite its location on the Equator due to its position with respect to Mount Kenya. The spatial distribution and the temporal variability of rainfall are strongly influenced by Mount Kenya and Aberdare ranges. Precipitations also vary greatly in terms of time and amount along the same gradient. Rainfall follows the seasonal

movements of the Inter Tropical Convergence Zone (ITCZ) resulting in two rainfall seasons (Huho *et al.*, 2010); first is the wet season that occurs during March-April-May and often accounting for 80% of total annual rainfall. The second wet season occurs in October-November-December.

### Sampling Procedure and Sample Size

The study used Slovin's formula (Galero, 2011) to determine the number of household respondents that allows to sample the population with a desired degree of accuracy and is written as:

$$n = N / (1 + Ne^2) \quad \dots(1)$$

where: n - Sample size, N - Total population and e - Error of tolerance=0.05.

Laikipia West sub-County had 39,966 households (KNBS, 2010) thus 196 households were sampled. For the household survey, 196 questionnaires were put to the selected household respondents. One hundred and eighty (180) were considered during data analysis representing 92% response rate, which was considered good (Mugenda and Mugenda, 2003) to draw conclusions for the study.

Multi-stage cluster sampling technique was used to select respondents and study site. In stage one, administrative wards were clustered based on their different economic activities. There are four wards in Laikipia West sub-County. The wards are: mixed livelihood zones which comprise of Muhotetu and Sipili and sub-humid agro-pastoralism livelihood zone comprising of Rumuruti and Olmoran. In stage two, purposive sampling was used to select the study ward. The selection of Rumuruti ward a sub-humid agro-pastoralism was based on variation in livelihood practicing options. Stage three involved proportionate random sampling to select household respondents from all the six locations in Rumuruti ward as shown in Table 1 using the following formula:

$$n = p / \mu \times 300 \quad \dots(2)$$

where, n is the sample population of the location, p is the population of the household in the location and  $\mu$  is the total households in the ward.

Rumuruti ward has six locations namely: Rumuruti, Thome, Ndurumo, Mutara, Sosian and

Table 1. Households sample population in rumuruti ward

Location	Total population	Sample population
Rumuruti	16,094	67
Thome	6,612	28
Ndurumo	6,030	25
Mutara	6,226	26
Sosian	6,422	27
Lorian	5536	23
Total	46,920	196

Lorian. The ward has eleven sub-locations namely: Rumuruti Township, Mutamaiyo, Lorian, Ndurumo, Kagaa, Mutara, Kiamariga, Thome, Mathira, Sosian and Maundu Miiri.

### Data Collection

Cross-sectional household survey and key informant interviews were used to collect data on the impacts of drought on household livelihoods in Laikipia West sub-County. Household surveys were carried out to gather statistical information about the attributes and actions of a population by registering response of some of its members to standardized questionnaires (Buckingham and Saunders, 2004). Household data was collected from proportionately random selected household in all the locations in the selected ward using structured questionnaires. Key informant interviews complemented the survey research and targeted, chiefs, elders, sub-County agriculture and livestock officers and non governmental organization officials. The key informant interviews are useful to supplement, validate, explain, illuminate and reinterpret quantitative data (Miles and Huberman, 1994). The key informant interviews consisted of guiding questions for uniformity during interviews with different categories of informants. Crop losses were analyzed by calculating the percentages of the crop area affected by drought.

### Results and Discussion

#### *Socio-economic characteristics of the households*

The study analyzed the source of households' income in order to evaluate their vulnerability to droughts as it varies from one source to the other. Rainfed agriculture for example is more vulnerable to drought events than government employment. Results presented

Table 2. Households source of income (N=180)

Source of income	Male	Female	Total	Per cent
Government employment	3	3	6	3.3
Business person	13	17	30	16.7
Maize farming	34	28	62	34.4
Dairy farming	6	3	9	5
Pastoralism	37	25	62	34.4
Wheat farming	1	0	1	0.6
Other			10	5.6
Total			180	100.0

in Table 2 revealed that around 75% of the household practiced farming and pastoralism. Since farming and pastoralism rely heavily on rainfall, such households are likely to be affected adversely in the situation of adverse weather. Considering its location *vis-à-vis* Mount Kenya the area may not be favorable for rain fed maize farming making respondents choose pastoralism as a complementary income source. The results also revealed some gender disparity in source of income among households; the higher number of men involved in pastoralism and maize farming is an indication that these are a male dominated activities.

In order to assess the levels of income, respondents were asked to indicate their annual income bracket. The respondent's income could limit or support drought coping mechanisms. The results in Table 3 show that 71.1% of the respondents had an annual income of below 120 USD per year which translates to below 10 USD per month. The high number of respondents earning below 10 USD per month is an indication of difficulties they are likely to face during drought. The household income was further categorized to low income (120 USD), middle income (120-500 USD) and high income (above 500 USD). According to Jaetzold *et al.* (2011) a rural family of five persons requires 172 USD per year (using 2009 prices) to be food secure and meet other household needs.

Table 3. Household annual income (N=180)

Household annual income (Ksh.)	Annual income (USD)	Frequency	Per cent
Below 120,000	120	128	71.1
120,000-500,000	120-150	38	21.1
Over 500,000	5000	14	7.8
Total		180	100.0

Low incomes among households in Laikipia West sub-County mean that people may not be in a position to meet their daily needs such as food, medical care and school fees and save fund for exigencies. During drought, the cost of basic commodities such as food is normally high which increases the burden on already strained resources among the households in Laikipia West sub-County. According to Parmeshwar *et al.* (2014) reduction in agricultural production due to drought subsequently causes increase in food prices. Drought reduces the household income leaving them with little to spend and making basic needs such as education a luxury when compared to food.

#### *Impact of the 2009 drought on household livelihoods in Laikipia West sub-County*

According to Ngaira (2004) drought is a form of environmental stress that originates from a deficiency in precipitation over an extended period of time, long enough to cause moisture deficiency, biotic loss, crop failure, loss of lives both human and bovine and general hardships. The impact of the 2009 drought on household livelihood in Laikipia West sub-County was analyzed on five categories of parameters. These are crops, livestock, health, social and environmental impact. The drought impacts were considered to be due to 2009 drought which was the most recent severe drought according to the SPI results (Karanja *et al.*, 2014).

#### *Impact of the 2009 drought on crops and livestock*

The household survey revealed that 2009 drought either resulted in reduced yields (57.2%) or complete failure (26.1%) of maize (Table 4). Reduced maize yields due to drought in Laikipia West sub-County confirms the earlier findings of Karanja *et al.* (2014) wherein rainfall variation was the main cause of decreased Irish potato yields also in Oljoro-oro division, Nyandarua County. According to Wilhite *et al.* (2007) the impacts of drought are a result of the interplay between natural event (precipitation deficiency) and response by the society. According to the key informants, Laikipia West sub-County experienced food shortages, lack of pasture, market supply shortages, and high food cost during the 2009 drought. All these increased the burden on the already constraints households in Laikipia West sub-County.

Table 4. Impact of the 2009 drought on crops (N=180)

	Frequency	Percent
Reduced maize yield	103	57.2
Maize failure	47	26.1
High cost of goods	30	16.7
Total	180	100.0

Price of goods is a resultant of demand and supply and as drought impacts the supply negatively this increased the prices of goods in the study area. Additionally, 54% of the respondent's crop area was impacted by drought (Table 5) while 88.4% reported death of livestock (Table 6). This clearly brings out the fact that animals are more vulnerable to drought than crops. Water scarcity during drought decreases the chances of crop growth leading to decreased yields. Grain-eating birds and grasshoppers are usually reliant on pastures to meet their food requirements; however, fodder scarcity during drought forces them to move to cultivated areas, causing severe damage to mature crops.

Table 5. Percentage of household crops impacted by drought (N=180)

Crops area impacted (%)	Frequency	Per cent
<25	37	20.5
25-50	46	25.5
50-75	48	26.6
>75	49	27.4
Total	180	100.0

Poor availability of fodder coupled with the competition for pasture and water between wildlife and domestic animals make livestock more vulnerable to drought than crops.

Drought reduces forage production and water supplies, thus putting serious pressure on the livestock industry (UNDP, 2000; UNSO, 1999). According to World Bank (2013) drought also makes animals more susceptible to diseases.

Table 6. Impact of 2009 drought on livestock at household (N=180)

Livestock's impacted	Frequency	Per cent
No livestock died	21	11.6
Few livestock deaths	135	75.0
All livestock died	24	13.4
Total	180	100.0

## Social Impacts of the 2009 Drought on Households

Besides the impact on crop and livestock production, the 2009 drought was also reported to have social impact in Laikipia West sub-County. Seasonal migration of animals (28.3%) and increased distance to water points (28.3%) were the main social impacts of 2009 drought on households (Table 7). It is noteworthy that conflict over pasture (18.3%) and job loss (11.1%) and children absenting school (8.8%) were also reported as consequences of drought in Laikipia West sub-County. Drought also created fodder scarcity, thereby contributing to the conflict between herders and farmers (World Bank, 2013) as in the case of 1990 second Tuareg Rebellion in Mali (Keita, 1998). According to Thébaud and Batterby (2001) in the Sahel region, expansion of agriculture during the wet 1950s and 1960s periods and a shift to agro-pastoralism thereafter pushed pastoralists into more marginal regions and led to a breakdown in the networks connecting herders and farmers. This further contributed to the conflict between these groups.

Table 7. Social impacts of 2009 drought in Laikipia West sub-County (N=180)

	Frequency	Per cent
Children missed school for lack of food and school fees	16	8.8
Seasonal migration with animals	51	28.3
Increased distance to the water point	51	28.3
Job losses in farms	20	11.1
Conflict over water and pasture	33	18.3
Others	9	5.2
Total	180	100.0

According to the informants, increase in conflict in Laikipia West sub-County is as a result of high suspicion between the farmers and the pastoralist. The pastoralist feels that the decrease in the volume of the river downstream is as a result of the farmers using the water in the upstream for irrigation. Many a times this led to pastoralist grazing their animals on farms leading to conflict. The conflicts are not just human to human conflict but also human to wildlife conflicts. The elephants migrate upstream when the rivers dry up downstream, invading people's farms and in some instances attacking domestic animals leading to heavy

losses to the farmers. Long time taken to compensate for these losses further complicates the situation.

The informants' findings show that respondents who had lost all their animals or suffer total crop failure during drought are reported to commit suicide. In spite of huge expenses on measures to mitigate drought impacts, the numbers of farmer suicides continues to grow demonstrating a lack of social and community support in the existing drought relief packages (Kiem, 2013). Seasonal migration with the animals separates families for some time, that constraints opportunity for parents to raise their children together. Migration also affects school attendance among children from pastoralist households leading to loss of school time which translates to poor overall performance. According to the informants Government initiatives such as relief food and school feeding program in Laikipia West sub-County need to be strengthened to deal with drought events. Drought also increases distance to the water points which is an additional burden to the social responsibilities of women in Laikipia West sub-County. They spend a lot of time looking for water which is unhygienic many times.

### **Environmental Impact of the 2009 Drought**

Drought was found to have a long lasting environmental impact in Laikipia West sub-County. Drying of rivers (78.9%), lack of wood fuel (11.6%) and increased fire incidences (8.8%) are the environmental vagaries reported as aftermath of droughts (Table 8). Drying of rivers which was the greatest environmental impact shows that people and animals had to walk a greater distance for water and this could increase conflict over the few existing water sources. Animal migration over long distances also in turn increases the rate of soil erosion and degradation. The increased fire incidence leads to loss of biodiversity leading to adverse consequences on the ecosystem.

### **Impact of the 2009 Drought on Health**

Periods of droughts were often characterized by low hygiene standards according to the informants. People were forced to walk for long distances to fetch water for domestic use and livestock. During such times human

*Table 8. Environmental impact of 2009 drought in Laikipia West sub-County (N=180)*

	Frequency	Per cent
Lack of household fuel	21	11.6
Drying of rivers	142	78.9
Increased cases of fire	16	8.8
Others	1	0.7
Total	180	100.0

beings and animals consume water from a common water source which increases the chances of contamination. When water quality is compromised, disease incidences among both human and livestock increases. In the study respondents were asked whether the 2009 drought caused any health related issues. The results presented in Table 9 revealed that the health impacts include human diseases, livestock diseases and crop diseases. Out of 180 respondents, conveyed that drought triggered malnutrition among members of the households (40.3%), livestock diseases (28.8%) and increased crop pest (18.8%) besides other issues. Reduced water volumes in rivers or lakes also led to concentration of pollutants. Increased cases of human diseases resulted in less productivity among households since more time was lost for seeking treatment as opposed to economic development. Increased cases of livestock diseases is likely to make human life more vulnerable as the animal products such as milk and meat that people consume may also act as source of infection.

### **Conclusion and Recommendations**

The 2009 drought severely impacted the households' livelihoods of Laikipia West sub-County and it led to death of livestock, reduced crop yields and increased food prices. The drought also led to drying of rivers thereby increasing distance to the water points which

*Table 9. Health impacts of 2009 drought in Laikipia West sub-County (N=180)*

	Frequency	Per cent
Increased cases of livestock disease	52	28.8
Increased crop pest	34	18.8
Human diseases	16	8.8
Human death	6	3.3
Malnutrition	72	40.3
Total	180	100.0

led to conflict over the scarce commodity. The conflict over water was not limited to human-human interactions but also human and wildlife. The proximity of Laikipia West sub-County to Mount Kenya, national park made it easier for the wild animals to access farms during drought in search of water and pasture. The invasions of wildlife in farms led to further losses which were sometimes so severe that households were unable to cope. Drought impacts households differently due to the difference in the levels of income. High income could do more savings and could thus sustain the households during drought. The study recommends policy decision for legislation on compensation for the households by the Ministry of Environment and Natural resources and the county government of Laikipia. Farmers whose crops are destroyed or whose livestock is lost needs to be compensated within a short period of time to allow them to have funds for the usual household activities like their counterparts who harvest and sell their farm produce normally.

### Competing Interests

Authors have declared that no conflicting interests exist.

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