# Livestock Raiding and Rainfall Variability in Northwestern Kenya.

By: Carol R. Ember, Teferi Abate Adem, Ian Skoggard & Eric C. Jones

C.R. Ember, T. Abate Adem, I. Skoggard, E.C. Jones. 2012. Livestock Raiding and Rainfall Variability in Northwestern Kenya. *Civil Wars* 14(2):159-181.



## Abstract:

In 2009, Witsenburg and Adano summarized their research on rainfall variability and livestock raiding in Marsabit District, Kenya. They found that livestock-related violence was higher in wetter months and wetter years, contrary to the common assumption that scarcity of water and pasture is the primary driver of livestock violence. Our research, focusing on the neighboring Turkana District of northwestern Kenya, attempted to replicate the Witsenburg and Adano findings for the years 1998–2009. We find significant relationships between rainfall variability and intensity of livestock violence, but in the opposite direction – drier months and drought years in Turkana District have higher intensities of violence.

**Keywords:** livestock raiding | rainfall variability | Kenya | livestock violence

## Article:

Introduction

This article explores possible links between rainfall variability and the intensity of livestock raids in and around Turkana District of Kenya, an arid region primarily populated by Turkana herders. As in other East African nomadic societies, livestock raids are not a new phenomenon for Turkana but the scale and ferocity of such raids has varied over time. To what degree does rainfall account for this variability in Turkana District? Our research analyzes empirical data on rainfall fluctuation and human casualties from livestock raids for the years 1998–2009.1 One of our main purposes is to see if Witsenburg and Adano's findings for Marsabit District, Kenya hold true for Turkana District.2 Since our findings are largely in the opposite direction, we end with a discussion of why the results may be so different.

Our attention to rainfall falls broadly within the scope of studies that examine the possible effects of resource scarcity on violence. For pastoralists, rainfall appears to be a reasonable proxy for the availability of pasture and water – necessary resources for livestock. The time lag for the emergence of savanna grasses is relatively short – such grasses sprout quickly with the onset of rain and quickly become dormant with the onset of the dry season.3 During prolonged drought, pasture and water (except in areas with rivers and deep wells) become much more scarce.

Ecological theories about violence are not new,4 but increasing attention is being paid now to the impact of climate change. Humanitarian agencies and climate change advocates have suggested links between recent rise in the scale and ferocity of livestock raids with aspects of climate change locally felt in the form of frequent droughts.5 Perhaps for this reason, the Witsenburg and Adano findings for Marsabit District were so surprising – they produced evidence supporting the opposite view – that in a pastoral region, more rain and presumably more resource abundance were associated with more intense violence.6

While rainfall variability is our focus in this article, we do not presume that intensity of livestock raiding can be explained solely by rainfall variability. Indeed, the voluminous literature on cattle raids among pastoral communities suggests a combination of cultural,7 economic,8 and political9 factors in addition to, and in interaction with, ecological factors. We focus on rainfall for heuristic reasons. It is important to see if, and how strongly, rainfall variability (as a proxy for pasturage) does predict variation in livestock violence. More complex models can be built to incorporate other factors later.

By what mechanisms would rainfall affect violence? Assuming that scarce rainfall reflects resource scarcity for pastoralists, the view of humanitarian agencies and climate change advocates is mostly based on an implicitly assumed trigger sequence scenario in which droughts lead to the depletion of pastures and water resources. The resulting scarcity, the assumption goes, causes competition over resource access which leads to tensions and rivalries among different pastoral groups. If not mediated by state intervention and/or local institutions for resource sharing and cooperation, the argument continues, this competition will culminate in fighting.10 This argument mainly addresses unpredictable scarcity such as drought. This scenario is consistent with a worldwide cross-cultural study by Carol and Melvin Ember that found that non-state societies with more unpredictable natural disasters that seriously destroyed food supplies were much more likely to have frequent warfare.11 Cross-culturally, when war occurs, it usually involves taking land and/or other resources, possibly as a cushion against current and future unpredictable events.12 Droughts are one of the most important natural disasters in Kenya. Therefore, we would expect to find that yearly rainfall would be negatively related to livestock raid violence.

A somewhat different mechanism is that scarcity causes herders to take more risks, such as moving closer to other groups to obtain sufficient pasture. As we discuss more fully in the section on the Turkana, extant ethnographic accounts suggest that the pastoral pattern involves moving between relatively safe wet season and dry camps during a normal year, with further stretching to marginal pastures during drought years. In this pattern, herders who move to isolated camps in rarely used drought refugee land are more vulnerable to livestock raids than those in the regular camps.13

An alternative view, proposed by Witsenburg and Adano based on empirical evidence from Marsabit District in Kenya, suggests that livestock raids are more violent in wet seasons and

years when both pasture and water are abundant.14 In this district where an increasingly armed population from competing ethnic groups lives side by side (Borana, Gabra, Somali, Dassenetch, Burji, Garri, Ajuran, Sakuye, Sidamo, Konso and Waata), Witsenburg and Adano noted that when resources dwindled in drought years, people were more inclined to cooperate and use wells and pasture together rather than fight.15 Instead, conflict over resources seemed often triggered by access problems including the failures of locally working institutions by which resources are shared and controlled.16 More importantly, Adano and Witsenburg found that human casualties from raids typically peaked in the main rain season (April–June), dropped in the dry season (July–September), and increased again when the small rains come (between October and December).17 This finding was consistent with interviews with local people who argued that raids during the wet season are more fierce, deadly, and violent than the ones during the dry season.18 One explanation given for this is the condition of the livestock; they are stronger, fatter, and fit for long trek. Other reasons include the availability of vegetation and surface water for the animals, and thicker vegetation cover for hiding the attackers.19 These conditions, the argument goes, together with the availability of more young men to engage in raiding, provide good opportunity for organizing and executing successful livestock raids.

After briefly reviewing Turkana District and Turkana pastoralist practices, we ask the following questions for the years 1998–2009: Does monthly rain and yearly rain predict livestock-related violence in Turkana District? Are the patterns consistent with those found by Witsenburg and Adano for Marsabit District? That is, do wetter months and wetter years have more livestock-related violence or do drier months and years have more violence? In addition, we ask whether rainfall unpredictability is related to more livestock-related violence. This interest comes from the cross-cultural study discussed above; that study also found that chronic scarcity (constant hunger or seasonal scarcity) had no independent effect on warfare frequency.20 From the point of view of pastoral people with rainy and dry seasons, monthly rainfall is largely predictable – they know which months are wetter and which months are drier. Yearly variability, on the other hand, is largely unpredictable – the weather can be drier or wetter than normal, but not usually in a predictable pattern. But there is another kind of rainfall unpredictability we can look at. A particular month in a particular year can be much drier or much wetter than it is supposed to be. Does that kind of unpredictability predict more livestock-related violence?21 Finally, although we would have liked to test the idea that the presence of assault rifles was associated with more violence, almost all of raids we reviewed in our time period had some assault weapons, or the newspaper reports only said ‘guns’ without specifying which kind of gun, so we did not have enough reliable variability for testing.22

## Turkana Background

The Turkana are Nilotic people, closely related to the Iteso, Karamojong, Dodoth, Ngijie, Taposa, Jiye, and Donyiro. Turkanaland corresponds closely to the boundaries of Turkana District in Kenya which lies between 1°30′ and 5°00′ North (see the inset to Figure 1). Although many ethnic groups in eastern Africa raise domesticated herd animals, most groups are mixed

agro-pastoralists living in settled hamlets, neighborhoods, or villages. The Turkana, together with certain Somali, Afar, and Gabra communities,23 are one of the few pastoral groups currently pursuing a primarily nomadic life in eastern Africa.24 They live in one of the driest districts of Kenya, raising five species of livestock (i.e., camels, cattle, sheep, goats, and donkeys). Rainfall in the district from 1998 to 2009, our study focus, only averaged 372 mm a year. The general pattern of rainfall is bimodal with a relatively longer rainy season starting sometime in March through May, and a shorter and somewhat less rainy season in October and November. Higher elevation areas receive relatively more rains than lower areas. As a consequence, there are two rainfall gradients across the district: a strong south-to-north gradient and a weak west-to-east gradient;25 the south and west are generally wetter.

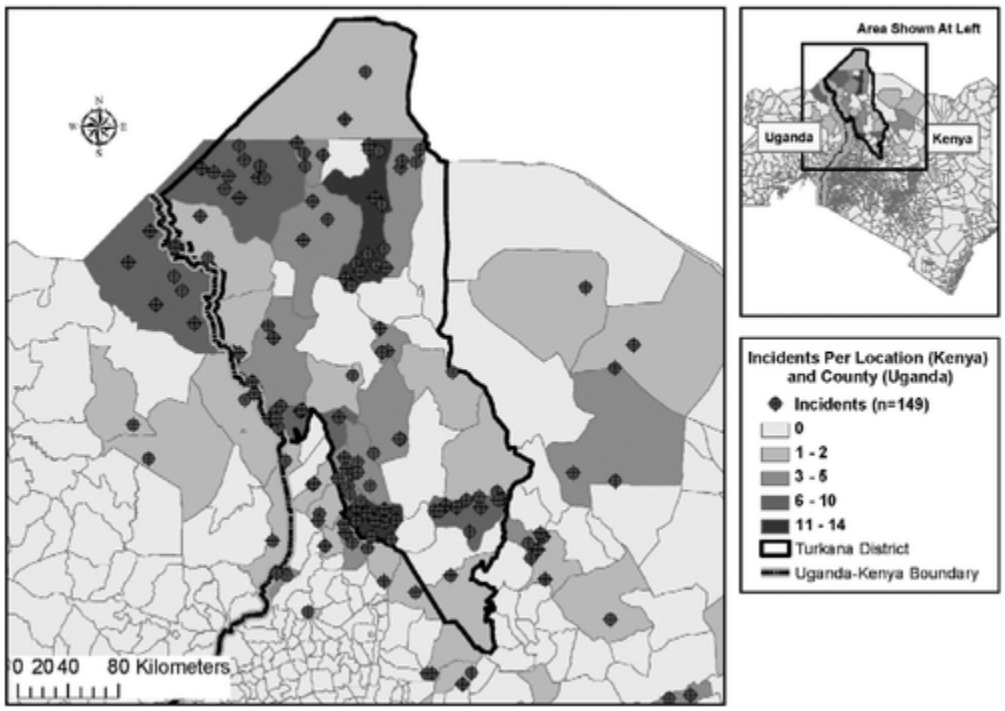


Figure 1 Turkana Livestock-Related Violence, 1998–2009

The spatial and seasonal variation in rainfall gives rise to uneven pasture and water availability over space and time. To an extent, as some ecologists noted, a key aspect of Turkana nomadic pastoralism involves opportunistic movements over a fairly wide space pursuing pasture and water.26 But ethnographic accounts show that this opportunistic movement takes place within broader patterns of established social relations and effective land use strategies.27 The broad strategy involves seasonally moving from areas of low productivity in the wet season to more productive rangelands during the dry season. For Turkana, the wet season pastures consist of large expanses of low-lying plains located at the center of the district. Their annual nomadic movement typically begins from this location where relative abundance of fresh grass during rainy months allows for larger camps and the corralling of all the animals of related herd owners. Over the ensuing nine or so drier months, the herd is taken to high elevation areas, typically

either to the southwest or northeast, with the highest plant biomasses. With the onset of the expected long rains beginning in March, the herd will once again return to the main camp on the plains.

But what about drought years? In times of severe droughts, ethnographers report that the herd will be taken further away from regular dry season rangelands to satellite camps on rarely used isolated plateaus and remote valleys. These drought refuge areas are often located along borders and historically contested areas, thus causing fundamental livelihood dilemmas for herd owners. As McCabe noted in his chronicles of four Turkana herders over a 16-year period in 1980–96, access to these valuable sites greatly enhanced the odds of herd survival. Yet this move also increased the vulnerability of herders and their families to raiding and violence. As a consequence, the changing fortunes of the four herders and their families greatly depended on how each of them ensured his herd survival by accessing these sites while managing security risks. Herders using more daring moves toward rarely used drought reserves minimized their herd loss due to drought but encountered frequent attacks by well-armed Pokot raiders. By contrast, those who stayed within boundaries of dry season rangelands faced fewer raids but lost part of their herd due to drought and/or stress-related livestock diseases.28

The occurrence of livestock raids and counter-raids with neighboring groups, notably the Pokot, is not a new phenomenon in southern Turkana. It has a long history extending back to the 1880s,29 and it is discussed in major works on both Turkana and Pokot.30 But, with the adoption of automatic Kalashnikovs (AK-47s) beginning in the mid-1970s, studies show that the frequency and intensity of raids have grown considerably to become ‘the single greatest risk to the persistence of nomadic pastoralism and the continued survival of pastoralists themselves’.31 The availability of these weapons is believed to have transformed livestock raids from small-scale opportunistic attacks, often with spears and/or outdated rifles, to highly organized assaults with devastating casualties often undertaken by what now can be considered professional rustlers.

In the late 1970s, the government of Kenya disarmed the southern Turkana, shifting the balance of power in the region in favor of the well-armed Pokot.32 Over the ensuing several years, the Turkana suffered massive casualties from Pokot raids. Between 1992 and 1999 alone, for example, the Pokot reportedly carried out 14 large-scale ‘AK-47 raids’ in critical dry-season grazing areas in South Turkana.33 Estimates of human casualties included over 10,000 Turkana deaths from raids undertaken in the years 1991–94 alone.34 The raids had also reportedly decimated Turkana herds. The four herding families chronicled by the South Turkana Ecosystem Project research had, for example, lost 15 per cent of their total livestock in the second year of the drought in 1979–81, and another 35 per cent of the remaining total during the first year of their subsequent recovery.35

One of the Turkana responses to minimizing risks of raids has been to reduce their degree of vulnerability to potential raiders by shortening the time of stay in one place. This entails

increasing the frequency of moves. In McCabe's report for the 1980s, for example, the herders moved their main camp on average 15 times per year, and the percentage of moves attributes to fear of attacks by Pokot and other raiders accounted for over 20 percent of their total moves. By 1998, however, the threat had become very serious to such a degree that the average number of camp moves per year by herders interviewed by Pike was 24, and all of them were in response to fear of raids.36

A second response to increasing risk of raids was the emergence of a defensive social organization called Arum-Rum. According to McCabe, this new organization consisted of about 50 or more families, which previously migrated in small independent groups, living together within three concentric rings of fences under the leadership of a single leader.37 In this system, which was apparently adopted from the Karimonjong,38 livestock stayed in the tightly secured inner fence, while the people lived in the second. Armed men guarded both people and livestock from positions on the third fence.

While this fear-induced clustering of many people and livestock in one place may have provided the Turkana with a temporary sense of security, it created a dilemma regarding decision-making. The group had to move more frequently than individual households as localized resources were exhausted quickly due to the high concentration of livestock. Yet, the arrangement required all herding units to coordinate their moves if they wanted to remain within the group.

The ethnographic reports of Turkana researchers suggest that livestock-related violence would be expected to be higher in drier times (both drought years and drier months) because that is when the Turkana have to move further from their wet-season camps and closer to other ethnic groups. However, this is not what the data from Witsenburg and Adano suggest. Their data from Marsabit suggest that most livestock-related violence occurs in wet months and wetter years.39

Our purpose is to systematically test the Witsenburg and Adano hypotheses – and the alternatives from the ethnographic literature on the Turkana – with data relevant to Turkana District. In other words, we test the hypotheses that: (1) monthly rainfall variability will be related to livestock-raid violence; and (2) yearly rainfall variability will be related to livestock-raid violence. As discussed above, we also tested an additional hypothesis dealing with unpredictability – namely, that livestock-related violence will be greater if a particular month/year combination departs considerably from an average month. Because different directions have been suggested, we use two-tailed tests in our analyses.

## Methods

### Livestock-Related Violence

Our reports of violence come from media and news reports about Turkana that appeared in the LexisNexis online database (accessed from the summer of 2009 through November 2010) reporting on news from 1998 to 2009.40 Research assistants looked at all articles in LexisNexis

for media and news reports containing the variant names Turkana or Turcana (the actual search was Tur*ana) for each year beginning with 1998 and ending in 2009. Approximately 500 articles were found per year.41 Each article was read to assess whether it referred to Turkana people (sometimes Lake Turkana was referred to) and whether it reported any violence, raids, or attempted violence. The assistants were allowed to disregard any article that was clearly not referring to Turkana people or was very far away from Turkana District (for example, the article referred to a Turkana person or a group in Nairobi). However, they were instructed to download the article if they thought it was relevant or were unsure of the relevance. A database was designed to have a record for each violent incident, rather than by article, because sometimes more than one incident were reported in an article. For example, an article could report on several attacks over a few days in different villages, or an attack followed by a counterattack a day or two later. Note that immediate or short-term defense tactics such as gathering some help to try to retrieve stolen animals within hours of an initial attack was not counted as a separate incident, but counter-attacks a day later were included. We focus explicitly on livestock-related violence here, as Witsenburg and Adano did.42 In our research, all of the following needed to be present to count as livestock-related violence involving Turkana: (1) raids were socially organized at least on one side; (2) the violence involved Turkana as attackers or attacked in or bordering Turkana District; and (3) the incident involved attempts or actual theft of livestock, involved disputes over access to water or pasture for livestock, or were stated to be retributions for previous livestock raids. All livestock-related incidents were tagged as such in the database. Other information recorded from the news reports included the news source and byline, headline, author, date and place of conflict, ethnicity of attacking party and of attacked party, number of people reported killed in the incident, number of people reported wounded, reported atrocities, property destroyed or stolen, number and type of livestock taken, weapons used, and purported reasons for conflict.

Because the LexisNexis database includes hundreds of news sources, duplicate accounts of incidents were commonplace and had to be culled from our database. The assistants made the first round of decisions regarding what were duplicate reports of the same incidents on the basis of the identities of parties involved in the incident and the place and date of the incident. However, reports might vary in the information given about a particular incident; some reports might only identify one party, or be less specific of the location of the incident, identifying a district rather than a county, or town. Also information on the number of casualties and livestock stolen might vary. Initial reports might not be as complete as later accounts that verified total deaths and stolen livestock. Wounded might turn into deaths. Assistants made preliminary indications about possible duplicates and suggested which article to use. The authors reviewed cases where it was unclear whether there were duplicates, and cases in which it was not easy to decide which article to use. Articles with more information and more detailed information were typically used, although in some cases more than one article were used because each provided different information (e.g., one might have number of deaths, other might have specific number of livestock stolen). If there were multiple figures on casualties, we usually averaged them,

except when one figure appeared to be a serious outlier. Figure 1 shows the locations of the 149 incidents of livestock-related violence involving Turkana that form the basis of our study. The administrative units (locations in Kenya; counties in Uganda) with more incidents have darker shading.

Our primary measure of livestock-related violence is the number of reported human deaths during livestock-related raids. The number of casualties was the most widely reported statistic in the news media next to incident reports. We focus on reported deaths rather than the number of incidents for three reasons. First, media and news reports only reported violence involving more than one ethnic group, suggesting a bias in reporting toward inter-ethnic conflict and away from intra-ethnic conflict. We know from ethnographic reports that the Turkana engage in some intra-ethnic livestock raiding. Since no intra-ethnic raids were reported during the 12-year period, we are concerned that a lack of an incident in a particular month and year does not necessarily mean that no livestock raid occurred during that time frame. Second, we suspect that the media will pick up the more spectacular incidents and underreport the minor incidents.43 Third, Witsenburg and Adano did not find any results with the number of incidents reported, so we did not think that such a line of analysis would be productive.

For the reasons stated above, in all the analyses involving number of deaths in livestock-related violence, we only consider mortality numbers for reported incidents. In other words, we did not consider a month with no reported incidents a ‘zero’ on casualties; rather we counted it as missing information. A ‘zero’ only occurs if an incident was reported, but there were no reported deaths. This approach has the effect analytically of focusing on degree of violence rather than incidence of violence, which is in line with our usage of number of deaths.

Because our rainfall data were only available by the month, we aggregated the number of reported deaths during livestock-related raids involving Turkana (as attackers or as attacked) for each month as well. Further sums or averages were computed to match rainfall analyses (e.g., sum of deaths per year, average deaths for January, and average monthly deaths per dry month) – see below. We used a secondary measure of livestock-raid violence – the average number of deaths per raid by particular month and by particular years.

Examples of Raids

To illustrate the type of raids we are talking about, we give two examples. The first is one of the largest in terms of the number of animals stolen (although this number could be exaggerated), and had above average casualties (11 is the average number of casualties per raid). The second is smaller in scale with a below-average number of casualties.

1. In April 2008, hundreds of Turkana and Samburu raiders stole approximately 20,000 animals from two locations in the Chalbi desert region of Marsabit District. About 1,500 animals were recovered relatively immediately when a posse of locals and police caught up with the raiders and continued with intense fighting. In the attack by the Turkana and Samburu, 14 people died,

including a child and a police reservist. The attack supposedly occurred in retaliation to two prior raids by local herders on Turkana and/or Samburu.44

2. In January 2002, more than 150 raiders from West Pokot took over 500 animals from the Turkana in a border area where the Kenyan Army had been keeping the peace but recently had withdrawn. Four people, including one raider, died in the attack. Security personnel pursued the raiders but were not able to recover any animals because the terrain was rugged and hilly.45

Measures of Rainfall

We chose the starting date of 1998 because that was the first date we could get precise measures of rainfall constructed from meteorological data on 0.25 square degree (approximately 30 square kilometers) quadrants by month and year for the entire Turkana District. Our data were collected from 2010 to 2011, so our end date was 2009, a 12-year period from 1998 to 2009. These rainfall data were obtained from the Tropical Rainfall Measuring Mission (TRMM) 3B43.46 Our collaborators from a larger project on agent-based modeling of violence in eastern Africa from George Mason University used ArcGIS to convert the hierarchical data format, which is not directly importable by ArcGIS, into ASCII files. MATLAB was used to create a multidimensional array from which the data on a rough rectangle around Turkana District were abstracted and put into Excel files. After overlaying an administrative map of Turkana District on top of the rectangular parcel grid, we excluded all parcels outside Turkana District for the purposes of computing rainfall. There were a total of 108 quadrants. The advantage of this weather dataset is that it does not need to take one or a few weather stations as proxies for the whole district.47 Rather, the rainfall data per month and year are aggregated from all the parcels that comprise the administrative Turkana District into a specific monthly or yearly average for the whole district. We would have liked to have rainfall information for the specific area where raiders came from. However, newspaper reports usually do not state the location of the raiders' homeland except in the most general terms (i.e., ethnicity) – they usually state the location of those raided. We use the aggregated rainfall for Turkana District as if people in that general region are generally experiencing divergence in rainfall in the same direction and degree from normal. Yearly rainfall for Turkana District (e.g., 1998 and 1999) was an average of yearly rainfall for all of the 108 quadrants. Averages were computed for each month (January, February, etc.) across the 12 years and the 108 quadrants.

We also evaluate the unpredictability of each particular month's rainfall (e.g., January 1998) by calculating a z-score for that month/year based on the average for that month across the years (e.g., January) and the standard deviation for that month across years. As before, the particular month/year rainfall amounts are averages across all the quadrants. We take the average rainfall for the month/year combination (e.g., January 1998) and subtract the overall average for that month (e.g., January) across the 12 years and divide it by the standard deviation of monthly rainfall for that month. If the particular month/year is close to normal for the month, it is

assumed to be predictable; if it is far from normal, it is unpredictable. However, it can be unpredictable in one of two directions – drier than normal for the month or wetter than normal.

Results

Monthly Rainfall

Figure 2 shows the average rainfall in Turkanaland by month computed from 1998 to 2009. As is apparent from the graph, there is a bimodal rainfall pattern with the highest rainfall in April and May (locally called the 'long rains') and the next highest peak is in October and November (the 'short rains'). On the basis of ethnographic report, the long rains in some areas begin sometime in March with an early part of the month being very dry and the later part of the month very wet.48

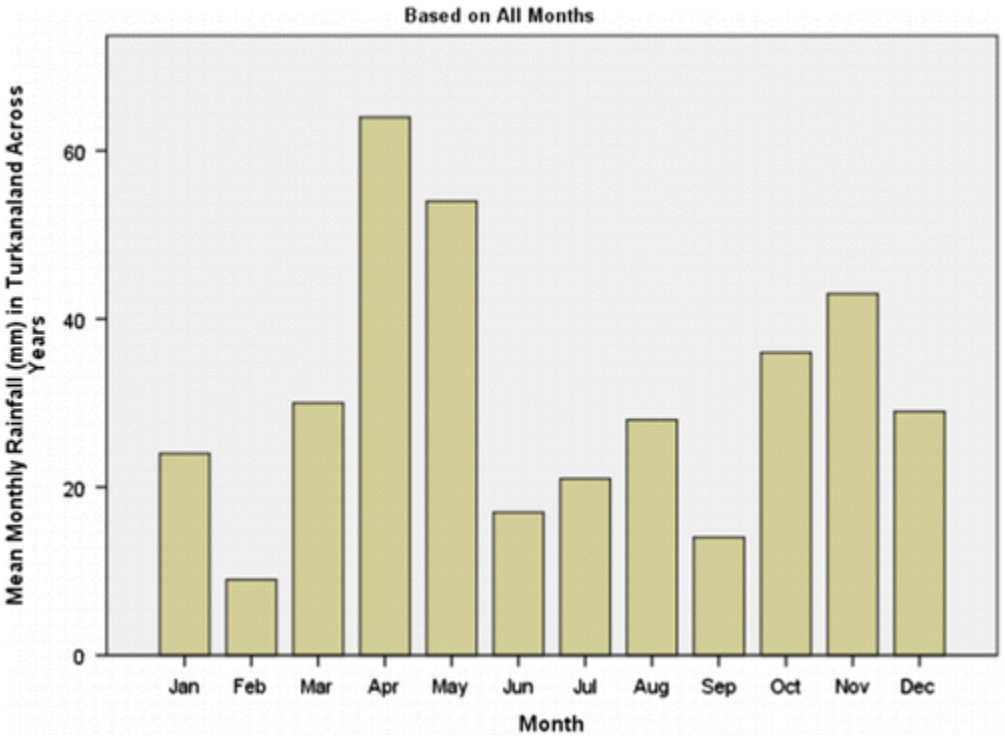


Figure 2 Average Rainfall in Turkanaland by Months (1998–2009).

Figure 3 shows the average number of deaths in livestock-related deaths per month. Just eyeballing the graph shows that three of the four rainiest months (May, October, and November) have the lowest mean number of livestock-related deaths. February, the driest month, has the highest number of deaths per month. If we look at livestock raid intensity judging by the average number of deaths per raid, Figure 4 shows a similar pattern.

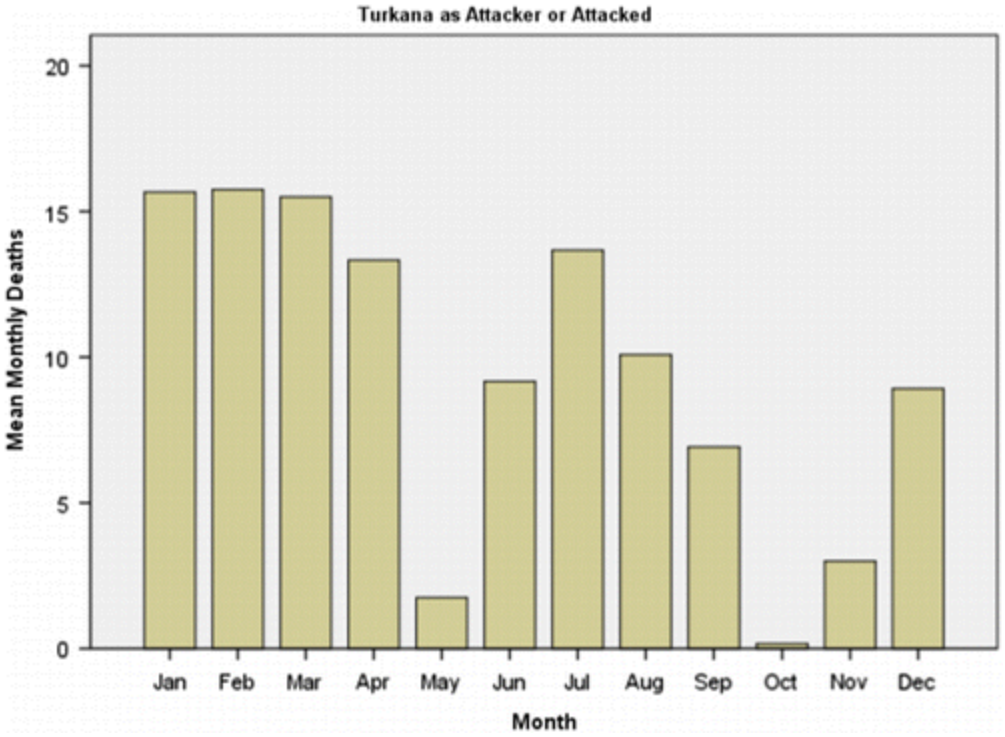


Figure 3 Average Monthly Deaths in Turkanaland due to Livestock Raids (1998–2009).

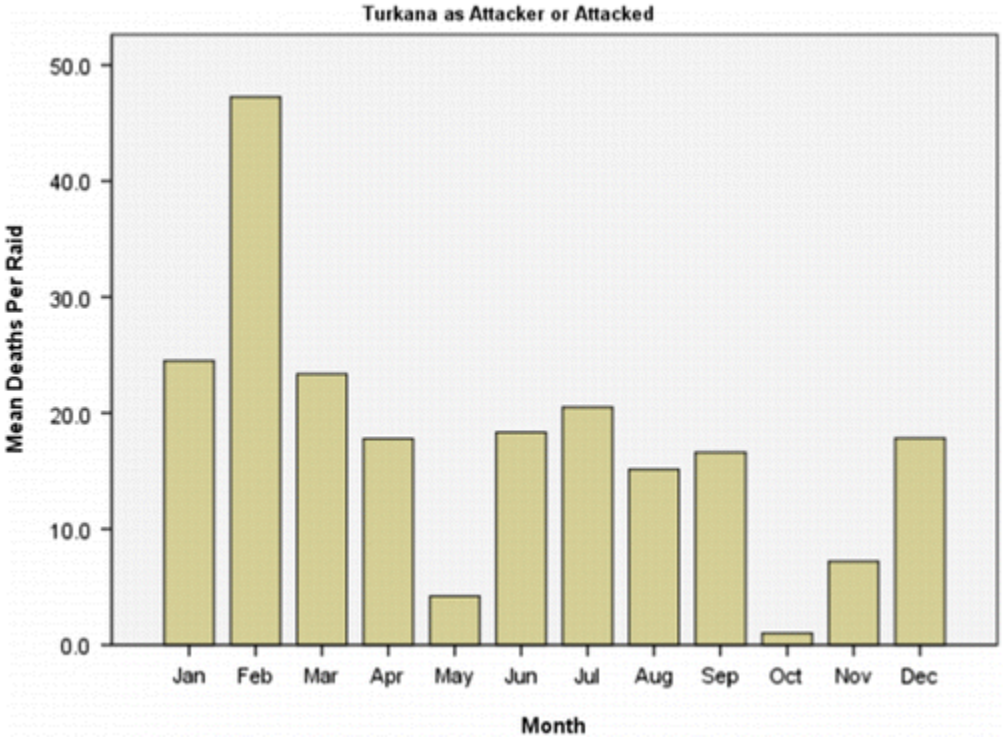


Figure 4 Average Deaths Per Raid (Livestock-Related) by Month (1998–2009).

Witsenburg and Adano had suggested that some restocking was done just before the heaviest rains.49 Accordingly we grouped months by the following types: dry months, months before the rains (March and September), short rains (October and November), and the long rains (April and May). Figure 5 shows that the rainy seasons have the lowest average number of monthly deaths in livestock raids. The month before the rains is almost as high as the dry months on average, so there might be some merit to Witsenburg and Adano's suggestion of restocking during that time. Unfortunately, we do not know when the rains start in March, so it is difficult to evaluate whether raiding is largely taking place during the dry or wet part of March. If we divide March into three parts, the number of deaths in livestock raids is somewhat bimodal. There are 83 total deaths in the beginning of March across the 12 years, which is probably dry, 71 in the last third of March, which is probably wet, and 33 deaths in the middle. This may give some support to the restocking thesis.

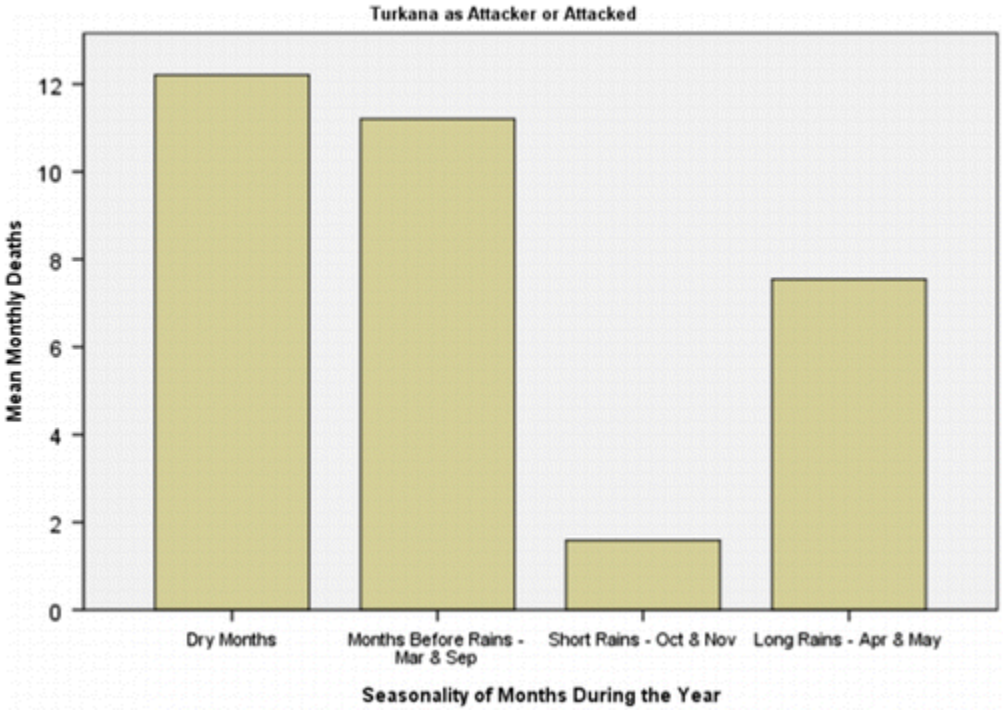


Figure 5 Association of Average Monthly Deaths (Livestock-Related) with Seasonality of Rainfall (1998–2009).

Rather than looking at the months ordered by yearly calendar, Figure 6 shows the months ordered by their category of standard deviation away from average monthly rainfall. In general, the months with below normal rainfall have the highest number of mean monthly deaths.

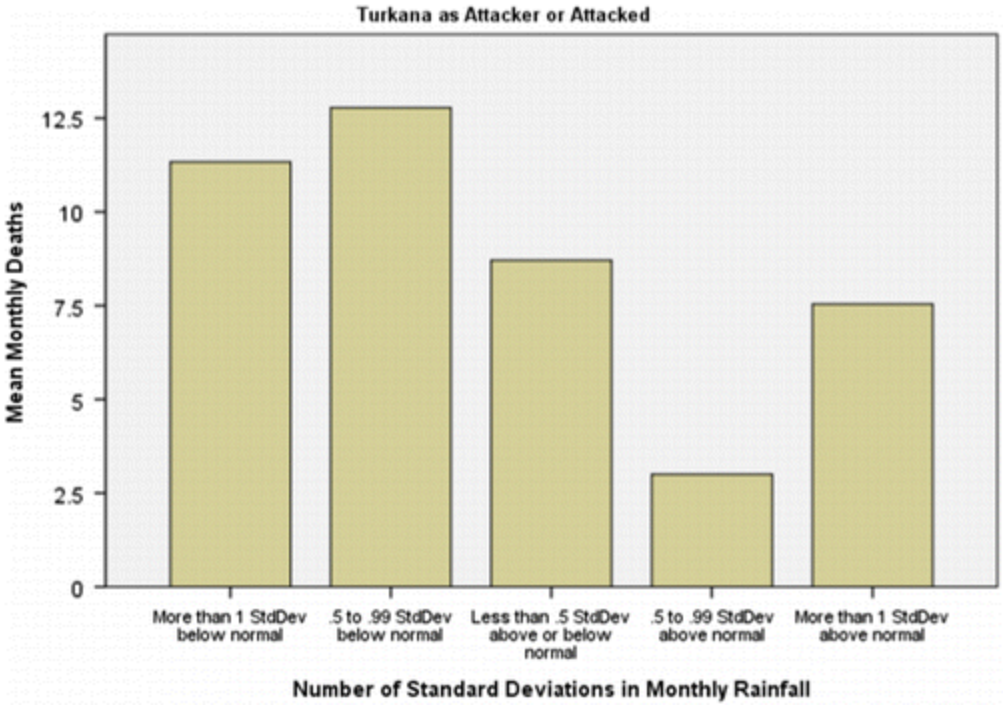


Figure 6 Association of Average Monthly Deaths (Livestock-Related) with Standard Deviation in Monthly Rainfall (1998–2009).

Are these trends statistically significant? For each month, we computed the average rainfall across the 12 years and correlated it with the average number of livestock-related deaths for that month. The correlation is moderately strong ($r = -.58$), and significant ($n = 12$; $p < 0.047$, two tails). Note that the direction of the relationship is opposite to the direction found by Witsenburg and Adano.50 The less the rain per month, the higher the deaths in livestock-related violence.

Yearly Rainfall

Are wetter years more likely to have more livestock-related deaths in Turkana District as Witsenburg and Adano suggested for Marsabit District? The short answer is no.

Figure 7 shows the total rainfall in Turkanaland by year from 1998 to 2009. The average yearly rainfall is only 372 mm. However, the year 2000 was extraordinarily dry with only 167 mm of rainfall. As can be seen in Figure 8, the year 2000 was also by far the highest year of livestock raid casualties with 367 reported. Of the next three years with relatively dry weather (2009, 1999, and 2008), two (2008 and 1999) had the second- and third-most casualties (164 and 136, respectively). The year 2009, the second driest year, looks anomalous with relatively low casualties, which we cannot explain. The year 2006 also looks somewhat anomalous with high livestock violence in spite of being the wettest year during the time frame. However, much of the violence in 2006 may have to do with events leading to the 2007 election. This election not only resulted in widespread ethnic conflict, but also involved redrawing of district boundaries in both Turkana and Baringo (later called East and West Pokot).

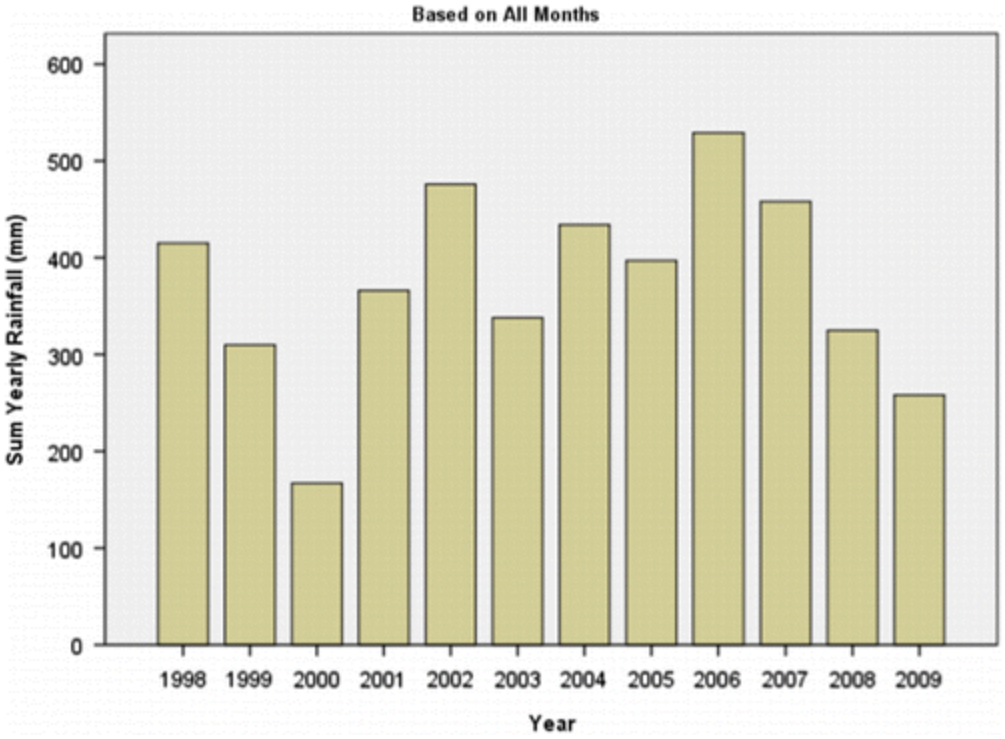


Figure 7 Total Rainfall in Turkanaland by Year (1998–2009).

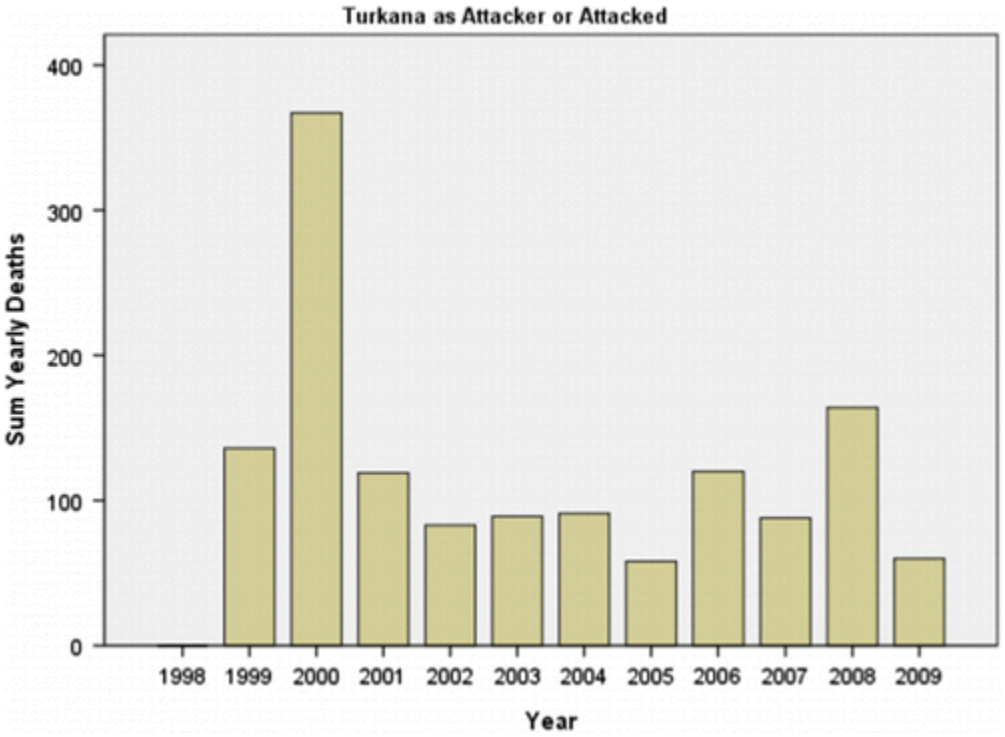


Figure 8 Total Yearly Deaths in Turkanaland Due to Livestock Raids (1998–2009).

The correlation between total rainfall per year and the number of livestock-related deaths is moderately strong and significant ($n = 12$; $r = -.61$, $p < 0.035$, two tails). The graph in Figure 9 shows the average number of yearly deaths by years ordered by number of standard deviations from a normal year. The relationship is not quite linear, but the two highest categories – where the yearly rainfall is more than 0.5 standard deviations below average – have the highest mean number of deaths. Once rainfall is normal, the curve flattens out.

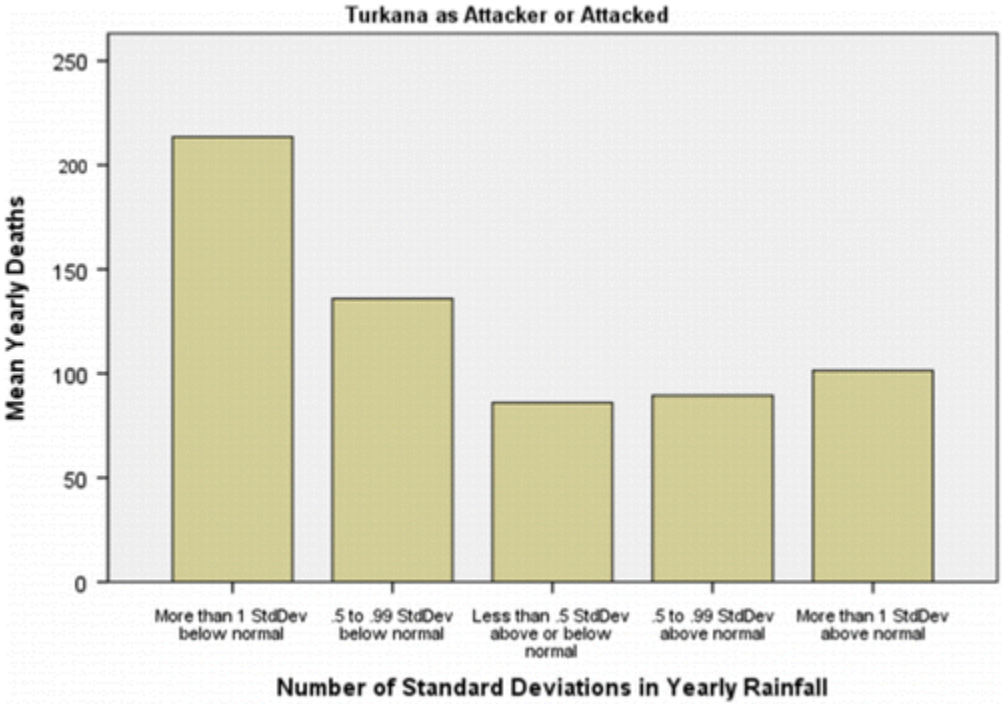


Figure 9 Association of Average Yearly Deaths (Livestock-Related) with Standard Deviation in Yearly Rainfall (1998–2009).

If we look at just raids where the Turkana are the attackers (Figure 10), the year 2009 does not look anomalous. It is the second driest year and has the third highest peak in casualties. The driest year, 2000, still has the highest peak in casualties. The fourth driest year, 2008, has the second highest number of casualties. Now 1999, the third driest year, with low casualties, looks anomalous. The year 2007 with above-average rainfall also looks anomalous with the fourth highest number of casualties. As discussed above, this might be related to the election crisis of 2007.

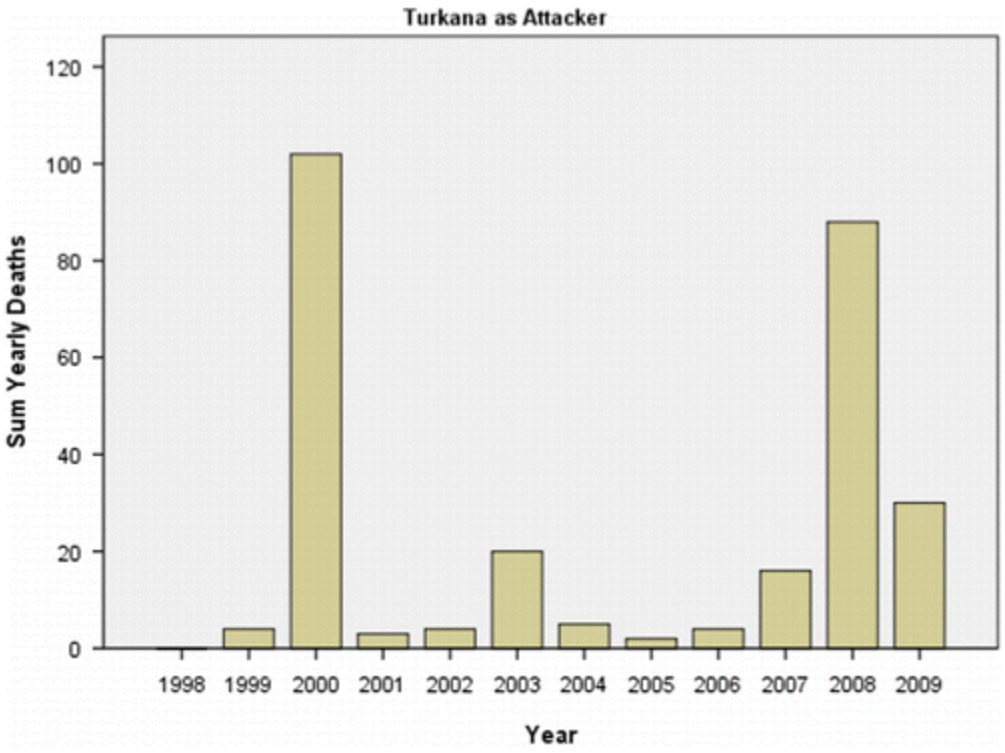


Figure 10 Total Yearly Deaths in Turkanaland Due to Livestock Raids (1998–2009).

Month and Year Combined

Pastoralists know the weather well, so a dry month or season is to be expected. But what if a month is much drier than expected or is much wetter than expected? Does this kind of unpredictability predict the degree of livestock-related violence?

Figure 11 shows the grouping of particular month/years combinations into number of standard deviations away from a normal month (e.g., January 2000 compared to all Januaries). When we compute the number of deaths in livestock-related violence for particular month/year combinations, we only use 74 month/year combinations with at least one reported livestock-related incident.51 Although the relationship is not linear, deaths seem the highest where a particular month in a particular year is 0.5–0.99 standard deviations drier than a normal month; the next highest category is when the month is one or more standard deviations below normal. If we group the first two categories into more than 0.5 standard deviations below normal versus the other three, the correlation with number of deaths per month is $-.31$ ($n = 74$, $p < 0.007$, two tails). The pattern looks more linear if we just look at raids where the Turkana are attackers (see Figure 12). Using the five standard deviation categories for each month/year and the number of livestock-related deaths, the size of the sample is only 31 and the correlation ($r = -.26$, $p < 0.07$, two tails) is marginally significant. Contrast the situation looking just at raids where the Turkana are attacked by others. Figure 13 looks slightly bimodal, with the least deadly livestock-raid

violence when rainfall is approximately average.52 These last two graphs (Figures 12 and 13) suggest that the Turkana and their attackers are following somewhat different strategies.

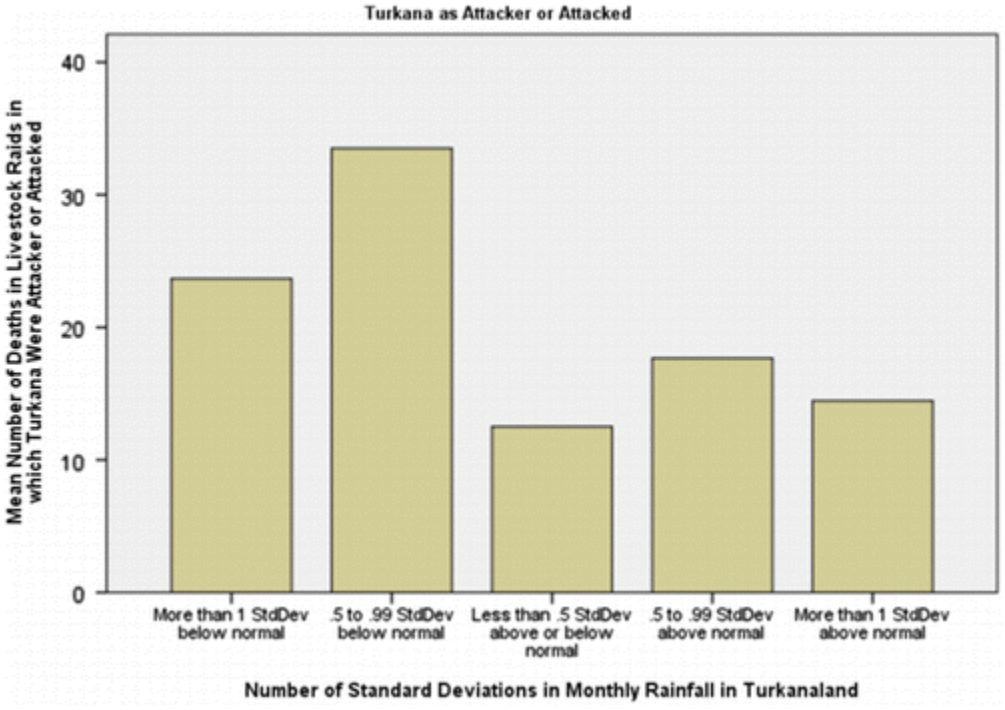


Figure 11 Looking at Deaths in Livestock Raids and Deviation of Each Month from Normal Across Years (1998–2009).

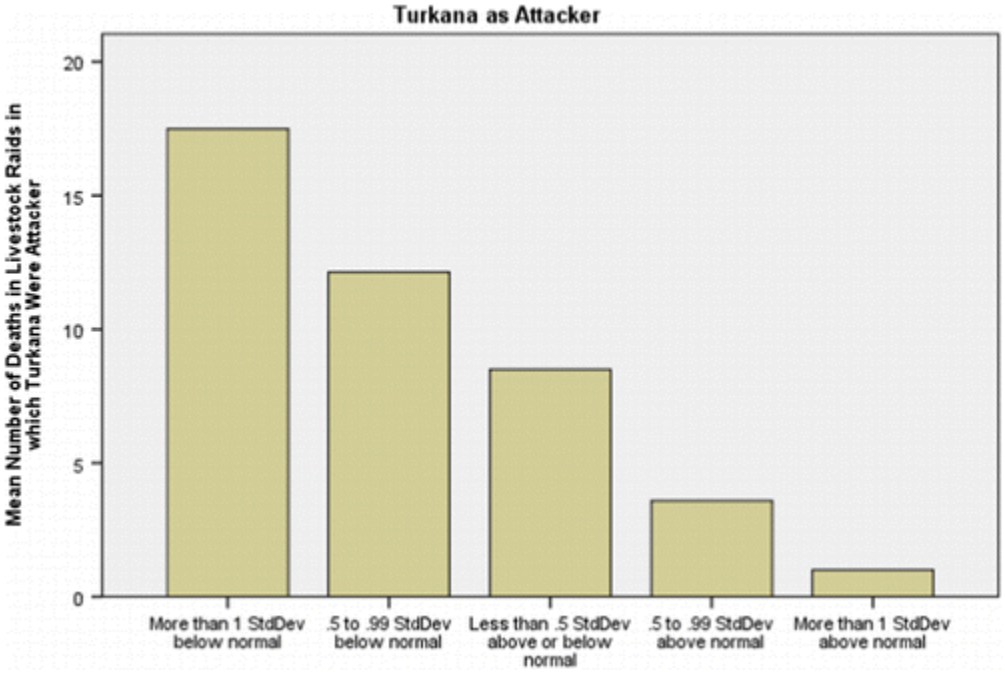

Figure 12 Looking at Deaths in Livestock Raids and Deviation of Each Month From Normal Across Years (1998–2009).

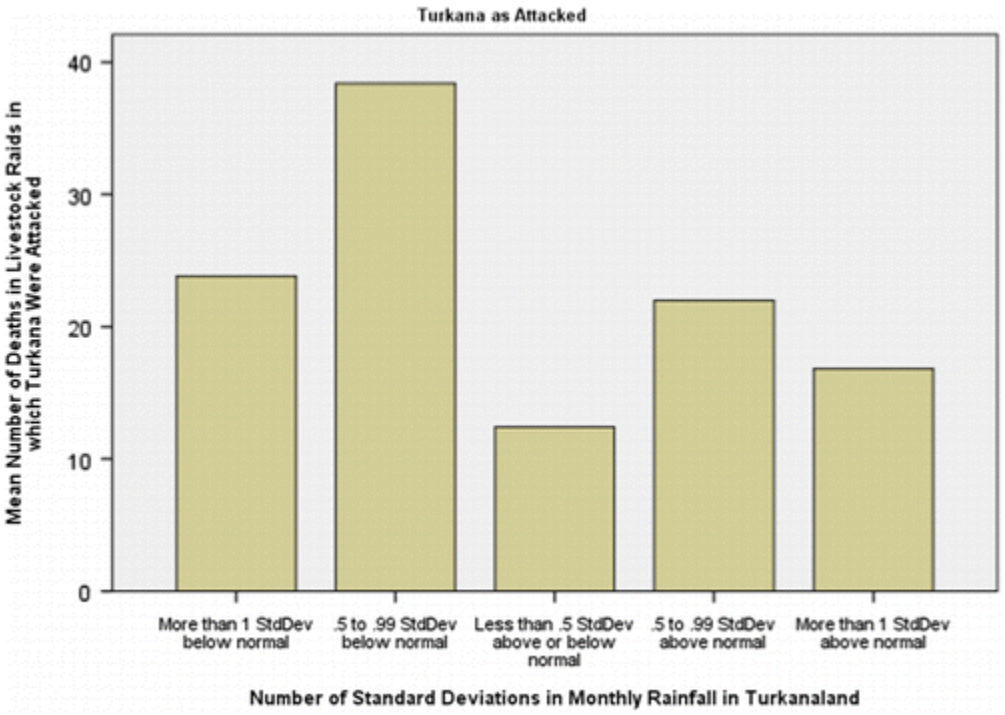


Figure 13 Looking At Deaths in Livestock Raids and Deviation of Each Month From Normal Across Years (1998–2009)

Discussion

Across all the analyses of rainfall and livestock-related violence, the results for Turkana District show a clear and consistent pattern – the most intense livestock violence occurs when rain is less than normal for a typical month, a typical year, and a particular month/year combination. These patterns are opposite to those suggested by Witsenburg and Adano for Marsabit.53 But these data are consistent with what we know from the ethnography of the Turkana. The Turkana are Nilotic people who adapted to the harshest environment of the central Rift Valley, using mobility strategies to cope with dry conditions. Central Turkana country is very dry, but it is suitable for pasturing more animals and more people during the wet season. As described above, when the pasture is disappearing, the Turkana head for wetter areas. If necessary, the herds are divided by type of livestock with different groups of men going with different types of animals. In the driest months, the Turkana are furthest from base camps. But in drought years, they must go even further away to wetter areas close to the territory of other ethnic groups. These lands are more desirable as drought reserves, but they are also more dangerous. The herding groups are also small, making the group more vulnerable to attack. The ethnographic description of mobility patterns may help explain why there is more violence from attacks during dry months, drought years, and when month/year combinations are drier than normal. But it is only part of the picture

because the Turkana are not just attacked. They are also attackers, and the attacks by Turkana on other groups fit the patterns we have found even more strongly. For example, a comparison of Figures 12 and 13 suggests that Turkana attacking violence during livestock-related attacks are linearly related to drier than normal conditions, but the pattern is less linear when the Turkana are attacked (as we suggested above, others may be following somewhat different strategies). Why should the Turkana attack in drier conditions? Here our reasoning is speculative since we do not have interviews with Turkana individuals, but if pasture and water are scarce and access cannot be arranged peacefully during dry times, there may be little choice but to aggressively fight for access even if the attacking groups are small. In addition, livestock theft may make up for the loss of livestock lost in drought conditions or livestock theft of animals grazing in wetter conditions cushions against future losses. Thus, we suggest that a combination of mobility strategies (moving to riskier places during dry times inviting more attack) and scarcity (attacking to gain access to pasture and making up for animals losses) may account for the Turkana patterns.

In addition, we have raised the question whether unpredictability of rainfall is related to more livestock violence. We use extreme yearly rainfall variability as a kind of unpredictability. Droughts and floods are not predictable and may seriously destroy food supplies. We have also looked at the degree to which a particular month/year departs from what a normal month should be. With regard to data from Turkana District from 1998 to 2009, drought years do have more livestock-related violence, as do months that are much drier than expected. But for the Turkana, unpredictability seems only important in one direction – drier than normal, but not wetter than normal, is related to more violence. Why? We have to remember that the Turkana area is generally very dry, so drier than expected can produce severe scarcity. While some flooding has occurred, wetter than normal is probably much less of a problem than drought. But while results regarding unpredictability are supported, we have to wonder whether it is unpredictability that is important for Turkana District or simply drier than normal conditions. For in all tests of the hypotheses, both predictable and unpredictable dryness predict more violence.

Do these rainfall patterns fit other groups? We intend to explore this question by examining data from other districts, starting with the two Pokot-inhabited districts of Kenya. Our preliminary analyses looking just at the attackers of the Turkana (mostly Pokot, but not differentiated here) suggest that the attackers are largely following the Turkana pattern of attacking more in dry months and dry years, but there are suggestions that the pattern is probably not as strong for those attacking the Turkana as for the Turkana as attackers. The more critical question, which remains to be investigated moving forward is why results for Turkana differ so much from Marsabit District. It is possible that some methodological differences between our study and the Witsenburg and Adano study could account for some of the differences. First, we have looked at a later time frame; their study, which covers the years 1913–99 (with 28 analyzable years) only overlaps with our first two years (1998–99). Conceivably rainfall has become more erratic and we are seeing a different pattern in the later time frame. Second, although we cannot imagine

how it would affect results, the Marsabit study used rainfall from only one place as a proxy for rainfall in the entire district, whereas our data come from the entire Turkana district. Third, the Marsabit study did not disaggregate ethnic groups; it is possible that different ethnic groups have different patterns. On more theoretical grounds, we have two theories we intend to try to test. The first relates to the difference in subsistence in the two districts. While it is true that ethnic groups in both areas rely on herding animals, most of the Marsabit ethnic groups (except for the Gabra) are more dependent on agriculture than the Turkana. While rainy seasons usually provide more pasture for animals and therefore have more resource abundance in pasture, the rainy season may be scarce in food supply as crops are just being planted and stored food may have run out. Thus, 'rain' does not necessarily mean generally abundant resources for mixed agro-pastoralists. The second theory is that mobility strategies are the underlying issue, not rainfall. The Turkana traditionally break into smaller groups and move herds farther to different pasture area in drier times. As we discussed earlier, these other pastures are in riskier places closer to other ethnic groups. In contrast, some of the Marsabit groups depend on cooperating with other ethnic groups in dry times. For example, the Gabra have no rivers, and to survive during dry times provide labor for the Borana in exchange for access to their deep wells.54 The need for cooperation may mitigate against fighting in those times. If this latter idea is correct, we would not expect a simple relationship between rainfall and violence, but rather an interaction that varies with mobility strategy.

## Acknowledgements

This research was supported by the Office of Naval Research ONR under MURI grant no. N00014-08-1-0921 to George Mason University with a sub-award to the Human Relations Area Files (PI: Claudio Cioffi-Revilla; co-PIs: Carol R. Ember, Sean Luke, and Kenneth De Jong). The opinions, findings, and results are those of the investigators and do not reflect the views of the sponsors. We thank Sophie Skoggard and Brittany Burke for their work collecting and summarizing violent episodes from LexisNexis for 1998–2009, Kate Cummings for entering the preliminary data into a database, Brittany Burke and A.J. Faas for their work locating place names of incidents and additional database entry, Atesmachew Hailegiorgis and Chenna Cotla Redda for performing the necessary steps to make the weather data available to us, and A.J. Faas for identifying the rainfall parcels matching Turkana district and preparing Figure 1. We also thank two anonymous reviewers of Civil Wars for their suggestions and valuable comments.

## Notes

1. The primary reason for using this time period is the availability of precise rainfall data for 30 square kilometer parcels across the entire Turkana region; see the 'Methods' section for further explanation.

2. Karen M. Witsenburg and Wario R. Adano, 'Of Rain and Raids: Violent Livestock Raiding in Northern Kenya', Civil Wars 11 (2009) pp.514–38; see also W. Roba Adano and Karen Witsenburg, Surviving Pastoral Decline: Pastoral Sedentarisation, Natural Resource Management and Livelihood Diversification in Marsabit District, Northern Kenya, PhD Thesis, University of Amsterdam (2004).

3. Michael A. Little, Rada Dyson-Hudson and J.T. McCabe, 'Ecology of South Turkana' in M. Little and P. Leslie (eds) Turkana Herders of the Dry Savanna: Ecology and Biobehavioral Response of Nomads to an Uncertain Environment (Oxford: Oxford UP 1999) p.53.

4. For ecological factors that may cause land use conflicts in Turkana, see, for example, Gufu Oba, 'Ecological Factors in Land Use Conflicts, Land Administration and Food Insecurity in Turkana, Kenya' Pastoral Development Network Papers, No. 33a (London: ODI 1992). Broader discussions of environmental problems and violent conflict can be found in Thomas Homer-Dixon, Environment, Scarcity and Violence (Princeton, NJ: Princeton UP 1999); Günther Baechler and Kurt R. Spillmann, Environmental Degradation as a Cause of War: Ecological Conflicts in the Third World and Ways for their Resolution, ENCOP Study Vol. I (Zürich: Rüegger 1996); Günther Baechler and Kurt R. Spillmann (eds), Environmental Degradation as a Cause of War: Regional and Country Studies of Research Fellows, ENCOP Study Vol. II (Zürich: Rüegger 1996); Günther Baechler and Kurt R. Spillmann (eds), Environmental Degradation as a Cause of War: Country Studies of External Experts, ENCOP Study Vol. III (Zürich: Rüegger 1996). For a critique, see Nils Petter Gleditsch, 'Armed Conflict and the Environment: A Critique of the Literature', Journal of Peace Research 35 (1997) pp.381–400 and Detlef F. Sprinz, 'Modeling Environmental Conflict' online at < www.uni-potsdam.de/u/sprinz/doc/model.pdf>, accessed 9 Dec. 2011. See also theories about population pressure in Andrew P. Vayda, 'Hypotheses about Functions of War' in M. Fried, M. Harris, and R. Murphy (eds) The Anthropology of Armed Confict and Aggression (Garden City, NY: Natural History Press 1967) pp.85–91; Andrew P. Vayda, War in Ecological Perspective (New York: Plenum, 1976); Roy A. Rappoport, Pigs for the Ancestors (New Haven, CT: Yale UP 1967).

5. For example, UN OCHA/Kenya, 'Kenya: Tracking of Killings and Displacement in Pastoral Areas: Annual Reviews' (2010), online at < http://ochaonline.un.org/kenya/Resources/Archive>, accessed 12 Apr. 2011 and Jennifer Smith, 'The Rough Guide to Climate Change and Conflict', A Catholic Aid agency for England and Wales (CAFOD) policy paper (2009), online at < www.cafod.org>, accessed 11 Jan. 2011. An alternative explanation for the greater intensity of livestock raids is the prevalence of guns; Sandra Gray, Mary Sundal, Brandi Wiebusch, Michael A. Little, Paul W. Leslie, and Ivy L. Pike, 'Cattle Raiding, Cultural Survival, and Adaptability of East African Pastoralists', Current Anthropology 44 (2003) pp.S3–30, have suggested that the availability of assault weapons in the mid-1970s may have increased raid frequency and ferocity compared to the past.

6. See note 2.

7. For studies emphasizing cultural causes such as ideals of warriorhood, aspirations of acquiring more cattle for the purpose of bride wealth payments, expanding one's herd, and replacing herd losses, see Katsuyoshi Fukui and David Turton (eds) Warfare among East African Herders (Osaka: National Musuem of Ethnology 1979).

8. With the increasing expansion of global market forces into pastoral communities, some argue that livestock raids have become more lethal as the motives include commercial gains (see, M.L. Fleisher, 'Cattle Raiding and its Correlates: The Cultural-Ecological Consequences of Market-Oriented Cattle Raiding Among the Kuria of Tanzania', Human Ecology 26 (1998), pp.547–72); John G. McPeak, Peter D. Little and Cheryl R. Doss, Risk and Social Change in an African Rural Economy: Livelihoods in Pastoralist Communities (New York: Routledge 2011). Because of this transformation, some argue that livestock raids have lately become more of a problem than an ecologically sound mechanism for redistributing wealth as suggested in earlier studies. For Turkana, this claim is made in the following works: Gray et al. (note 5) pp.S1–28; Dylan Hendrickson, Jeremy Armon and Robin Mearns, 'The Changing Nature of Conflict and Famine Vulnerability: The Case of Livestock Raiding in Turkana District, Kenya' Disasters 22 (1998) pp.185–99; Jeremy Lind, Adaptation, Conflict and Cooperation in Pastoralist East Africa: A Case Study from South Turkana, Kenya, Paper prepared for the Centre for International Climate and Environmental Research, Oslo, Apr. 2003; Dylan Hendrickson, Robin Mearns and Jremy Armon, 'Livestock Raiding Among the Pastoral Turkana of Kenya: Redistribution, Predation and the Links to Famine', IDS Bulletin 27/3 (1990) pp.17–30.

9. Important political issues that may account for the continuity of violent livestock raids in pastoral communities include weak state presence and legitimacy. See Alemaya Mulugeta and T. Hagmann, 'Governing Violence in the Pastoralist Space: Karayu and State Notions of Cattle Raiding in the Ethiopian Awash Valley', Afrika Focus 21 (2008), pp.71–87; T. Hagmann and Alemmaya, 'Pastoral Conflict and State-Building in the Ethiopian Lowlands' Afrika Spectrum 43 (2008) pp.19–37; Jon Abbink, 'The Shrinking Cultural and Political Space of East African Pastoralists', Nordic African Studies 6 (1997) pp.1–15. See also Katsuyoshi Fukui and J. Markakis (eds), Ethnicity and Conflict in the Horn of Africa (London: James Currey 1994); Jon Abbink, 'Causes and Trajectories of Local Conflict Among Pastoral Peoples in Northeast Africa', Ethiopian Journal of the Social Sciences 5 (2007) pp.25–42.

10. See note 5.

11. Carol R. Ember and Melvin Ember, 'Resource Unpredictability, Mistrust, and War', Journal of Conflict Resolution 36 (1992) pp.242–62.

12. Carol R. Ember and Melvin Ember, 'Resource Unpredictability, Mistrust, and War', Journal of Conflict Resolution 36 (1992) pp.242–62

13. J.T. McCabe, Rada Dyson-Hudson and Jan Wienpahl, ‘Nomadic Movements’ in M. Little and P. Leslie (eds) Turkana Herders of the Dry Savanna: Ecology and Biobehvioral Response of Nomads to an Uncertain Environment (Oxford: Oxford UP 1999) pp.109–121.

14. Witsenburg and Adano (note 2); Adano and Witsenburg (note 2).

15. Adano and Witsenburg (note 2).

16. Adano and Witsenburg (note 2) p.720.

17. Witsenburg and Adano (note 2) p.524.

18. Witsenburg and Adano (note 2) p.525.

19. Witsenburg and Adano (note 2) p.520.

20. Ember and Ember (note 11).

21. Using the ACLED database, which included non-livestock violence, Clionadh Raleigh and Dominic Kniveton, ‘Come Rain or Shine: An Analysis of Conflict and Climate Variability’ Journal of Peace Research 49 (2012) pp.51–64.

22. In our time frame, there is no apparent increase in level of violence – see Figure 8, for example.

23. P.D. Little, Somalia: Economy Without State (Oxford, UK: James Currey 2003); Getachew Kassa, Among the Pastoral Afar in Ethiopia: Tradition, Continuity and Socio-Economic Change (Utrecht: International Books; Addis Ababa: OSSREA 2001); M. O'Leary, ‘Patterns of Range Use, Nomadism, and Sedentarization: The Case of the Rendille and Gabra’ in G. Palsson (ed) From Water to World Making (Uppsala, Sweden: The Scandinavian Institute of African Studies 1990) pp.151–74.

24. J. Terrance McCabe, Cattle Bring Us to Our Enemies: Turkana Ecology, Politics, and Raiding in a Disequilibrium System (Ann Arbor, MI: The University of Michigan Press 2004).

25. James Ellis and D. Layne Coppock, ‘Vegetation Patterns In Ngisonyoka, Turkana, Appendix II’ in Rada Dyson-Hudson and J. Terrance McCabe (eds) South Turkana Nomadism: Coping With an Unpredictably Varying Environment (New Haven, CT: HRAF 1984) p.316.

26. H. Croze and G.M. Gwyenne, ‘A Methodology for the Inventory and Monitoring of Pastoral Ecosytem Processes’ in J. Galaty, D. Aronson, P.C. Salzman and A. Chouinard (eds) The Future of Pastoral Peoples: Proceedings of a Conference Held in Nairobi, Kenya, 4–8, August 1980 (Ottawa: International Development Research Center 1981) p.350.

27. McCabe (note 24) p.231.

28. McCabe (note 24) pp.127–56.

29. John Lamphear, The Scattering Time: Turkana Responses to Colonial Rule (Oxford: Clarendon Press 1992).

30. P.H. Gulliver, The Family Herds: A Study of Two Pastoral Tribes in East Africa the Jie and Turkana (London: Routledge and Kegan Paul 1955); Harald K. Müller, Changing Generations: Dynamics of Generation and Age-Sets in Southeastern Sudan (Toposa) and Northwestern Kenya (Turkana) (Fort Lauderdale: Verlag Breitenbach 1989); Michael Bollig, 'Ethnic Conflicts in North-West Kenya: Pokot–Turkana raiding 1969–1984' Zeitschrift für Ethnologie 115 (1990) pp.73–90.

31. See Gray et al. (note 5) p.19.

32. The main reason for leaving the Pokot armed, while disarming the Turkana, appears to be their cultural and linguistic affinity with the Kalanjin which Pokot politicians used to secure the support of President Moi and other influential policymakers in the national government – see McCabe (note 24).

33. I.L. Pike, 'The Biosocial Consequences of Life on the Run: A Case Study of the Turkana of Kenya' Human Organization 63 (2004) pp.221–35.

34. McCabe (note 24) p.90.

35. Rada Dyson-Hudson and J. Terrance McCabe. South Turkana Nomadism: Coping with an Unpredictably Varying Environment (New Haven, CT: Human Relations Area Files 1985).

36. Pike (note 33) p.226.

37. McCabe (note 24) p.228.

38. Gray et al. (note 5).

39. Witsenburg and Adano (note 2); Adano and Witsenburg (note 2).

40. LexisNexis Academic, online at < www.lexisnexis.com/hottopics/lnacademic/?>, accessed July 2010 to 2011.

41. Except for about 200 articles in 1998.

42. Witsenburg and Adano (note 2).

43. If this were true, the total number of casualties would be underestimated. However, our main question is whether the variability in rain by season or year predicts degree of violence; as long as the minor incidents are systematically underreported, the results should not be affected. However, a reviewer raised the question whether the wet season, when roads become impassible,

was likely to be more underreported than the dry season. This could potentially bias our results regarding monthly deaths if wet months were underreported, although it would not bias our yearly rainfall analysis. However, we also calculated mean deaths per livestock raid. Since this number only analyzes reported instances, this measure controls for underreporting. The results using this measure parallel our other findings (see Figure 4; the other analyses are not shown). Drier months are more likely to have higher mean deaths per raid than normal or wetter months.

44. 'Kenya: 14 Killed as Security Team Fights Bandits', Daily Nation 19 April 2008. Nairobi. Accessed from LexisNexis (note 40).

45. 'AAGM: Four Killed as Raiders Strike in Turkana', Daily Nation 12 Jan. 2002. Nairobi. Accessed from LexisNexis (note 40).

46. The data used in this effort were acquired as part of the activities of National Aeronautics and Space Administration's (NASA's) Science Mission Directorate, and are archived and distributed by the Goddard Earth Sciences (GES) Data and Information Services Center (DISC). The 'Make NetCDF Raster Layer' tools from the Multidimension Tools toolbox of ArcGIS was used.

47. Witsenburg and Adano (note 2) used archival records from both police reports and security commission reports on the Marsabit region to assess both the number of incidents and the number of people killed in particular incidents. Their rainfall data came from a weather station on Marsabit Mountain or Marsabit Town (pp.516–17). They noted that the area around the weather station (average of 800 mm) was wetter than many of the surrounding regions (district as a whole averages between 200 and 300 mm).

48. Dyson-Hudson and McCabe (note 35) noted this pattern in their 20 months of fieldwork between July 1979 and March 1981.

49. Witsenburg and Adano (note 2) pp.525–28.

50. Witsenburg and Adano (note 2)

51. The rainfall data are computed with all months and years.

52. As noted above, research by Raleigh and Kniveton (note 21) looking at all kinds of violence in Africa reported a pronounced bimodal pattern with more violence occurring when particular months were much drier or much wetter than normal.

53. Witsenburg and Adano (note 2).

54. Toru Soga, 'Sharing System of the "Scarce Resources in Southern Ethiopia"' in Svein Ege, Harald Aspen, Birhanu Teferra and Shiferaw Bekele (eds) Proceedings of the 16th International Conference of Ethiopian Studies (Trondheim: NTNU-Trykk 2009), pp.357–67; Adano and Witsenburg (note 2, p.727) also suggested that the need for cooperation may mitigate violence.