Close-up on renewable resources and armed conflict
The spatial logic of pastoralist violence in northern Kenya

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A B S T R A C T
Methods of spatially disaggregated conflict analysis are becoming increasingly popular and open avenues for systematic micro-level research. Especially within the field of environmental security research they bear the promise of a better assessment of environment–conflict linkages at the sub-national level. Yet, this branch of research lacks a thorough theoretical involvement with the spatial logic of armed contests over renewable resources and this hampers the use of highly disaggregated data. To address this shortcoming, the present contribution proposes an actor-centred approach, which allows determining the precise locations of violent events in armed contests over renewable resources. It is developed by analysing the spatial logic of pastoralist violence in northern Kenya, a frequently cited example of scarcity-related struggle over renewable resources. The analysis demonstrates that pastoralist violence in northern Kenya has frequently occurred close to well sites and in locations of higher rainfall, which offer favourable conditions for livestock raiding. These results lend support to narratives of pastoralist violence, which emphasise the strategic use of violence with regard to the ecological opportunities and constraints of African rangelands. They also highlight more generally that conflict locations reveal more about the strategic choices made by armed groups in a given conflict situation than about the ultimate causes of their struggle. This calls for a more conscious use of disaggregated data in environmental security research.

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Introduction

Little is known about the potential of adverse environmental conditions and demographic pressures to ignite violent distributional conflicts over renewable resources such as land or water. The bulk of the evidence available today stems from single-case studies, which tend to emphasise the complexity of the matter and the difficulty of isolating ecological from social, political or economical drivers in scarcity-related conflicts (Bächler, 1999; Homer-Dixon, 1999; Kahl, 2006; Ohlsson, 1999; Suliman, 1993). The few authors who have attempted to unveil systematic interactions between ecological, demographic and conflict indicators in large-N analyses have produced inconclusive and sometimes contradictory results (see Buhaug, 2010a; Burke, Miguel, Satyanath, Dykema, & Lobell, 2009, 2010; De Soysa, 2002; Esty et al., 1998; Hauge & Ellingsen, 1998; Salehyan, 2008; Theisen, 2008; Urdal, 2005). As argued by several scholars, an important reason for this is their use of over-aggregated country-level data, which do not adequately capture relevant sub-national variations in the variables of interest (Buhaug, Gleditsch, & Theisen, 2010; Raleigh & Urdal, 2007). In response to this shortcoming, a number of spatially disaggregated studies have been conducted more recently. These pay particular attention to local variations in environmental and demographic indicators as well as in the incidence of violent conflicts (e.g. Fjelde & von Uexkull, 2012; Østby, Urdal, Tadjoeddin, Murshed, & Strand, 2011; Raleigh & Urdal, 2007; Theisen, 2012; Urdal, 2008).

Using finer-grained data and GIS-based methods bears the promise of a better assessment of environment–conflict linkages at the sub-national level, but it also imposes new requirements on the theoretical foundations of these studies. To use spatial regression analysis with disaggregated data as an effective instrument, researchers need a sound understanding of the spatial dynamics at work in the conflicts they are studying. The observation that a violent event occurred in location A rather than in location B adds little to the knowledge about environment–conflict linkages unless it is related to an explicit idea about how environmental and conflict indicators are expected to coincide in space. Unfortunately, most analysts in current disaggregated research miss to deal thoroughly...
enough with the spatiality of armed conflicts over renewable resources. They are thus prone to erroneous inferences when interpreting spatial correlations between local indicators of environmental scarcity and conflict. Theisen (2012), for instance, who observes that conflict locations in Kenya do not necessarily coincide with locations where population pressure on arable land is high, concludes somewhat rashly that land scarcities play only a minor role in explaining communal violence in this country. Yet, while his result indicates local land scarcities to be a poor predictor of conflict locations in Kenya, it does not preclude them from being an important cause of violence. Theisen neglects here that scarcity-induced violence does not necessarily need to take place where environmental scarcities are most severe. This is made evident by a closer look at the origins and the spatial logic of the clashes to which he is referring. According to Kahl (2006) and Oucho (2002), high fertility rates, large influxes of migrant farmers from other provinces and competition over farmland were important contributors to inter-communal tensions in Kenya’s Rift Valley. Once initiated, communal violence however did not take place where land scarcities were most severe. Attacks rather occurred in towns and on rural settlement schemes harbouring immigrant populations as part of a strategy to expel and dispossess them of their land (Anderson & Lochery, 2008; HPG, 2008; ICC, 2008; Kahl, 2006; Kanyinga, 2009).

To address this shortcoming, this article invites analysts of the environment–conflict nexus to approach the spatial dynamics of armed contest over renewable resources from the perspective of the involved actors. Understanding what they want and what ecological constraints they face helps explaining how they strategically utilise relevant attributes of their environment. This, in turn, allows a precise assessment of the likely locations of violent events in conflicts over renewable resources. For the sake of detail, the analysis focuses on armed clashes between pastoralist groups in northern Kenya, which I refer to in this article as ‘pastoralist violence’. However, the general approach guiding the analysis is simple and straightforward to adapt to different conflict situations and types of resources. Armed violence between pastoralist groups in Kenya and elsewhere is frequently cited as a typical example of inter-communal strife over access to scarce subsistence resources. Under the highly unpredictable ecological conditions of arid and semi-arid lands (ASAL) resources such as water, land or livestock are imbued with exceptional value and thus elicit competition (Butler & Gates, 2012: 24; Meier, Bond, & Bond, 2007: 721). Competition for resources, in turn, informs particular strategies of armed pastoralists with regard to relevant attributes of their environment such as the emplacement of wells, pastures and communal resource boundaries. Taking this spatial logic into consideration, it is possible to explain why pastoralist violence is likely to occur in specific places and hence to gain a better grasp of the spatiality of armed conflicts over renewable resources.

The remainder of the article is organised as follows: the second section presents pastoralist violence in northern Kenya as an exemplary test case for studying the spatial logic of armed contests over renewable resources. The third section elaborates hypotheses about how armed pastoralists utilise different opportunities and constraints of their environment and about how this is likely to affect the spatial distribution of pastoralist violence. These hypotheses are tested by means of a spatial regression analysis in the fourth section. The fifth and final section discusses the empirical results as well as their wider implication for disaggregated environmental conflict research.

An exemplary case of resource–conflicts under adverse ecological conditions

The area under investigation comprises the northern Kenyan counties Marsabit, Isiolo, Mandera, Samburu, Turkana and Wajir (see Fig. 1). High temperatures make northern Kenya a dry region. Rainfall is erratic and varies considerably across space and time. The majority of rains fall in higher altitudes and usually in the month between March and May as well as October and December (McSweeney, New, & Lizcano, 2008). Variations in rainwater availability are further amplified by extreme weather events such as droughts and floods. These harsh conditions impede agriculture and thus pastoralism is the predominant activity. People in northern Kenya sustain their livelihoods essentially through the herding of sheep, goats, camels and cattle and exploit the mobility of their herds in order to adapt to frequent changes in the spatio-temporal distribution of pastures and water (Adano, Dietz, Witsenburg, & Zaal, 2012: 69; McCarthy & Di Gregorio, 2007; WRI et al., 2007).

The ecological vulnerability of the region is further exacerbated by high levels of poverty and poor access to public services (CoK, 2007; WRI et al., 2007). For a long time, pastoralism in Kenya has been regarded as unproductive and destructive to the environment and public resources have primarily been directed to farming areas in the central and western parts of the country (Eriksen & Lind, 2009: 829). As a result, Kenya’s northern rangelands remain economically marginalised and poorly equipped with road infrastructure, health and education facilities, as well as other services which would help local communities to diversify their livelihoods and withstand extreme weather events (Schilling, Akuno, Scheffran, & Weinzierl, 2011, 2012).

Resource scarcities and erratic rainfall play a prominent role in the region’s frequent communal conflicts between Boran, Gabra, Pokot, Samburu, Turkana and other pastoralist groups (Wallensteen & Themner, 2012). For one part, climate-induced spatial adjustments of herders often lead to territorial contention and competition over grazing resources between neighbouring groups. In the absence of effective regulations such disputes can become violent. Not only is the relationship between overlapping customary and formal land legislation ambiguous, but confusion also arises from the coexistence of different land registration laws in Kenya, leaving room for diverging interpretations and manipulation (Kråtli & Swift, 2001; Lengoiboni, 2011; Mureithi & Opio, 2010).

For the other part, the harsh ecology of northern Kenya has rendered violent livestock raiding not only a viable but also culturally accepted practice among pastoralist communities. Livestock is crucial to the survival and livelihoods of pastoralists as a source of food and cash revenue, but also as a symbol of prestige and prosperity. Animals serve as bridewealth and are exchanged among pastoralists with the purpose of broadening and intensifying social networks of mutual insurance in case of unforeseen events such as drought and disease (Bollig, 1993; McCabe, 1990; Omolo, 2010: 90). They further allow the settlement of disputes as a means of compensation (Schilling et al., 2012: 2). Hence, armed raids against other pastoralist groups are considered a strategy to cope with the dire living conditions of ASAL. Livestock thus obtained compensates for the loss of animals to drought, disease and theft (Kråtli & Swift, 2001: 22; Witsenburg & Adano, 2002: 13).

Over the last centuries, customary institutions have evolved in the region’s frequent communal conflicts between Boran, Gabra, Pokot, Samburu, Turkana and other pastoralist groups (Wallensteen & Themner, 2012). For one part, climate-induced spatial adjustments of herders often lead to territorial contention and competition over grazing resources between neighbouring groups. In the absence of effective regulations such disputes can become violent. Not only is the relationship between overlapping customary and formal land legislation ambiguous, but confusion also arises from the coexistence of different land registration laws in Kenya, leaving room for diverging interpretations and manipulation (Kråtli & Swift, 2001; Lengoiboni, 2011; Mureithi & Opio, 2010).

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Over the last centuries, customary institutions have evolved in northern Kenya, which define under what circumstances raids are legitimate, how stolen animals are redistributed and how resulting hostilities between different groups can be settled through compensation (Hendrickson, Mears, & Armon, 1996; Meier et al., 2007).

Pervasive research also shows that pastoralist violence in northern Kenya is closely related to specific ecological patterns, which provide armed herders with situational opportunities for livestock raiding. Heavy rains during the wet season wash away the tracks of stolen animals and make it easier for raiders to escape,
while thick vegetation provides opportunities to hide. Animals are also stronger then and readily available surface water allows raiders to trek away over long distances (Meier et al., 2007). Moreover, labour is in surplus during the wet season, as herds are concentrated and require the attention of less people. Thus idle young men engage more easily in raiding (Adano et al., 2012: 71). This is confirmed by statistical analyses, which reveal an increase in the frequency and severity of pastoralist violence during wet month in north-east Kenya (Raleigh & Kniveton, 2012; Witsenburg & Adano, 2009).

Conversely, drought conditions and the depletion of resources can constrain pastoralist groups to venture further away from their home range into more dangerous peripheral areas, where they are susceptible to attacks by neighbouring groups (Leff, 2009). This pattern has been observed in Turkana county. Dry conditions in the inner area of the county regularly force Turkana herders to leave for wetter mountain ranges on the northern, western and southern borders of the county. This does not only facilitate raids by neighbouring groups such as the Toposa and Pokot, but frequently also involves disputes with these communities over the use of water points and shared dry season pastures (Eriksen & Lind, 2009: 826f; Opiyo, Wasonga, Schilling, & Mureithi, 2012; Schilling et al., 2011). This pattern is likely to be responsible for the frequency of pastoralist conflicts observed in the border areas of Turkana county (see Fig. 1).

This is not to say that pastoralist violence in northern Kenya is solely driven by resource scarcity and varying weather conditions. Several authors argue indeed that livestock raiding as a customary livelihood sustaining practice with regard to harsh environmental conditions is evolving into a more predatory and commercially motivated enterprise, due to the gradual integration of Kenya’s rangelands into a modern market economy (see Eaton, 2008: 94ff). According to them, pastoralist conflicts in northern Kenya are affected by a multitude of supplementary factors, among which the most frequently cited are: the proliferation of small arms due to civil wars in neighbouring Somalia, Uganda and Sudan (Gray et al., 2003; Mkutu, 2006), the failure of the Kenyan government to effectively disarm pastoralist groups (Miet, 2012), ethnic electoralism and the instrumental utilisation of communal disputes by local politicians (Boye & Kaarhus, 2011; Greiner, 2013; Witsenburg & Adano, 2009: 532), the erosion of customary institutions of conflict mitigation and the inefficiency of their formal substitutes (Krätli & Swift, 2001; Mureithi & Opiyo, 2010), and, most importantly, the lack of state security provision (Eaton, 2008, 2012; Leff, 2009: 193ff). Although these factors add a more complex dimension to pastoralist violence, they have to be seen against the background of resource scarcity and erratic environmental conditions in northern Kenya, without which livestock, water and pastures would not be such highly coveted prizes. In this regard pastoralist violence in northern Kenya can be considered as a typical example of conflict over renewable resources, whose availability is constrained by adverse environmental conditions. Studying the spatial distribution of pastoralist violence in this region can thus reveal general patterns, which apply to similar conflicts.

Explaining the spatial distribution of pastoralist violence in northern Kenya

Common sense and available evidence suggest that armed groups choose conflict locations with regard to their strategic ambitions and objective constraints such as geographical distance,
terrain, infrastructure, military strength and the spatial distribution of resources (Buhaug, 2010b; LeBillon, 2001). Spatial analysts hence need to take these factors into consideration to predict the spatial distribution of violent events in a given conflict situation. To give an example, Hegre, Østby, and Raleigh (2009) demonstrate in their analysis of the Liberian civil war that violent events occurred more frequently in relatively wealthy locations. They explain that widespread poverty and significant economic inequalities played an important part in causing the conflict and providing support for different rebel groups. In the midst of chaos and widespread impunity, many combatants thus seized the opportunity for sacking well-off neighbourhoods. Similarly, Chojnacki and Metternich (2008) reveal that violent events in Somalia frequently took place near important roads and road junctions and stress their importance for moving troops and levying taxes on transported goods. In the same vein, conflicts over subsistence resources can be expected to take place either where these are concentrated or in locations that are otherwise relevant for obtaining access to them. This logic also applies to conflicts over livestock, water and pastures in northern Kenya. Hence, it is possible to predict where these are likely to occur by relating pastoralists’ strategic objectives to the distribution of relevant geographical opportunities in their environment.

**Motivations and objectives of armed pastoralists**

Pastoralist violence revolves essentially around the appropriation of livestock and the access to related productive assets such as water and land. Livestock is of central importance for the survival of pastoralists in ASAL, as animals can be moved according to spatial and temporal changes in the distribution of rainwater and pastures. Livestock raiding is commonly practised as a means to replenish herds after death from drought or disease (Adano et al., 2012). Moreover, livestock enhances the social status of herders. It allows marriage and independence but also the participation in social networks of reciprocal exchanges and mutual insurance (Bollig, 1993; De Vries, 2012; McCabe, 1990; Mieth, 2012). For many Pastoralists livestock raiding is also a supplementary source of income thus extending its livelihood sustaining to a profit-oriented logic. As highlighted by Eaton (2008: 101), most raiders are not poor. Prior acquisition of weapons, recruitment of men and the marketing of stolen animals all require a certain amount of financial and organisational resources (see also Mieth, 2012: 67; Witsenburg & Adano, 2009: 529). Often, raids provide the means to finance further raids (Krååtli & Swift, 2001). Finally, revenge is an important motivation for armed violence between pastoralist communities. In the absence of effective state security provision, minor thefts of livestock can trigger retaliatory raids and indiscriminate violence against members of the community associated with the thieves. It is however difficult to isolate revenge as a conflict motive, as retaliatory raids might serve other purposes and are not necessarily carried out by the direct victims of a previous theft or raid (Eaton, 2008, 2012; Krååtli & Swift, 2001).

While these are commonly mentioned motivations for pastoralist violence, their importance can vary from situation to situation and between different pastoralist groups. A survey conducted in southern Turkana reveals indeed that motivations of Turkana and Pokot raiders in this region differ. The former stated hunger, poverty and lack of pastures as their primary reason for raiding, whereas the latter were seeking wealth, status and territory. This contrast is explained by differences in the availability of resources in the respective territories of both communities at the time of the interview (Schilling et al., 2012).

Beyond the individual level, livestock raiding can also procure additional benefits to pastoralist groups, local politicians and business partners from outside the pastoral sector (Krååtli & Swift, 2001). Raids and the related insecurity keep neighbouring groups away from shared water and grazing resources and thus help extending a group’s territory. In theory, a military dominant group can claim privileged access to important resources. In practice, however, the extensive militarisation of pastoralists in northern Kenya has led to a situation where neither group prevails. Hence, many high potential areas remain unused because of a high risk of violence (Eriksen & Lind, 2009: 828; Opiyo et al., 2012: 444; Schilling et al., 2012: 12). Raids and violence between pastoralist groups are also a way to bolster political claims to particular territories and the resources and public infrastructures they contain. As a result of colonialism and subsequent politics of administrative decentralisation and reorganisation land claims in Kenya are deeply intertwined with questions of ‘ethnicity’ and local political representation (Kahl, 2006; Médard, 2008; Ocho, 2002). This conjuncture incites politicians to exploit conflicts between different pastoralist groups in order to influence the outcome of local elections. Here, livestock raids are instrumental in order to scare away the electorate of political challengers, while politicians, once in office, can endorse the land claims of their supporters (Greiner, 2013; Krååtli & Swift, 2001).

In sum, livestock raiding does not only provide herders with immediate individual benefits but is also a means to safeguard longer term interests with regard to water and land, which are essential for livestock production. Conversely, conflicts over grazing resources provide the opportunity for short-term material gains. As highlighted by a peace worker in Marsabit: “If you go out fighting over land, and you see goats, there is no way you will leave them.” (Hilary Halkano, 2009, quoted in Witsenburg & Adano, 2009: 532). Hence, it is difficult to determine in a given case whether livestock raiders are just seeking wealth and prestige or also pursuing an overarching geo-political agenda. Nevertheless, knowledge of these different motivations can inform hypotheses about where pastoralist violence is likely to occur.

**Geographical opportunities and the location of pastoralist violence**

Livestock is a highly mobile resource. Raiders need to anticipate herd movements and to assess favourable locations for an attack. Anthropological fieldwork conducted in African ASAL suggests that the location of water wells plays an important part in this calculus (Turner, 2004: 877; Witsenburg & Adano, 2002). These are fixed points in space that herders need to regularly visit in order to water their animals, although seasonal variations in the availability of surface water and different water requirements of various livestock species lead to more or less frequent visits. Nevertheless, they are a crucial determinant of land use in the ASAL and thus a central spatial reference point for both herders and raiders (Oba & Luisi, 1987; Adano & Witsenburg, 2004: 275ff). As pointed out by a herdsman interviewed in Marsabit county, violence occurs at well sites because the frequent concentration of people and animals in these places makes raiding profitable. Moreover, he explains that wells are usually situated in bushy depressions in the landscape, making it easy for raiders to surround and surprise herders when they are busy watering their animals (quoted in Witsenburg & Adano, 2002: 11). These locations thus offer several opportunities for an attack.

In addition, well sites have a particular strategic importance in territorial disputes between rivaling pastoralist communities. Violence and insecurity at particular well sites can effectively prevent another group from utilising the surrounding land and thus force it to leave a contested area; especially in dry periods when alternative sources of water such as seasonal rivers, earth pans and dams cannot be utilised. There is indeed anecdotal evidence linking
fights over permanent water sources to seasonal aridity in Turkana and Marsabit county (Schilling et al., 2012: 11; Witsenburg & Adano, 2009: 526).

Hypothesis 1: Pastoralist violence is more likely in the vicinity of well sites.

The spatio-temporal availability of rainwater is another major determinant of pastoralist land use. In the wet season, few spatial constraints are imposed on pastoralists. At this time herds remain usually confined in secure areas and close to water sources, to make the most efficient use of more abundant pastureland, while reducing the risk of attacks by predators, bandits and raiders. Major movements are avoided in order to maintain the calorific energy expenditure of livestock low (Schwartz, 2005). In dry periods, on the other hand, available surfaces for grazing are drastically reduced and herders usually move to more humid and cooler mountain areas where animals cope better with dry season conditions. Due to their topography but also to their central importance in pastoralist economies, these areas frequently delimit communal territories and are commonly used by neighbouring groups during the dry season. Here, the proximity of rival groups can both create the opportunity for raids and incite competition over commonly used resources (Mureithi & Opio, 2010). This pattern is most visible in Turkana county where, during the dry season, herds disperse into peripheral mountain ranges where they are more vulnerable to attacks by enemy groups (Eriksen & Lind, 2009: 827; McCabe, 2004; Opio et al., 2012: 446).

Hypothesis 2: Pastoralist violence is more likely in wetter areas.

Escaping with the stolen animals is a further critical component of livestock raiding. This is much easier if a raid takes place close to the. The communal territory, where, in many cases they will be supported by the local population. As explained by Eaton (2008: 106f), it is difficult to trace back stolen livestock once it has crossed a communal border. Armed herdsmen in search for stolen animals in other groups' territory usually arouse suspicion among the local population. Frequently, they are held for thieves and raiders themselves. Moreover, local officials and the police may be inclined to protect chased raiders in exchange for a part of their booty. Communal border areas thus provide additional opportunities for livestock raiding, which might explain the high level of insecurity in these areas (c.f. Eriksen & Lind, 2009; Opio et al., 2012: 444; Witsenburg & Adano, 2009: 528).

Armed violence in border areas might as well reflect territorial conflicts between different pastoralist groups as witnessed between Pokot, Turkana and Samburu pastoralists in north-western Kenya. As explained by Greiner (2013), these conflicts have to be seen against the background of Kenya’s ongoing politics of administrative restructuring and land reform. Although these aim at formalising communal claims over territory, local infrastructures and grazing resources, they provide belligerent groups with the opportunity to shift administrative boundaries and hence gain exclusive rights over commonly used resources. This has led to a series of attacks between the three communities at the borders between their respective territories (see also Schilling et al., 2012: 8).

Hypothesis 3: Pastoralist violence is more likely close to communal borders.

Quantitative analysis

In order to test the hypotheses of the previous section, the study area is divided into 2301 equally sized square units (grid cells) of approximately 11 km side length. Spatial data on pastoralist violence and on relevant geographic attributes of the pastoralists’ environment are projected in the World Geodetic System (WGS 84), aggregated at the grid cell level and merged into a single dataset. The variables of the analysis and the underlying data are briefly presented here. Descriptive statistics can be found in the online appendix (Table 2).

Dependent variable

The dependent variable pastoralist violence takes two values: ‘one’ for grid cells which were affected at least once by pastoralist violence in the period between 1997 and 2013, and ‘zero’ otherwise. Information on conflict locations is taken from the ‘Armed Conflict Location and Event Dataset’ (ACLED Version 4: Raleigh, Linke, Hegre, & Karlsen, 2010). ACLED data are derived from a variety of sources including reports from humanitarian agencies, local media and research publications. Among other information, they include dates and locations of violent events which resulted in at least one fatality and hence allow the creation of high resolution conflict maps. In order to compute the dependent variable only instances of armed violence involving pastoralist groups such as the Boran, Gabra, Samburu, Pokot or Turkana are included in the analysis. Events involving unidentified armed groups are also included if the related report or media source explicitly mentions livestock raiding or conflict over water and grazing land. Moreover, only events with the highest geo-precision code of ‘one’ are considered, which indicate events with exact coordinates or known to have occurred within a limited distance from a specified location (Raleigh, Linke, & Dowd, 2014: 13f). Considering that the geographical units of the analysis are very small, events with a lower geo-precision would produce inaccurate results. This reduces the number of grid cells with violence from 88 to 73.

Main explanatory variables

Well site is a binary variable indicating whether a grid cell is located within a distance of 10 km from a well site. Ambushes by armed livestock raiders are not necessarily expected to occur at the exact location of wells but still within a limited distance. This also helps accounting for minor inaccuracies in the precision of the utilised data. The Euclidian distance to the closest well site for every grid cell is computed using 5 km resolution data from the World Resource Institute (WRI, 2007), originally adapted from field data of the German Agency for Technical Cooperation (GTZ, 1996). In line with hypothesis 1, pastoralist violence is expected to be more likely in the vicinity of well sites.

Spatial differences in humidity and the availability of dry season pastures are captured via a log-transformed measure of average annual rainfall. It is computed on the basis of precipitation estimates for the years 1950–2000 with a resolution of roughly 1 km × 1 km (Hijmans, Cameron, Parra, Jones, & Jarvis, 2005). These are aggregated to match the resolution of the analysis taking the mean value of all pixels whose centre-point lies within a larger grid cell. In line with hypothesis 2, pastoralist violence is expected to be more likely in locations with higher rainfall throughout the year. I also include a variable, which measures the distance of a grid cell to a communal border. Data on the location of the territories of different pastoralist groups are obtained by geo-referencing Steve Huffman’s ‘Ethno-linguistic map for the Horn of Africa’ (Huffman, 2011), based on data from the 16th edition of the ‘Ethnologue’ (Lewis, 2009), the most precise dataset on settlement patterns of linguistic groups throughout the world. The data are complemented by a digitalised version of the ‘Peoples of Africa Atlas’ (Felix & Meur, 2001). Only the territories of pastoralist groups
involved in fights between 1997 and 2013 are considered. In line with hypothesis 3, pastoralist violence is expected to be more likely close to communal borders.

It should be noted that communal borders in pastoralist areas are subject to frequent changes, depending on the relative strength and weakness of different groups. Hence, the static data employed here can only provide an approximate representation of different communal territories and might disregard small changes, which have occurred during the observed period. I do not expect these inaccuracies to be important enough to impact the results of the analysis in a significant way, but I acknowledge that more precise data would have been preferable, if available.

Control variables

The analysis includes a log-transformed measure of population density in each grid cell. I retrieve raster data for population densities in 2000 at a resolution of roughly 4.6 km × 4.6 km from the ‘Gridded Population of the World (GPW3)’ data project (CIESP & CIAT, 2005) and aggregate them to fit the resolution of the analysis. GPW data capture the spatially interpolated average number of inhabitants per km² in each grid cell adjusted to match UN totals. High population densities are commonly associated with a higher risk of armed violence in spatially disaggregated research, although the reason behind this relationship remains unclear (see Fjelde & von Uexkull, 2012; Raleigh & Hegre, 2009; Raleigh & Urdal, 2007; Theisen, 2012). In the context of this analysis, I assume that violence is more likely where there are more people. As a result of ecological and economical changes in northern Kenya an increasingly higher part of local pastoralists adopt a more sedentary lifestyle, staying closer to towns and permanent water sources; often in territories claimed and occupied by several groups. The resulting concentration of people and animals in these areas does not only beget increased resource degradation and competition, but also facilitates large scale raiding (Kratli & Swift, 2001: 26ff; Adano & Witsenburg, 2004). More densely populated and ethnically diverse areas are also more likely to experience electoral clashes between different communal groups, as towns and greater settlements are the primary locations of political demonstrations (cf. Greiner, 2013).

The case study literature concurs in blaming the poor provision of state security as an important cause of violence in northern Kenya (e.g. Eaton, 2008, 2012; Leff, 2009: 193f; Mkutu, 2006). Yet, although the general level of insecurity in northern Kenya’s rangelands is high, some areas are probably still more secure than others. Three main roads pass trough the region and connect the towns of Lodwar, Marsabit, Moyale and Wajir to larger towns and cities in west and central Kenya. As these can be utilised for the fast deployment of military and police forces, it is likely that raiders will avoid them. Conversely, the weakly controlled northern and north-western borders of Kenya provide raiders with additional opportunities to evade prosecution and sell stolen animals on foreign markets. Tracing back stolen livestock is more difficult once it has crossed these borders and public authorities in border areas lack the means to prosecute those involved in violence taking place in another jurisdiction (Leff, 2009: 193; Witsenburg & Adano, 2009: 535). Hence, I further include two control variables to account for geographical constraints on state-led interventions: distance to the next major road and distance to the next international border (both measured in km). Spatial data on the location of Kenya’s international borders are derived from the ‘Global Administrative Unit Layers’ (GAUL: EC-FAO, 2013). Data on major roads are taken from the World Resource Institute (WRI, 2007).

Results

As in most spatial conflict analyses with a binary dependent variable, the fraction of observations with armed violence is very small. Overall, 73 grid cells are coded as affected by pastoralist violence between 1997 and 2013 versus 2228 grid cells coded as ‘zeros’. This might induce biases in the regression estimates, as explained by King and Zeng (2001). To circumvent this problem, the maximum likelihood estimates of the logistic regression analysis are corrected ex post via the software ‘Zelig’ for R (Imai, King, & Lau, 2011), using the ratio of ‘ones’ and ‘zeros’ in the dataset. The results are shown in Table 1.

As can be seen in model 1, areas in the vicinity of well sites have a higher likelihood of pastoralist violence and the relationship is highly significant. I use the simulation capacities of Zelig to calculate the substantive effect of this variable on the probability of pastoralist violence when all other variables are held constant at their mean (for metric variables) or base category (for categorical variables). The results indicate that, on average, pastoralist violence is almost three times more likely close to well sites than in other areas (with a 95% confidence interval 1.6–4.7). Hypothesis 1 is thus supported. Likewise, logged average annual rainfall is positively and significantly related to a higher likelihood of pastoralist violence. This is consistent with hypothesis 2. Holding all other variables constant, an increase from the first to the third quartile on the logged rainfall measure (corresponding, respectively, to 307 mm and 437 mm of average annual rainfall), on average, is associated with a factor 1.6 increase in the predicted probability of pastoralist violence (with a 95% confidence interval 1.1–2.2). Fig. 2 in the online appendix displays the spatial distribution of pastoralist violence against the background of spatial variations in average annual rainfall in northern Kenya. It shows that an important part of events is located in wet areas (blue and green areas, in the web version). The occurrence of violent events in dry areas (red and

Table 1
Rare event logistic regression: Changes in the likelihood of pastoralist violence in northern Kenya.

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 2</th>
<th>Robustness checks – model 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No extreme values</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>−12.600 (2.909)**</td>
<td>−4.836 (0.552)**</td>
</tr>
<tr>
<td><strong>Well site</strong></td>
<td>1.022 (0.2847)**</td>
<td>0.966 (0.285)**</td>
</tr>
<tr>
<td><strong>Log. average annual rainfall</strong></td>
<td>1.262 (0.4835)**</td>
<td>−0.006 (0.004)</td>
</tr>
<tr>
<td><strong>Distance to communal border</strong></td>
<td>0.001 (0.004)</td>
<td>0.516 (0.111)**</td>
</tr>
<tr>
<td><strong>Log. population density</strong></td>
<td>0.484 (0.112)**</td>
<td>0.000 (0.002)</td>
</tr>
<tr>
<td><strong>Distance to int. border</strong></td>
<td>−0.001 (0.001)</td>
<td>0.000 (0.002)</td>
</tr>
<tr>
<td><strong>Distance to major road</strong></td>
<td>0.005 (0.002)*</td>
<td>0.002 (0.002)</td>
</tr>
<tr>
<td><strong>No. observations</strong></td>
<td>2301</td>
<td>2301</td>
</tr>
<tr>
<td><strong>Log. likelihood</strong></td>
<td>−300.13</td>
<td>−300.84</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses; **p < 0.01, *p < 0.05.
orange areas, in the web version), on the other hand, can partly be explained by higher population densities in the vicinity of major towns such as Lodwar, Wajir and Mandera. Overall, these findings indicate that the spatial distribution of pastoralist violence in northern Kenya is closely related to the spatial distribution of opportunities for livestock raiding.

Communal borders, on the other hand, do not seem to influence the local occurrence of violence between pastoralists. The coefficient of the variable is close to zero and statistically not significant. Holding all other variables constant and reducing the distance to a communal border from the third to the first quartile (from 50 km to 9 km), on average, is associated with a factor 0.98 decrease in the predicted probability of pastoralist violence (with a 95% confidence interval 0.7–1.4). This result is surprising given that communal borders are frequently depicted as dangerous places in the anthropological literature. Yet, it might stem from the correlation between the communal border and the rainfall measure, making it difficult to isolate the effects of both variables (see Table 3 in the online appendix). As mentioned earlier, areas of higher rainfall are indeed often located at the border between communal territories and this creates both opportunities and incentives for livestock raiding when different groups access the same dry season grazing areas. I thus remove the rainfall variable in model 2 in order to check whether this reveals a relationship between the distance to communal borders and a higher likelihood of pastoralist violence. The significance of the coefficient of the communal border variable is improved, but not sufficiently to reach statistical significance.

An explanation for this surprising result could be that communal boundaries are not equally well defined across the study area and hence are not an equally obvious spatial reference for belligerent pastoralists. To give an example, the boundaries between Boran and different Somali speaking groups in the eastern part of the study area are more vaguely defined in Lewis (2009) than the boundaries between Turkana and their neighbours in the western part of the study area. Overall, hypothesis 3 is not supported, although this result should be treated with some caution as it is based on a static representation of communal boundaries.

As expected, higher population densities are systematically related with a higher risk of pastoralist violence. The coefficient for this variable is significant and positive. Holding all other variables constant at their mean or base category, an increase from the first to the third quartile on the logged population density measure (corresponding, respectively, to 2 and 6 inhabitants per km²), on average, is associated with a factor 1.7 increase in the predicted probability of pastoralist violence (with a 95% confidence interval 1.3–2.1). The coefficient for distance to international borders is close to zero and not significant. International borders do not seem to play an important part with regard to the choice of conflict locations by armed pastoralists in northern Kenya. Pastoralist violence, on the other hand, becomes more likely with increasing distance to main roads. Holding all other variables constant and augmenting the distance to major roads from the first to the third quartile (from 30 km to 101 km) the predicted probability of pastoralist violence is 1.4 times higher, on average (with a 95% confidence interval 1.0–1.9). This indicates that armed pastoralists prefer to attack in less accessible locations where it is more difficult for military and police forces to intervene.

Two robustness checks are performed on the results of model 1: Firstly, I rerun model 1 on a restricted sample excluding observations with extreme values on the rain variable (model 2). The results are reported in the third column of Table 1 and do not differ substantially from the results in the first column. Hence, outlying observations do not seem to have a major influence on the regression results. Secondly, I rerun model 1 on a sample, which also contains ACLED-events with a geo-precision code of ‘two’, indicating conflict locations with only approximate location information such as ‘north of Lodwar’ or ‘close to the border between Marsabit and Isiolo county’. This increases the number of grid cells with pastoralist violence to 86. As can be seen in the fourth column of Table 1, the regression results remain largely unaltered by this modification, except for the distance to roads measure, which is only marginally significant (p < 0.07). Finally, I test for spatial autocorrelation in the residuals of model 1 to check for spatial clustering of the errors, which would produce inaccurate regression estimates. The results of the test indicate that there is no significant correlation between residuals across space. The Moran Index of Spatial Autocorrelation is close to zero, with a p-value of roughly 0.22.

Discussion

Methods of geographical disaggregation have become increasingly popular and open avenues for systematic micro-level research. Especially within the field of environmental security research they bear the promise of a better understanding of scarcity-conflict-linkages at the sub-national level. Yet, this branch of research lacks a systematic understanding of the spatial dynamics at work in armed contests over renewable resources and this prevents the adequate use of highly disaggregated data and methods of spatial regression analysis. In response to this shortcoming, I analyse the spatial logic of pastoralist conflicts in northern Kenya, in order to gain a better idea of where violence typically occurs in armed contests over renewable resources. The results of the analysis indicate that the spatial distribution of pastoralist violence in northern Kenya is closely related to the spatial distribution of opportunities for livestock raiding. Pastoralist violence is more likely close to permanent water sources and in wetter areas, where animals can be appropriated more easily. Not incidentally, these places are also strategically important in order to effectively use surrounding pastureland. This points to the complementary logic of pastoralist violence as a means for both obtaining short term material gains and securing long term access to essential resources.

These findings complement previous analyses on the timing of pastoralist violence (e.g. Meier et al., 2007; Raleigh & Kniveton, 2012; Theisen, 2012). They demonstrate that strategies of violent livestock appropriation are not only determined by timely but also by spatially varying patterns of resource distribution and accessibility, and thus add an additional dimension to popular ‘opportunity-narratives’ of pastoralist violence.

The very general logic exposed here, whereby resource seeking armed groups choose conflict locations with regard to situational opportunities for the violent appropriation of resources, also applies to conflict situations involving different actors and resources (see Hegg et al., 2009). Although, different resources might imply different strategies of appropriation and thus imply a different distribution of violent events across space and time (LeBillon, 2001: 573). To give an example, arable land, as opposed to livestock, is immobile and requires armed groups to temporarily gain control over a given territory if they are to benefit from it. This might lead to more extensive and enduring violence, as opposed to scattered and occasional attacks by livestock raiders. A deeper understanding of such variations and their underlying logic will help analysts of the environment–conflict-nexus to make better use of spatially disaggregated data.

Currently, environmental security research is still impeded by a simplistic spatial understanding of conflicts over renewable resources: Most analysts implicitly assume that, if environmental scarcities beget armed conflict, violence is likely to take place where ecological and demographic constraints are most severe.
Raleigh & Undal, 2007; Theisen, 2012; Undal, 2008). In doing so, they confound two different areas of research: the analysis of the local causes of armed conflicts and the analysis of the spatial distribution of conflict events. The consequences are not as dramatic in research designs with fairly large units of analysis, such as countries or first order administrative subunits. Here, it might still be reasonable to expect scarcity-induced conflicts to occur in resource scarce countries or administrative regions. In research designs with smaller units of analysis, the consequences are, however, more problematic. As highlighted by this analysis, precise locations of violent events reveal more about the geographic constraints and opportunities that conflict actors integrate into their strategy than about the ultimate causes of their struggle. Thus it is erroneous to consider the spatial co-occurrence of ecological and conflict indicators in highly disaggregated data as evidence for the existence or non-existence of a systematic causal connection between environmental scarcities and armed conflict.

If disaggregated data are to be efficiently used in order to analyse environment–conflict-linkages at the local level, researchers need to deemphasize the ecological conditions of conflict locations. Instead they need to focus on the livelihoods of individuals and groups involved in struggles over renewable resources and to assess the local ecological conditions, on which these people depend. This implies a shift from comparing locations with and without conflict to comparing the living conditions of violent and non-violent individuals and groups. Due to its limited scope, this empirical analysis, of course, only provides preliminary insights into the spatial logic of armed conflict research. Considering the ever-increasing pace at which new disaggregated data become available, this line of inquiry is likely to undergo important developments. Future analyses will nevertheless need to integrate more thorough theoretical reflections about the spatial linkages between resource variability and conflict to make the best use of newly available data and research tools.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.polgeo.2014.06.003.

References


