

Geographic determinants of inter-community conflicts in the Kerio Valley, Kenya: Implications for peace building

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ABSTRACT

Kerio Valley has been marred by inter-community conflicts for decades that have caused numerous deaths and sufferings hampering development in the region. Inter-community conflicts have become more frequent and severe in recent years, aggravated by both geo and anthropogenic factors and whose comparative significance is not clearly documented. Specifically, the study sought to examine the nexus between geo-factors and inter-community conflicts in Kerio Valley. The study adopted a cross-sectional research design. Primary data was collected using questionnaires and key informant interviews. Data was analysed using frequencies, percentages and thematic technique. The findings reveal that inter-community conflict in Kerio Valley is characterized by deep rooted and recurring tensions, centred on livestock theft and retaliatory attack. The study found that geo-factors are a major contributor to inter-community conflicts in Kerio Valley with the most important geo-factors being drought (95%), terrain (89%), water resources (84.4%) and soil quality (78.7%). The study concluded that geo-factors exacerbates conflicts in Kerio Valley region by creating scarcity of environmental resources like pasture and water in line with Homer-Dixon environmental scarcity theory. The terrain of the area has also reduced the capacity of the state to manage environmental scarcity. The study recommends development of comprehensive peace building strategies that include environmental management projects that address land degradation, water scarcity, climatic stresses, and livelihood diversification.

Keywords: Environmental Scarcity, Geo-Factors, Inter-Community Conflicts, Kerio Valley, Kenya

I. INTRODUCTION

The term ‘conflict’ refers to a clash of issues, interests or values (Mason & Muller, 2007). Inter-community conflicts refer to clashes between two or more communities (van Baalen, 2024). The clashing groups are organized along certain identities that are different and competing (Watson, 2023). A defining feature of inter-community conflicts is the absence of state involvement. This feature distinguishes inter-community conflicts from civil war, with the latter describing a clash between a group and the State (van Baalen, 2024). In fact, most inter-community conflicts occur from the breakdown of state structures and authority enabling the community militias to thrive.

Inter-community conflicts have been a longstanding and pervasive issue around the globe (Bayramov, 2018). Sapeha et al. (2024) noted that, although there has been a general reduction in communal conflicts, sixty-seven such conflicts were recorded globally in 2019. In rural areas of El Salvador, there have been armed conflicts characterized by tussles over land ownership (García Pinzón, 2022). In Colombia, disputes over control of mineral resources, and community access to these resources have led to five decades of civil conflict (Rus, 2014). In Africa, inter-community conflicts have been reported in the Niger Delta region fuelled by the desire to control the massive oil resources and gain political power (García Pinzón, 2022). Different groups have territorial claims and disputes often arise leading to violence and displacement of populations. Angola has also experienced inter-community conflicts fuelled by a range of factors including historical grievances, competition for resources, political instability, and external interference (Sempijja & Brito, 2025).

The East African region is also typified by a myriad of inter-community conflicts driven by political exclusion, power imbalances and securitization of identity (Jibat, 2024). In Ethiopia, ethnic federalism has facilitated resource competition and elite manipulation that has transformed historical grievance into violent communal conflict (Jibat, 2024). The Democratic Republic of Congo is characterized by ethnic militias that have fuelled regional military tension (Majani, 2025). Somalia has also experienced inter-community conflicts driven by deep-seated clan rivalries fuelled by competition for resource and political control (Khalif, 2024). In Uganda, inter-community conflicts centre on land disputes and competition for resources in the cattle corridor (Nassef et al., 2023). On the other hand, Tanzania has

emerged as a model of stability having neutralized community conflicts by cultivating a unified national identity. However, localized tension persists between nomadic pastoralist and settled farmers over land use (Nassef et al., 2023).

In Kenya, inter-community conflicts are closely associated with the control for local resources and political dynamics (Lind, 2018). Inter-community conflicts in Kenya particularly in the northern parts have also been associated with nomadic way of life (Njoka et al., 2022). One of the documented conflicts is the Luo-Nandi conflict on the border of Nandi and Kisumu counties (Odero et al., 2023). Another notable conflict is the Turkana-Pokot conflict in the border region of Kainuk. This conflict is driven by competition over water resources and grazing land by the two pastoralist communities (Lind, 2018). In Laikipia, conflicts have been reported between Samburu, Turkana, Pokot, Kalenjin, and Maasai (Njoka et al., 2022). The conflicts are attributed to land distribution, control for pasture, and sociocultural issues such as cattle rustling and bride price payment.

The conflicts between Elgeyo-Marakwet, West Pokot and Baringo communities have been predominant in Kerio Valley region. Lack of land adjudication in the area has resulted in disagreement on whether land should be allocated as communal property or private property (Kipchumba, 2019). The Keiyo and Marakwet favour the private property tenure system while the Pokot want the land to remain as communal tenure. Sporadic violence also occurs between the Pokots, Markwets, and Tugens due to over grazing (Chirchir, 2019). Inter-community conflicts in Kerio Valley have been on the increase since the year 2000 and were becoming more violent (Elfversson, 2016).

The Kerio Valley region has been marred by conflicts pitting the Pokot, Elgeiyo- Marakwet, and Tugen communities. Inter-community conflicts pose a substantial threat to the peace, stability, and prosperity of Kerio Valley region. The conflicts have had a negative effect on the livelihood and wellbeing of residents as well as the development of the region. Many lives have been lost, property destroyed alongside critical facilities like schools and health centres. Inter-community conflicts also undermine investment in Kerio valley region. Strategies implemented in the past to resolve inter-community conflicts have not succeeded in building sustainable peace.

Literature suggests that geo-factors, whose role is not well documented, play a role in escalation of conflicts. These are physical characteristics of a specific location that influence different aspects of human activities (Raza, 2023). Geo-factors include topography, climate, soil characteristics, natural resources, and water bodies (Brethouwer et al., 2022). Liao et al. (2023) opined that geo-factors such as water resources and climate have the potential of fuelling conflicts between communities. However there is limited research on the influence of these factors in the perennial Kerio Valley conflicts a gap that necessitated the study.

1.1 Research Objective

To assess the geo-factors that exacerbates inter-community conflicts in Kerio valley

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Environmental Scarcity Theory

The study was guided by the environmental scarcity theory by Thomas Homer-Dixon (Mason & Muller, 2007). In this theory, Homer-Dixon (1999) opined that scarcity of environmental resources can create civil violence as community compete for scarce resources. He advanced that inter-community clashes are likely to increase as scarcity of environment resources like arable land, freshwater and forest increases. The theory also proposes that clashes are likely to increase when the human population expands increasing strain on existing environmental resources (Masara, 2021). The third proposition is that clashes can also be created by unequal distribution of environmental resources leading to scarcity in some communities. Homer-Dixon (1999) further argued that the probability of environmental scarcity translating to conflict is moderated by state capacity to manage scarcity.

The theory's primary strength lies in its ability to link ecology to explain conflicts. It highlights the relationship between environmental stress and social response (Mahlakeng, 2023). However, the theory is often criticized for underplaying the role of political agencies and resilience in mitigating or exacerbating conflicts (Masara, 2021). The framework informed the study by directing the research regarding the geo-factors to focus on during data collection. The theory also helped to clarify why geo-factors like climate leads to conflicts as well as to identify the mechanism through which geo-factors triggers or exacerbates inter-community conflicts.

2.2 Empirical Review

According to Oprsal et al. (2016), geo-factors determine the ecological capacity of a given geographical area because they have a major bearing on land use including crop production and livestock production, land degradation, crop cover, and biodiversity of a given area. Jailly (2022) noted that topographical issues fuel disputes because they determine the resources available in a given locality. Brethouwer et al. (2022) observed that one of the factors that have contributed to conflict between Chinese and Indian communities in the Himalayan region is the accessibility and soil fertility of the borderland. The borderland is rich in mineral reserves including the world's largest zinc-lead deposits.

This implies that geo-factors such as soil fertility and soil composition have played a role in exacerbating the inter-community conflicts.

Liu (2021) observed that topographical feature of the Xinjiang region has contributed to the conflict between Uyghur community and the Han Chinese. The author noted that Xinjiang is the largest region in China accounting for about a sixth of country's total land mass. The vastness of the territory makes it easy for community militias to operate and evade government authorities. The region also is located on China's border with India, Pakistan, Afghanistan, Kyrgyzstan, Tajikistan, Kazakhstan, and Mongolia. Since the borders are fluid, it is easy for community militias to hide across borders after committing atrocious acts. The Xianjiang region is also rich in natural gas and crude oil that have given rise to conflict over these resources. Medina et al. (2023) documented that the swelling of Lakes Baringo and Bogoria had exacerbated conflicts among communities residing in Baringo County by diminishing land available for livelihood activities.

The fertility of the soil in borderland region can create competition for control over the borderland territories among neighbouring communities leading to border conflicts. Depetris-Chauvin and Özak (2021) observed that most border conflicts in Africa are concentrated on borders with higher agricultural potential. This support the notion that competition for lands with agriculturally productive soil is a major drive of border conflicts in Africa. Jong et al. (2021) noted that increased demand for food has transformed how people utilize land even causing conflicts in several locations. Zuo et al. (2022) observed that environmental damages such as soil degradation were partly responsible for emergence of land use conflicts in central mountain region of China.

Depetris-Chauvin and Özak (2021) advanced that drastic changes in climatic condition may explain why communities are defying historical ethnic borders leading to non-civil conflicts. Depetris-Chauvin and Özak (2021) observed that most conflicts in Africa are concentrated on borders with higher agricultural potential. Given that agriculture in most parts of Africa is rain-fed, suitable climatic conditions marked by reliable rainfall could provide an incentive for neighbouring communities to claim control of the borderlands. Kim and Garcia (2023) observed that climate change can lead to emergence of border conflicts through several pathways including interference with livelihood options, migration, altering government arrangements, and escalating existing conflicts.

The study by Diallo and Tapsoba (2022) found that climate shocks such as floods or droughts increased the probability for conflicts by as much as 38 percent in a sample of 51 African countries. The shocks have become more frequent and more severe in recent years. The study by Froese and Schilling (2019) observed that climate change does not affect all communities equally. Not all communities migrate due to changes in climatic patterns. The nexus between climate change and border conflicts is moderated by the level of resilience of the communities involved. This perspective highlights the need for a study focusing specifically on the Kerio Valley context.

Water resources is another geopolitical factor that can cause or exacerbated conflicts between communities. Liao et al. (2023) found that the allocation of water resources in China had become intense fuelling conflicts in the watershed and mountainous environments. Depetris-Chauvin and Özak (2021) found that presence of water bodies can exacerbate as well as reduce inter-community conflicts. On one hand, the presence of rivers and other water bodies in an area increases the significance of the ethnic borders and could be a driver for border conflict. Presence of water sources in the border areas creates an incentive for the neighbouring communities to exploit and control them. On the other hand, presence of a water body like a river on historical ethnic border may reduce the fuzziness of the border making it more tangible leading to low possibilities of border conflicts.

The study by van Weezel (2019) found a nexus between climate and conflicts between communities in Kenya and Ethiopia. In particular, results showed that there was a link between precipitation levels and conflicts between communities. The findings also support the point that geo-factors can play a role in shaping conflicts. Njoka et al. (2022) also opined that conflicts among the pastoralist communities in the northern parts of Kenya has been exacerbated by declining rainfall that evolve into prolonged drought. This climatic pattern causes scarcity of pasture and water leading to heightened competition for these resources.

Boitt et al. (2020) found that most of the top soil in Kerio Valley region had been washed away following heavy rains leading to excessive soil degradation. The washed sediments were deposited in Lake Kamnarok threatening the extinction of this oxbow lake. The degradation of the soil in the valley have diminished agricultural productivity in the region increasing competition for food and other resources. This is likely to be a cause of conflict in the area. D'Amico et al. (2022) also observed that the Elgeyo-Marakwet and Baringo parts of valley escarpment and floors had experienced change in vegetation from mountain rainforests into corn, hay, and tea fields. Cultivated crops have replaced natural vegetation leading to extreme soil erosion that has converted the areas into a semi-desert habitat.

III. METHODOLOGY

3.1 Research Design

The study adopted a cross-sectional research design. The study used quantitative and qualitative approaches in data collection where a questionnaire was administered to the respondents and key informants interview conducted.

3.2 Study Area

The study was conducted in Kerio Valley region, a triangle shaped basin that touches three different counties: Elgeiyo-Marakwet, West Pokot, and Baringo and serves as a natural borderline for these counties (Boitt et al., 2020). It lies between the Cherangani Hills, Elgeiyo Escarpment, and Tugen hills measuring 80 kilometres long and 10 kilometres wide at its broadest section (Aiyabei, 2021). The valley is about 1,200 metres deep with the Elgeyo Escarpment having a height of about 1,830 metres. The valley is home to four major ethnic communities namely; the Keiyo, Marakwets, Pokots, and Tugens (Boitt et al., 2020). The Pokots are primarily pastoralists with a nomadic lifestyle while the other three ethnic groups have a relatively sedentary lifestyle that combine crop farming and livestock rearing. The vegetation in the valley varies from place to place but most of the slopes are dominated by semi-tropical vegetation while the valley floor is dominated by thorny bushes. Kerio Valley has been classified as an arid area because it is typified by erratic rainfalls of about 860 millimetres per annum (Aiyabei, 2021). The choice of the study area was informed by the existence of persistent inter-community conflicts between the Keiyo-Marakwets, Pokots, and Tugens. Consequently, the area provided a suitable location for studying the nexus between geo- factors and inter-community conflicts.

3.3 Target Population

The target population was all households' living along the Kerio Valley and all conflict management practitioners working in the Kerio Valley region including local and regional administration officers, community elders, ward representatives, representation of local and international NGOs operating in the area, and representative of government agencies like KVDA.

3.4 Sampling and Sample Size

The sample size for the study was determined using the Cochran (1963) formula, which was selected because it provided as a mathematically rigorous method for determining a representative sample within a large and diverse population where the total count is not known. The p value represents the estimated proportion of the population that possessed the traits being studied.

$$n_0 = \frac{Z^2 pq}{e^2} \quad (1)$$

Where:

n is the desired sample size

e is the margin error,

p is the proportion of the population which has the attribute in question, if proportion is unknown, set $p=0.90$, which is the maximum variability

q is $1 - p$.

$$n = \frac{(1.96)^2(0.9)(1-0.9)}{(0.05)^2} = 138 \text{ households}$$

The 138 household were selected using the clustered random sampling. The study used the administrative locations within the region as clusters because location is internally heterogeneous in terms of livelihood, economic status, and conflict exposure. Two locations were picked from the Keiyo-Marakwet side, another two from the Pokot side and an addition two from the Tugen side. This method increased the representativeness of the sample by giving all members of the population an equal opportunity to participate. It also ensured that the sample encompasses respondents from diverse geographical locations. Within household, the at-home selection methods were used to pick a respondent. This method entailed selecting an adult (above 18 years) who was present at the household at the time of the study and, where there was more than one adult. This is a random selection approach that allowed the researcher to obtain diverse category of respondents in terms of age, gender and education level leading to diversity of views (Marlar et al., 2018). The conflict management practitioners (key informants) were selected using purposive sampling based on their expertise and experience in managing conflict in the region. This data was used to cross-validate the data gathered from the households.

3.5 Data Collection Instruments and Procedures

A questionnaire was used to collect data from 138 householdheads. Key informant interviews were conducted with 15 practitioners in Kerio Valley region. Validity of the instruments was enhanced by conducting a thorough review of literature before designing the instruments. The researcher also obtained input from the university research supervisor regarding the content and structure of the instruments. The use of multiple method of data collection also enhances

validity by enabling triangulation. A pilot study was also conducted in two locations within Muhoroni-Tinderet area to assess the instruments capacity to generate data that is relevant, accurate, and comprehensive enough to address the objectives of the study. The pilot test data was used to assess whether participants understood the questions as intended. Several ambiguous questions were identified and restructured. The pilot data was also used to determine whether the instruments cover all aspects of the variables being measured. The pilot study data was analysed using the Cronbach alpha method to determine the reliability of the instruments. The analysis yielded a Cronbach's alpha coefficient of 0.726 indicating acceptable reliability.

3.6 Data Analysis

Information gathered was analysed using descriptive statistics where frequencies and percentages were used to summarize data on each variable. Qualitative data collected through the interviews with the conflict management practitioners was analysed using the thematic analysis technique. The technique entailed identifying key issues highlighted in each interview and then bringing together frequently recurring issues to form themes and patterns. Deductive method of coding was used where the analysis began with predefined sets of codes that was assigned to new qualitative data.

3.7 Ethical Considerations

An introduction letter from Egerton University to NACOSTI was obtained. Afterwards, a permit to carry out research was obtained from National Commission of Science Technology and Innovation (NACOSTI). Informed consent was sought from all participants before the commencement of data collection exercise. Respondents were informed that it is their right to choose whether to participate in the study or not and even withdraw from the study at any time. Confidentiality and anonymity were maintained at all times.

IV. FINDINGS & DISCUSSION

4.1 Response Rate

Results in Table 1 shows that for questionnaire respondents, 122 out of the 138 targeted individuals participated. This figure resulted in a response rate of 88.4% which according to Sataloff and Vontela (2021) is excellent for data analysis and reporting. Seven of the household heads that were approached refused to participate while nine of the nonresponses were due to questionnaires that were left out of the analysis due to many questions were not answered.

Table 1

Response Rate

Category of Respondent	Number Targeted	Number Responded	Response Rate
Questionnaire respondents	138	122	88.4%
Key Informant Interviewees	15	11	73.3%

4.2 Geo-Factors that Exacerbate Inter-community Conflict in Kerio Valley

Results in Table 2 shows that 68.0% of the respondents believed that the landscape of Kerio Valley exacerbate conflict in the region by hampering the ability of law enforcement agencies to access certain areas. The terrain acts as a natural barrier that complicates law enforcement efforts, contributing to the persistence and escalation of conflicts. An overwhelming 89.3% of respondents agreed that the landscape in Kerio Valley provides ample hiding spots for combatants. Thus, majority of the respondents were of the view that terrain exacerbates conflict mainly by providing hiding places for combatants. These results are consistent with the study by Medina et al. (2023), which indicated that the landscape in Baringo characterized by swelling of Lakes Baringo and Bogoria had increased conflicts among community by diminishing Agricultural land.

The respondents' perspectives underscore the significant influence of geo-factors in intensifying inter-community conflicts in Kerio Valley, a phenomenon that aligns closely with the Environmental Scarcity Theory. This theory, as articulated by Homer-Dixon (1999), posits that states capacity to manage environmental scarcity can reduce or increase the probability of inter-community conflicts. The respondents highlighted how the rugged landscape hampers law enforcement efforts by creating natural sanctuaries for raiders, which is supported by Kipchumba (2019), who describe how steep slopes and rocky terrain facilitate concealment and prolong conflicts.

About 78.7% of the respondents believe that the soil type in Kerio Valley negatively impacts food production, which exacerbates conflicts over scarce resources. Poor soil quality, which may be sandy, rocky, or infertile, limits the ability of local communities to grow sufficient crops and sustain livestock. According to 77.0% of respondents, soil quality also hampers pasture production, which worsens inter-community conflicts. The results are consistent with Boitt et al. (2020) and Zuo et al. (2022), who noted that soil degradation and erosion, exacerbated by climatic variability, reduce land productivity, heightening tensions over the remaining fertile areas. Conversely, fertile soils in certain

locations support better livelihoods but can also become focal points of competition, aligning with the environmental scarcity theories view that resource scarcity and uneven distribution fuel conflict. Homer-Dixon (1999) environment scarcity theory opines that degradation of soil exacerbates conflicts by reducing an areas carrying capacity forcing pastoralists to cross contested ethnic borders.

An overwhelming 95.1% of respondents identified frequent droughts as a major driver of conflicts in Kerio Valley. Drought conditions lead to critical shortages of pasture and water, essential for livestock and human consumption. The study by van Weezel (2019) reinforces this, linking declining rainfall and persistent drought conditions to heightened resource-based tensions among pastoralists. This scarcity of water and grazing land, often shared among neighbouring communities, increases the likelihood of disputes, as communities struggle to secure their livelihoods; an outcome emphasized by Homer-Dixon's assertion that environmental scarcity exacerbates social vulnerabilities and conflicts. Climatic variability, including unpredictable rainfall and changing weather patterns, exacerbates environmental scarcity by disrupting traditional resource availability and prompting herders to move their livestock in search of better pastures. These movements often lead to territorial disputes, especially near natural features like the Kerio River, whose course can shift due to climate change, further complicating territorial boundaries. Studies by Lee and Tanaka (2016) support that climate-induced environmental changes can alter natural borders, heightening conflict risks.

About 84.4% of the respondents perceive water scarcity as a significant cause of inter-community conflicts in Kerio Valley. Water resources, in particular, are critical, as their scarcity and uneven distribution directly influence conflict intensity. In Kerio Valley, dependence on seasonal rivers and shared water points, which become dry or contested during droughts, heightens tensions among communities. This scenario aligns with Homer-Dixon's argument that environmental scarcity, especially of vital resources like water, can lead to violent clashes when access becomes limited and competition intensifies. Kipchumba (2019) reports that during dry seasons, residents often travel over 25 kilometers to access water, leading to conflicts as different groups compete for these limited supplies. Similarly, Kipchumba (2019) describe how water stress in West Pokot County, driven by heavy cold air flows and climatic factors, has historically resulted in raids and displacement, exemplifying how resource scarcity fuels violence. Studies from other regions, such as Yemen and China, further underscore this point.

Table 2

Views of Geo-Factors Influence Inter-community Conflicts in Kerio Valley

Statement	Number of responded (%)
The landscape in this area have contributed to the rise of conflict by making the area inaccessible to law enforcement	68.0
The area landscape has escalated conflicts in the area by making it easy for combatants to hide	89.3
The soil type has exacerbated conflicts by making the area unable to produce food that is enough for everyone	78.7
The soils in the area have worsened conflicts by making the area unable to produce adequate pastures	77.0
Frequent droughts lead to scarce pasture leading to conflicts	95.1
Water scarcity in the area is a major cause of conflict witnessed in the area	84.4

Figure 1 shows that environment pressure associated with drought is the most significant geo-factor contributing to inter-community conflict in Kerio Valley region. Specifically, drought propagates conflict by causing shortages of pasture and water, essential for livestock. When these resources become scarce, communities often compete fiercely for access, which escalate into conflicts. These findings align with those of Diallo and Tapsoba (2022), which indicated that climate shocks such droughts increased the probability for conflicts by as much as 38 percent in a sample of 51 African countries. Drought, rainfall pattern and climate change also emerged as a popular theme during the interview with 10 out of the 11 interviewees (90.9%) mentioning these as some of the factors that contribute to climate in the region. These interviewees describe the climate of the region as hot and dry with unpredictable or seasonal rainfall. Long dry spells, droughts, and intense or short rains create environmental stress, reducing water availability and pasture quality. For example, Interviewee 9 narrated that:

“These area experiences droughts that last for months, affecting animal health and prompting herders to move constantly, which can lead to clashes over grazing routes. The hot climate increases competition for limited resources, intensifying conflicts especially during dry seasons”. (Respondent 9, 11 November 2025).

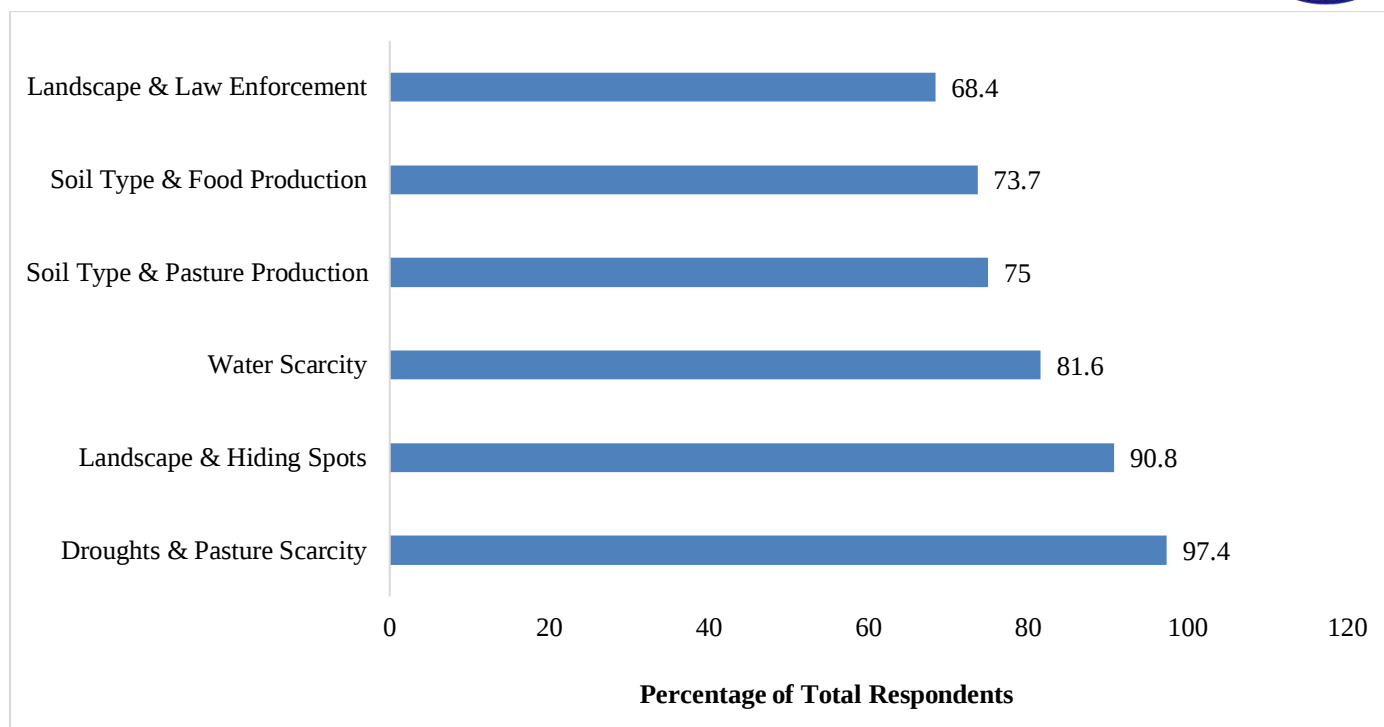


Figure 1
Ranking of Geo-Factors that Exacerbate Inter-community Conflicts

The second most significant geo-factor is the landscape, which according to 90.8% of the respondents exacerbate conflict by providing hiding spots for combatants. The terrain's natural features, such as caves, thick bush, or rocky outcrops, create ideal concealment for groups engaged in conflict. This makes it difficult for security forces to locate and apprehend those involved, thereby prolonging disputes and escalating violence. Landscape was also frequently recurring theme during the interviews having being mentioned by 9 (81.8%) of the interviewees. These interviewees described the landscape as rugged, hilly or rocky, with some noting gentle slopes or flat areas. The rugged and hilly terrain, as noted by multiple respondents, facilitates ambushes, hideouts, and escape routes for attackers, making security operations difficult. Interviewee 7 highlighted that

Hills and valleys enable surprise attacks and ambushes. The terrain's remoteness and natural caves create safe havens for raiders and combatants, perpetuating cycles of violence and attacks. (Interviewee 7, 8 November 2025).

These findings strongly align with the assertions of Jaily (2022), who argued that topographical issues fuel disputes because they dictate resource accessibility and create tactical boundaries in a given locality. The strategic exploitation of the physical environment by local militias in the Kerio Valley mirrors the dynamics observed by Liu (2021) in the Xinjiang region, where vast, rugged terrains and fluid geographical borders allow community militias to operate freely, launch surprise incursions, and easily evade government authorities. Furthermore, the findings coincide with observations by Medina et al. (2023) regarding Baringo County, where topographical changes and geographical features altered the physical landscape, compressed available territory, and heightened inter-community vulnerabilities.

Similarly, the landscape also serves to weaken institutional mitigation efforts. According to 68.4% of the questionnaire respondents and 8 out of 11 interviewees (72.7%), the rugged terrain and steep slopes make it difficult for security personnel to patrol and respond swiftly to conflict situations (Figure 1). This operational disadvantage directly undermines state authority. This was explicitly captured during the interviews, where Interviewee 11 noted:

"The remoteness and difficult terrain hinder access and law enforcement response. The land terrain is rugged, dissected and inaccessible making it difficult to combat the attackers." (Interviewee 11, 12 November 2025).

This structural challenge supports Thomas Homer-Dixon's Environmental Scarcity Theory, which posits that the probability of resource stress translating into violent conflict is heavily moderated by state capacity to manage and police geographical areas. In the Kerio Valley, the physical landscape effectively cripples this capacity, lowering the risks of legal retribution for combatants.

The third most important geo-factor is water scarcity. Limited access to clean and sufficient water sources affects daily life, agriculture, and livestock rearing. As water becomes increasingly scarce, communities are forced to compete for the dwindling supplies. Water scarcity was also a consistent theme across the interviews having been mentioned by 10 interviewees (90.9%). It emerged that most communities depend on seasonal rivers, boreholes, or shared water points that often dry up or are contested. Interviewee 6 narrated the following: Water resources are limited

and unreliable in these areas. Most communities rely on seasonal rivers, shallow wells, or boreholes that frequently dry up. Water scarcity often leads to clashes at shared water points. Interviewee 6, 8 November 2025)

Interviewee 10 also highlighted the following.

Water is very limited forcing communities to rely on few boreholes and seasonal rivers. People queue for hours at a single water point. Livestock often drink from the same sources as people, creating conflict. (Interviewee 5, 7 November 2025)

Further underscoring this pressure, Interviewee 10 highlighted how resource overlap exacerbates the crisis:

Water is very limited forcing communities to rely on few boreholes and seasonal rivers. People queue for hours at a single water point. Livestock often drink from the same sources as people, creating conflict." (Interviewee 10, 7 November 2025).

These field dynamics are structurally explained by the Environmental Scarcity Theory, where Homer-Dixon (1999) advanced that inter-community clashes inevitably surge as fresh water and arable lands decrease. Regionally, these results conform to empirical literature by Njoka et al. (2022), who observed that conflicts among pastoralist communities in northern Kenya are severely exacerbated by prolonged droughts that deplete water sources and induce aggressive competition for the remaining hydrologic features.

The dual nature of water bodies in border conflict zones highlighted by Depetris-Chauvin and Özak (2021) is clearly visible in the Kerio Valley. While rivers can demarcate clean ethnic borders, their presence also serves as a high-stakes incentive for neighbouring pastoralist communities to attempt territorial captures. This reflects the global trend reported by Liao et al. (2023), who found that intense structural allocations of water resources within mountainous and watershed environments consistently trigger intense communal friction.

Soil type also plays a role in exacerbating conflict mainly by affecting the production of pasture. Poor soil conditions limit pasture availability, leading to competition among pastoralists and farmers for grazing land. As resources become scarcer, conflicts over access intensify, sometimes resulting in violent clashes. Soil type also exacerbates conflicts by shaping the production of food for human consumption. Poor soil quality hamper the production of food leading to disputes over arable land and food resources, especially in times of environmental stress. The inability to produce enough food increases tensions, as communities struggle for survival, often resorting to conflict to secure access to limited resources. Soil fertility was mention as an important factor in 7 out of 11 interviewees (63.6%). Most of the respondents describe the soil in the area as not fertile and cited major land degradation.

The soil is mostly sandy and not very fertile, making farming difficult. It supports only certain types of grass, which are important for grazing. (Interviewee 6, 8 November 2025)

Soils in these regions are not fertile, mostly dusty and hard. They do not support farming, which leaves livestock as the only source of livelihood. (Interviewee 9, 11 November 2025)

These responses directly validate the local evaluations of Boitt et al. (2020), who documented that heavy, erratic downpours in the Kerio Valley wash away the topsoil, causing catastrophic soil erosion and severe land degradation that ultimately suppresses agrarian yields. This conversion of natural vegetation zones into heavily degraded, semi-desert habitats as corroborated by D'Amico et al. (2022) systematically removes livelihood options. This drop in carrying capacity forces communities to aggressively dispute remaining productive pockets, a reality mirrored globally in China's mountain regions where environmental soil degradation directly causes intense land-use conflicts.

However, qualitative findings also revealed micro-geographical variation. A minority of key informants reported that soils are generally fertile especially along valleys with silt deposits that support crop cultivation and pasture growth. Interviewee 3 narrated that

The soil in the area is fertile and this enables growth of pasture. Farmers in this region plant their crops without adding any manure. (Interviewee 3, 6 November 2025)

These findings suggest that soil fertility in Kerio Valley region varies from location to another. Some locations are characterized by dusty and rocky soil that does not support crop farming. Others are typified by fertile silt that supports crop production.

This internal contradiction highlights how soil factors drive conflict through two distinct pathways: absolute environmental scarcity (due to sandiness and erosion) and unequal distribution of highly fertile spots. This dual reality aligns with Oprsal et al. (2016), who proved that biophysical geo-factors govern the ecological capacity, biodiversity, and agricultural potential of historical landscapes.

Because areas with high agricultural potential offer higher return, they turn into highly contested targets for border expansion. This pattern matches Depetris-Chauvin and Özak (2021) findings that African inter-community conflicts are heavily concentrated around borderlands with superior soil fertility and agricultural potential. Combined with rising food demands forcing land modifications (Jong et al., 2021), soil variation directly turns specific green zones in the valley into localized conflict flashpoints.

The landscape and law enforcement was the least frequently cited factor by the questionnaire respondents. According to 68.4% of the respondents, the rugged terrain and steep slopes make it difficult for security personnel to patrol and respond swiftly to conflict situations. This issue also emerged during the interview where Interviewee 11

mentioned that:

The remoteness and difficult terrain hinder access and law enforcement response. The land terrain is rugged, dissected and inaccessible making it difficult to combat the attackers. (Interviewee 11, 12 November 2025).

Both qualitative and quantitative findings support the position that geographic factors such as landscape, water scarcity, soil fertility, and climate are key drivers of conflict in Kerio Valley. The most important geographical factor is climate that determines availability of food, water and pasture for livestock.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The study concludes that geographic factors play a significant role in exacerbating inter-community conflicts in Kerio Valley. The rugged landscape, including hills, caves, and dense vegetation, provides natural hideouts for armed groups and complicates law enforcement activities. Environmental stressors such as droughts, water scarcity, and soil degradation further intensify resource-based disputes, leading communities to compete more aggressively for water, pasture, and arable land. These environmental challenges, aligned with environmental scarcity theory, perpetuate conflict cycles and deepen community divisions.

5.2 Recommendations

Based on the findings of the study, policymakers at the national and county governments and stakeholders in Kerio Valley may consider investing in environmental management projects that address land degradation, water scarcity, and environmental stresses. This includes sustainable resource use, terracing, reforestation, and irrigation to enhance the valley's carrying capacity and reduce competition for environmental resources. There is also a need to diversify the economic activities in the area away from pure pastoralism to enhance the resilience of the communities to environmental stressors. The national and county governments should also consider providing targeted interventions such as livelihood restoration to address the stressors created for geo-factors. There is also a need for infrastructure development in the area to neutralize terrain advantage currently being exploited by warring factions thereby restoring state authority in the area.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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