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Exploring the Nexus between Climate Hazards and Conflict in Lamu County: Implications for Community Adaptation Action Plans

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Abstract

This paper investigated the complex relationship between climate change and security in Lamu County, with focus on community perceptions, vulnerabilities, and adaptation strategies. The study utilized a participatory approach involving Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) to gather insights from diverse community members. Results revealed a growing recognition of climate change as a significant factor amplifying security risks, including resource-based conflicts, food and water insecurity, pest and disease outbreaks, and rising sea levels. The analysis of historical climate data indicated shifts in rainfall patterns and rising temperatures, exacerbating these hazards. Furthermore, it underscores the need to mainstream climate change actions across various sectors for sustainable development and human security. Lamu County in Kenya faces a myriad of security challenges stemming from climate change, with the community perceiving droughts, pests, diseases, and conflicts as prominent hazards. These climatic impacts have led to crop failures, livestock losses, water scarcity, property damage, displacement, and instability. Local adaptation strategies have shown varying degrees of effectiveness, highlighting the need for community-specific and sustainable solutions. The study identified local adaptation strategies and emphasized the importance of early warning systems, informed decision-making, and mainstreaming climate change actions across sectors to enhance human security and sustainable development. However, it also acknowledges limitations in community participation and suggests future research avenues to ensure the inclusion of marginalized voices in such studies.

Keywords

Kenya, Climate Changes and Adaptation, Pollution, Climate Hazards, Conflict, Security, Temperature, Rainfall, Sea Level, Lamu County

1. Introduction

The researchers have studied the potential correlation between climate change and security for numerous years. Nonetheless, despite the mounting attention directed towards the intersection of climate change and security, there persists an ambiguity concerning the mechanisms connecting climate change with conflicts rooted in resource disparities. This uncertainty is brought partially by the complexity of climate change projections [1].

This research aimed at analyzing the community's perceptions concerning the interconnectedness of climate change and climate hazard security in Lamu County, Kenya. Climate change and the scarcity of both natural and human resources are being increasingly recognized as factors that amplify the dangers and challenges that worsen current social issues like poverty, inequity, lack of social safety, aggression, terrorism, and even civil conflicts. Among resources, natural resources are both abundant and contentious, leading to diverse conflicts on a global scale [2]. Literature on climate change suggests that current increase in greenhouse gasses from humans' activities and natural events have contributed to high rise in the average global temperatures beyond levels of the pre-industrial era [3]. In 2014, the global concerns regarding security and conflict gained international policy attention when the Intergovernmental Panel on Climate Change (IPCC) incorporated a section on human security within its 5th assessment report. This marked the initial recognition that climate change is eroding the livelihoods of many vulnerable communities worldwide [4]. The increase of mean global temperatures leads to global warming, which in turn has implications for changes in the rainfall patterns, the rise of sea levels, and the occurrence of prolonged and persistent drought conditions.

Lamu has experienced a series of severe climatic occurrences, including periods of droughts, high temperatures, rising sea levels, as well as the proliferation of human, livestock and crop diseases. These events have posed significant threats to the livelihoods of the local people. The repercussions of irregular and delayed rainfall have translated into reduced productivity, primarily due to prolonged droughts leading to crop failure, scarcity of animal fodder, and the degradation of inshore fish breeding sites within the County. The inadequate condition of road infrastructure has resulted in escalated input expenses and restricted access to vital resources, markets, and extension services [5]. Additionally, several security challenges due to terror attacks have disrupted livelihood activities, thereby weakening the capacity of the community to withstand diverse hazards [6] [7].

An assessment of historical climate data indicates a substantial shift in the county's climate over the past forty years. During this period, the *"short"* rain season from October to December (OND) has shown an increase, while the reliability and predictability of the *"long"* rain season from March to May (MAM) have diminished, accompanied by variability [8]. Concurrently, temperatures in the Indian Ocean have risen by 0.2˚C per decade. These alterations in climate patterns have contributed to a state of insecurity. As an example, in 2016, approximately 40% of children under the age of 5 experienced malnutrition due to poor agricultural productivity, disrupted fishing activities, water scarcity, and livestock losses among others [9] and [5]. These hazards have led to increased instances of crop failures, livestock mortalities, water shortage, pests and diseases, destruction of property, loss of vegetation, human displacements and insecurity. At extreme times, these have resulted in human injuries and loss of lives.

This study aims at exploring the interlinkages between climate hazards and security. It takes into consideration the use of weather and climate information to inform planning and decision making. The nexus between climate hazards and security in Lamu County represents a critical area of study with broad implications for sustainable development, human well-being, and regional stability. The study also serves to inform the ongoing and planned programs and projects and to encourage mainstreaming of climate change actions across various sectors.

1.1. Methodology

1.1.1. Data

The rainfall and temperature data was obtained from the Kenya Meteorological Department through http://kmddl.meteo.go.ke:8081/maproom/, while the sea level rise data was obtained from the Climate Change Knowledge Portal https://climateknowledgeportal.worldbank.org/.

1.1.2. Area of Study

The study was conducted within Lamu County between the months of May-June 2023. Lamu is located on the northeastern coast of Kenya. The County shares its borders with Garissa County to the northern side, Indian Ocean to the south and southeast, while Tana River to the southwestern and western directions. The County is Sub-divided into two Sub-Counties *i.e.* Lamu West and Lamu East. The two Sub-counties consist of 10 wards *i.e. Faza, Kiunga, Basuba, Hindi, Mkomani, Bahari, Witu, Shella, Mkunumbi and Hongwe* which were considered as study areas. According to the Kenya National Bureau of Statistics 2019 [10], Lamu County has an estimated population of 143,920 individuals, consisting of 76,106 males and 67,813 females. Approximately 73% of the county's population reside in the rural areas while the remaining 27% live in urban areas. On average, there are about 3.7 persons per household. According to the Köppen-Geiger climate classification, Lamu County falls within the categorization of a hot climate, specifically situated between Tropical Monsoon and Arid Steppe classifications [11].

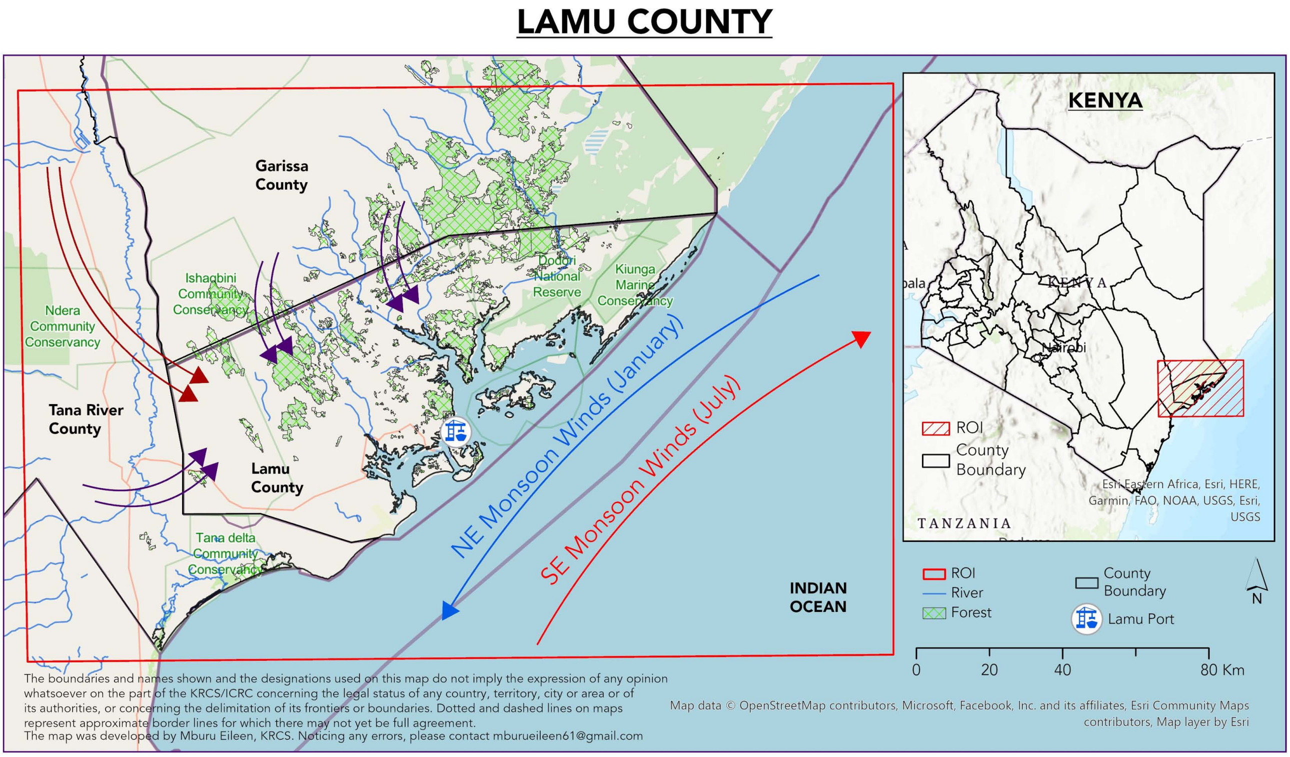


Figure 1. Area of study, Lamu county. The blue arrow shows the general flow of the North East Monsoon winds during January, Red arrow shows the general flow of the South East Monsoon winds during July, Dark purple arrows symbolize the movement of the pastoralist.

The Coastal Kenyan counties **Figure 1** experience a shift in weather patterns throughout the year. From November/December to early March, the prevailing Northeast (NE) Monsoon brings relatively dry conditions. Moving into March and April, the wind changes direction to east-to-south easterly, carrying moisture-laden air from the Indian Ocean, resulting in substantial rainfall. As the calendar progresses to May, June, July, and August, the influence of the Southeasterly (SE) Monsoon becomes more pronounced, leading to increased weather stability, overcast skies, and relatively cooler temperatures. Between September and November, the Northeast Monsoon gradually makes a comeback, and by December, the northern influence regains dominance [12] [13].

1.1.3. Methods and Data Collection

A comprehensive methodology was employed to gather and analyze data through a combination of qualitative and quantitative approaches, aiming to enhance the understanding of climate hazards, security, and community resilience. The study utilized two distinct yet complementary data collection methods; Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). FGDs served as a crucial platform for community members to openly share their valuable perspectives, personal experiences, and adaptation strategies in response to climate hazards and security concerns. Through these FGDs, qualitative insights were gained, allowing for the identification of community-specific vulnerabilities.

In parallel, the KIIs provided an in-depth interview with key county stakeholders, including local authorities and experts. Data analysis and interpretation were carried out through the use of tables, charts, and graphs, enabling the extraction of meaningful insights from the collected data. The methodology was structured into stages. It began with the preparation of background materials, which included the compilation of essential information about the community. Additionally, a review of existing literature on climate change and hazards was conducted. The subsequent stage involved the detailed analysis of climate change and hazards. This encompassed the identification and application of local knowledge, participatory mapping of hazards, and the creation of a seasonal calendar to pinpoint events and periods characterized by hazard-related stress. The prioritization of hazards was an essential step in this process.

Following the hazard analysis, a vulnerability assessment was conducted. This involved an analysis of vulnerable livelihood assets and resources, coupled with the identification of the specific impacts of hazards on the community. The outcomes of this assessment were synthesized into a vulnerability matrix, providing a quantitative representation of vulnerabilities within the community.

Subsequently, the research explored adaptation strategies. This included the identification of additional responses necessary to cope effectively with climate hazards and their associated impacts. A review of climate change scenarios, the identification of community adaptation goals, and the consideration of potential obstacles and opportunities were all integral components of this stage. The co-benefits of adaptation strategies were also assessed, specifically focusing on the environmental and socioeconomic advantages that could be derived from these strategies. A matrix was developed to document the diverse co-benefits associated with different adaptation measures.

Finally, the research developed community adaptation planning. An action plan was also co-developed with the community, outlining various activities for individuals, groups, the broader community, and other stakeholders.

1.1.4. Participatory Tools and Techniques Used in the Study.

The data collection began with a series of meetings to conceptualize and establish collaborations with key stakeholders. Subsequently, a one-day inception meeting was held with the Technical Working Group (TWG), followed by a four-day training session. This training aimed to strengthen the TWG's understanding and expertise in data collection. The data collection process was conducted with precision and inclusivity, as the team divided into five groups, each covering two wards over four days. A total of 229 **Figure 2** community and 19 KIIs participants participated. To ensure a good representation from diverse segments of the community, youths, women, men, elderly, and Persons Living with Disabilities (PLWD) were involved. The FGD and KIIs were employed as the primary methods for data gathering, with a particular emphasis on gender considerations to acknowledge unique vulnerabilities and contributions in climate-related

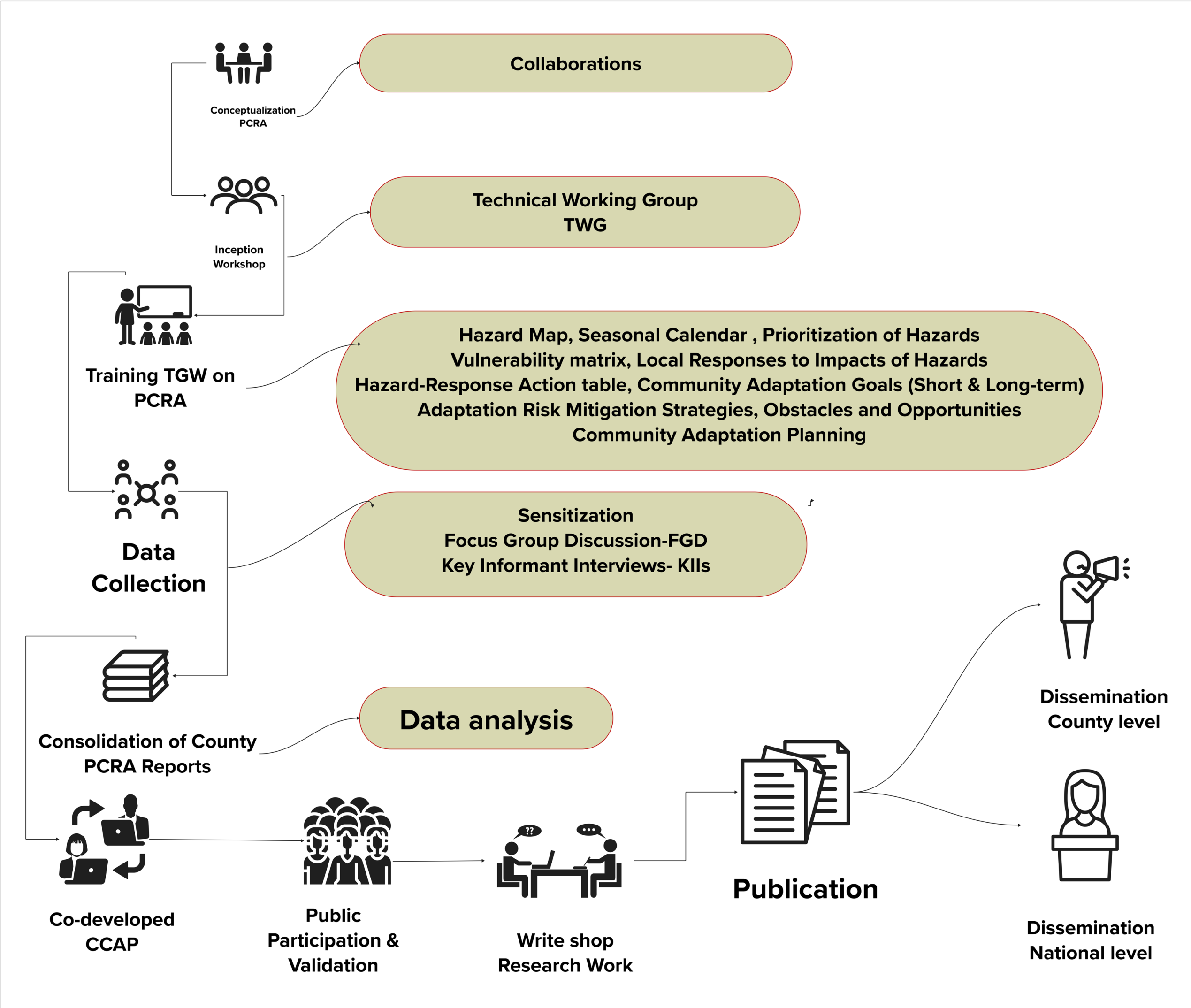


Figure 2. Lamu county, participatory tools and techniques used in the study.

challenges. After gathering data from all ten wards, the team convened a four-day meeting to consolidate the findings into a comprehensive county report. Data analysis was undertaken to derive valuable insights from the collected community information, enabling the identification of prevailing climate risks and their potential impacts on the county's social, economic, and environmental aspects.

1.1.5. Community Climate Hazard Conceptual Framework

The schematic conceptual framework depicted on Figure 3 illustrates the linkages between climate change and its impacts on the local community. The hazards arising from climatic change includes both direct and indirect consequences. In response to these challenges, the local community must have local adaptive measures that are not only effective but also sustainable. This necessitates the formulation of a comprehensive framework encompassing short-term and long-term goals, for the development of the community climate change

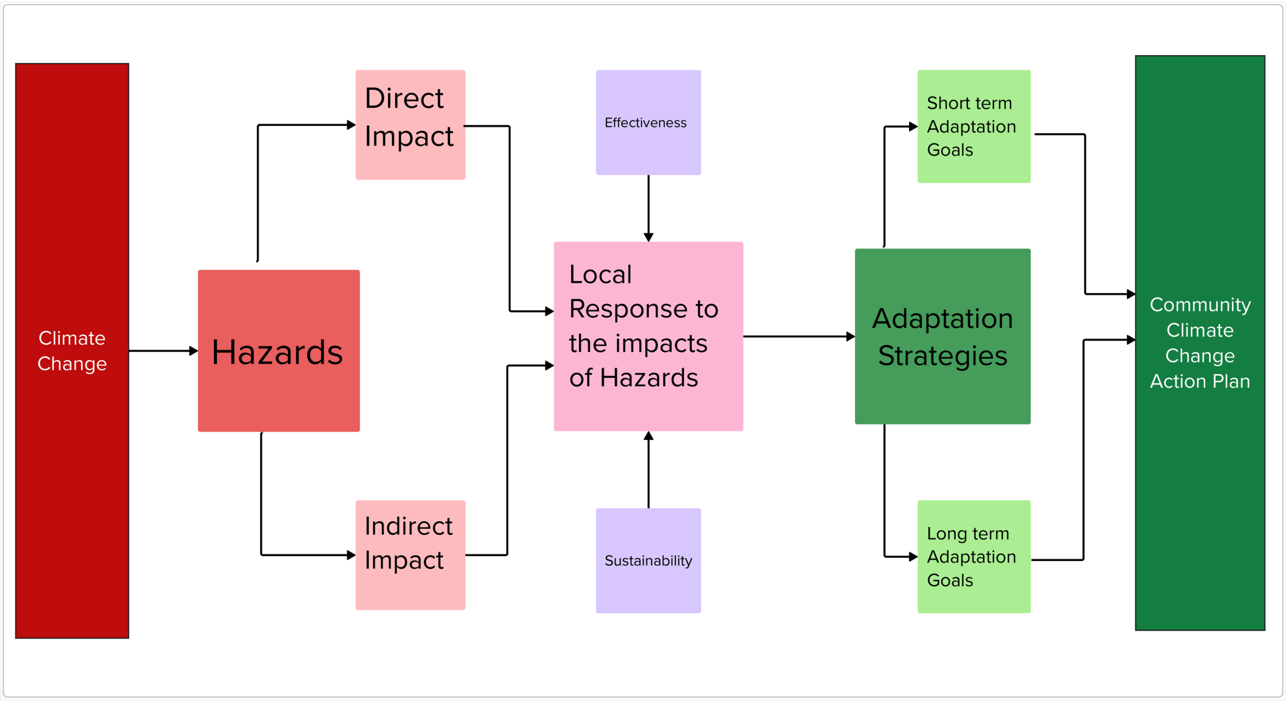


Figure 3. Lamu Ward basic conceptual framework of impacts of the climate hazards on the community.

mitigation and adaptation action plan.

2. Results

It was observed by the community that seasonal events have changed over the years in terms of timing and intensity Figure 4. Communities stated uncertainty in rainfall patterns making it difficult to plan farming calendar. This in many cases have resulted in the reduction of size of land under cultivation over the years with the majority of farmers not knowing the perfect timing for the farming activities. Rainfall has diminished over the years reducing the planting and even the harvesting period. It was also noted that during the dry season Lake Kenyatta dries up resulting in resource-based conflicts, due to lack of enough water [5] [8].

Figure 5 shows the segregation of the Lamu county community participants on gender, PLWD distribution and age. 229 total community participated whereby 157 were male while 73 were women.

2.1. Climate Hazards Impacting Lamu County's Community

Based on the community participatory climate risk assessment conducted in the 10 wards of Lamu County, the following hazards were identified and prioritized based on their frequency and severity of impact on people and resources (Table 1). In Shella Ward, the prioritized hazards were drought, storms, and pests and diseases. Basuba Ward prioritized drought, livestock diseases, and human-wildlife conflict. Hindi Ward identified drought, human diseases, and crops/livestock pests and diseases. Hongwe Ward prioritized drought, floods, and conflict.

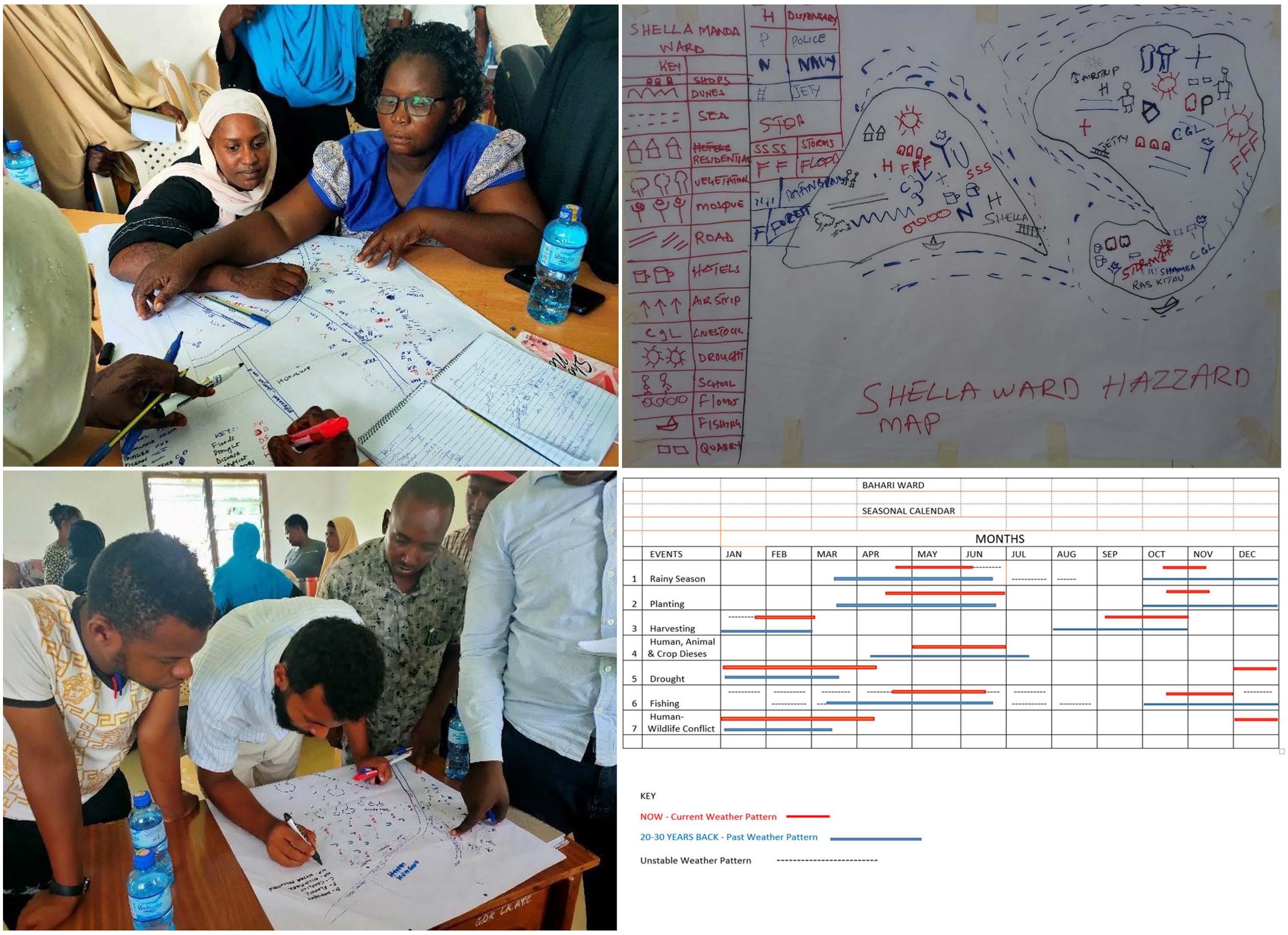


Figure 4. Mkunumbi Ward community participants (top left photo-Women and bottom left photo-Men) drawing Ward hazard map. Top right map is hazard map for Shella Ward, while bottom left indicated the Seasonal calendar for Bahari Ward.

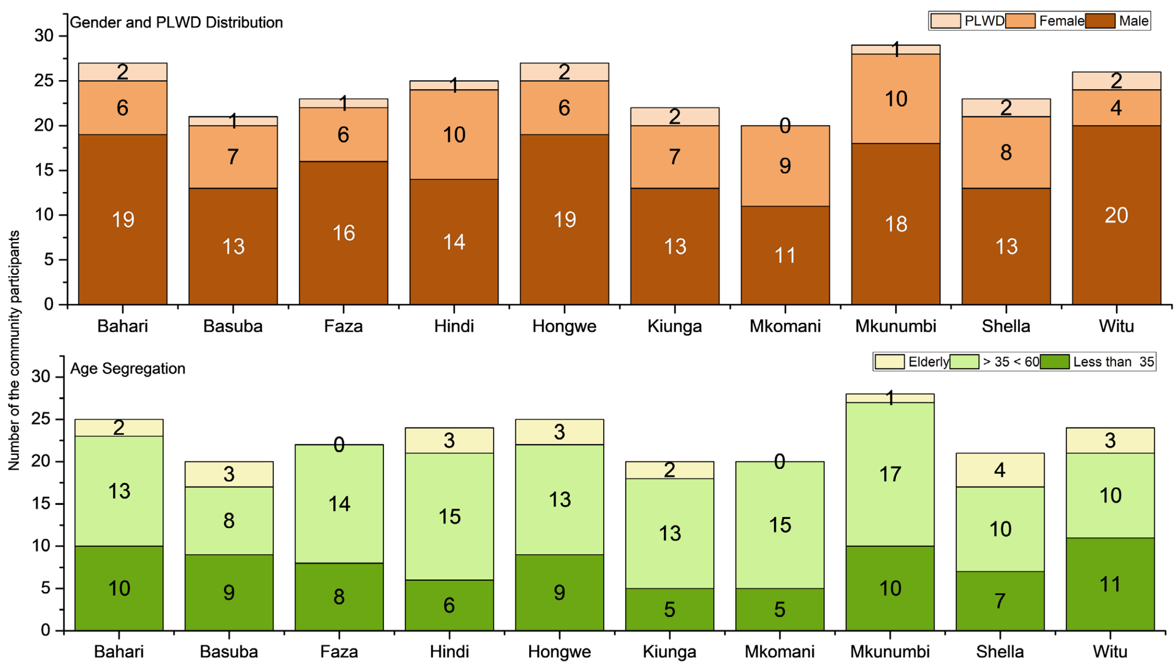


Figure 5. Lamu county community participants on gender, PLWD distribution and age segregation.

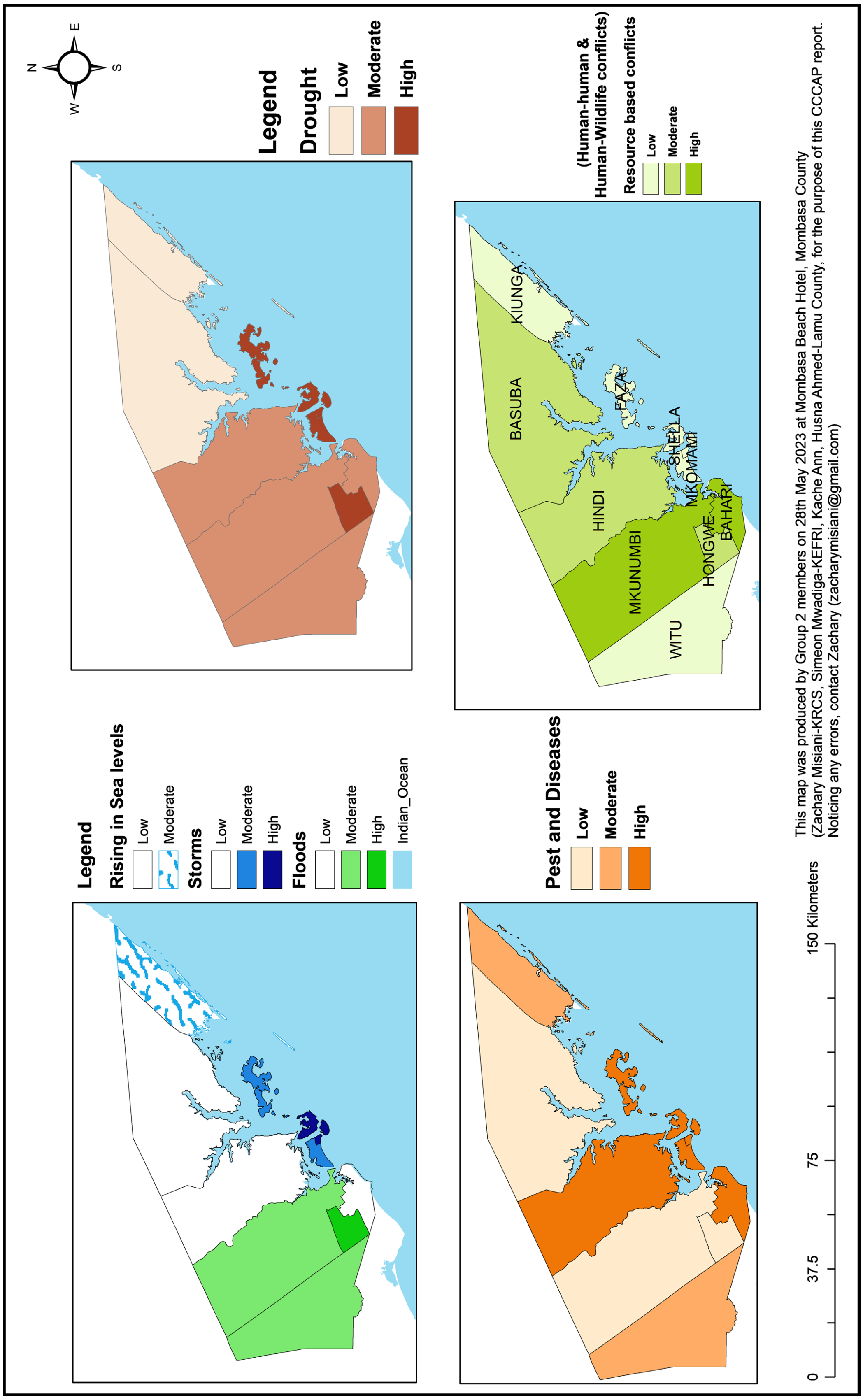
Table 1. Identification and mapping of the climate hazards that affect the community in Lamu County.

Ward	Priority Hazards
1. Shella	Drought, Storms, & Pests and Diseases.
2. Basuba	Drought, Livestock Diseases, and Wildlife Conflict.
3. Hindi	Drought, Human Diseases, & Crops/Livestock Pest's and Diseases
4. Hongwe	Drought, Floods, and Conflict.
5. Kiunga	Drought, Livestock Diseases, and Rising Sea Levels.
6. Mkomani	Drought, Strong Winds, and Increased Pests and Diseases.
7. Witu	Drought, Human Diseases, and Crops/Livestock's Pesticides and Diseases
8. Faza	Drought, Increase in Pests and Diseases, & Strong Winds.
9. Mkunumbi	Drought, Conflict (Resource-Based and Human-Wildlife), & Floods
10. Bahari	Drought, Resource-Based Conflicts, and Pests and Diseases

Kiunga Ward prioritized drought, livestock diseases, and rising sea levels. Mkomani Ward prioritized drought, strong winds, and increased pests and diseases. Bahari Ward identified drought, resource-based conflicts, and pests and diseases as the prioritized hazards. Mkunumbi Ward prioritized drought, conflict (resource-based and human-wildlife), and floods. Faza Ward prioritized drought, increase in pests and diseases, and strong winds. Finally, Witu Ward identified drought, human diseases, and crops/livestock's pesticides and diseases as the prioritized hazards. These prioritized hazards reflect the community's assessment of the highest levels of vulnerability and risk in their respective wards. The table and map below show a summary of the prioritized hazards and their spatial distribution across.

The hazard Map 1 indicates the community perception risks; sea level rise, floods, storms, drought, resource based-conflicts (human-human and human-wildlife) & pest and diseases at different wards. The prevailing perception within the community denotes that conflicts emanating from resource scarcity exhibit varying degrees of prominence within Lamu Wards. Specifically, the Bahari and Mkunumbi regions are characterized by a notably high prevalence of resource-based conflicts, followed by the Hindi and Hongwe wards, which exhibit a moderate level of conflict occurrence. In contrast, Basuba experiences a similar moderate level of conflict, while Witu, Kiunga, Mkomani, Shella, and Faza wards record a comparatively low incidence of such conflicts. The elevated prevalence of conflicts is primarily attributed to the competition arising from the limited availability of pasture and water resources. Additionally, longstanding rivalries between agro-pastoral communities, alongside cross-border migrations from Garissa and Tana River counties, have contributed to the escalated conflict dynamics. Community insights highlight an escalated influx of pastoralists from the Garissa region into Lamu, largely influenced by the prevailing water crisis in Garissa County.

The scarcity of water resources has prompted pastoralists to migrate to Lamu



Map 1. Spatial frequency distribution of risks as per the community perception.

in search of sustenance for their livestock, a trend confirmed by the National Drought Management Authority (NDMA). These migrating nomads often adopt dual roles, engaging in security duties while herding their livestock during daylight hours. The rationale underlying this migration pertains to the perception that Lamu offers enhanced access to water resources due to the availability of abundant open-access boreholes and wells, particularly contrasting with the constrained water availability in Garissa [7].

The Lamu Port, South Sudan, Ethiopia Transport Corridor (LAPSSET) project has attracted a substantial influx of people from different parts of Kenya towards Lamu County. The targeted demographic for this migration predominantly comprises non-native residents. Consequently, this phenomenon has engendered an escalated reliance on locally available resources, fueling inter-human conflicts. For example, the discovery of oil reserves in the Lamu area and the operationalization of the LAPSSET corridor, marked by substantial financial investments, have precipitated an escalation in land valuation. This upsurge has in turn facilitated the acquisition of land by external entities owing to their enhanced economic capabilities. The consequent emergence of horizontal socioeconomic disparity between indigenous inhabitants and non-native stakeholders has elicited sentiments of discontent, thereby catalyzing a climate of instability within Kenya's coastal precinct [6]. Community perception also indicates that conflicts have been worsened by the emergence of hazards originating from the repercussions of climate change, including but not limited to phenomena such as sea level rise, pest and disease outbreaks, storms, floods and periods of drought [14].

The pastoralist and farming communities have encountered rapid land acquisition and have faced with issues arising from population growth. These challenges encompass the depletion of grazing and agricultural lands, the expansion of urban zones, and the displacement of these communities due to both drought conditions and the intensification of expansive developmental initiatives characterized by the privatization and individualization of communal resources. Persisting and prolonged periods of drought have led to substantial livestock casualties, while excessive precipitation has correlated with an elevated frequency of pest and livestock diseases, including Rift Valley Fever. Owing to escalated drought occurrences and water scarcity, women are compelled to travel longer distances to secure water, thereby subjecting them to both physical fatigue and increased susceptibility to unsafe pathways. Furthermore, the limited freshwater availability in the county and increasingly high rainfall variability especially during the "long" rain season (MAM) have negatively affected the livelihood of these communities hence threatening security.

Figure 6 offers a comprehensive overview of the implications of climatic risks and trends on various assets and resources over time. It serves as a summary of the community's perception regarding the severity of climate change impacts on their resources, consequently affecting their livelihoods. Notably, the graph

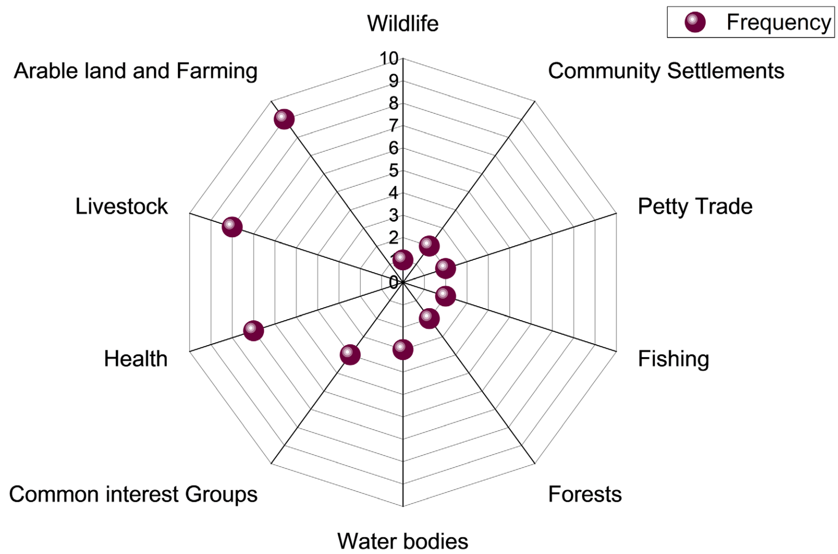


Figure 6. Community perceptions (frequency score given between 0 to 9) on likelihood of occurrences of climate change induced hazards on the community assets and resources.

highlights the significant effects experienced on agricultural and livestock farming, which serve as the primary sources of livelihood. Followed closely are the impacts on human health and the existence of common interest groups such as Non-Governmental Organization, Community-Based Organizations (CBOs) and Beach Management Units (BMUs), and youth groups, which directly influence the residents' livelihoods. However, it is worth mentioning that the effects of these hazards on fishing, a key economic and livelihood activity in Lamu, were not clearly noticeable across the majority of wards based on the data presented. However, existing literature indicates that prolonged droughts and alterations in rainfall patterns have had a profound impact on fishing. These changes have resulted in the extinction of certain fish species and a decline in the overall volume of fish [8] [11] and [15].

2.2. Community Adaptation Strategies for Conflict/Security

It is evident that certain local responses to the conflict have demonstrated limited effectiveness and sustainability (**Figure 7**). Specifically, initiatives like alternative livelihood programs and migration to newer farmland have proven to be less reliable in achieving the desired outcomes. Conversely, the community identified a cluster of local responses that stand out as exceptionally effective and sustainable. These include reconciliation efforts, awareness creation campaigns, the establishment of peace dialogue committees, and the active engagement of the community in reporting incidents while advocating for an increase in surveillance or policing. These initiatives promised in attaining the community adaptation goals, which primarily encompass peaceful coexistence, the establishment of rescue centers, and the safeguarding of livelihoods and property within our community.

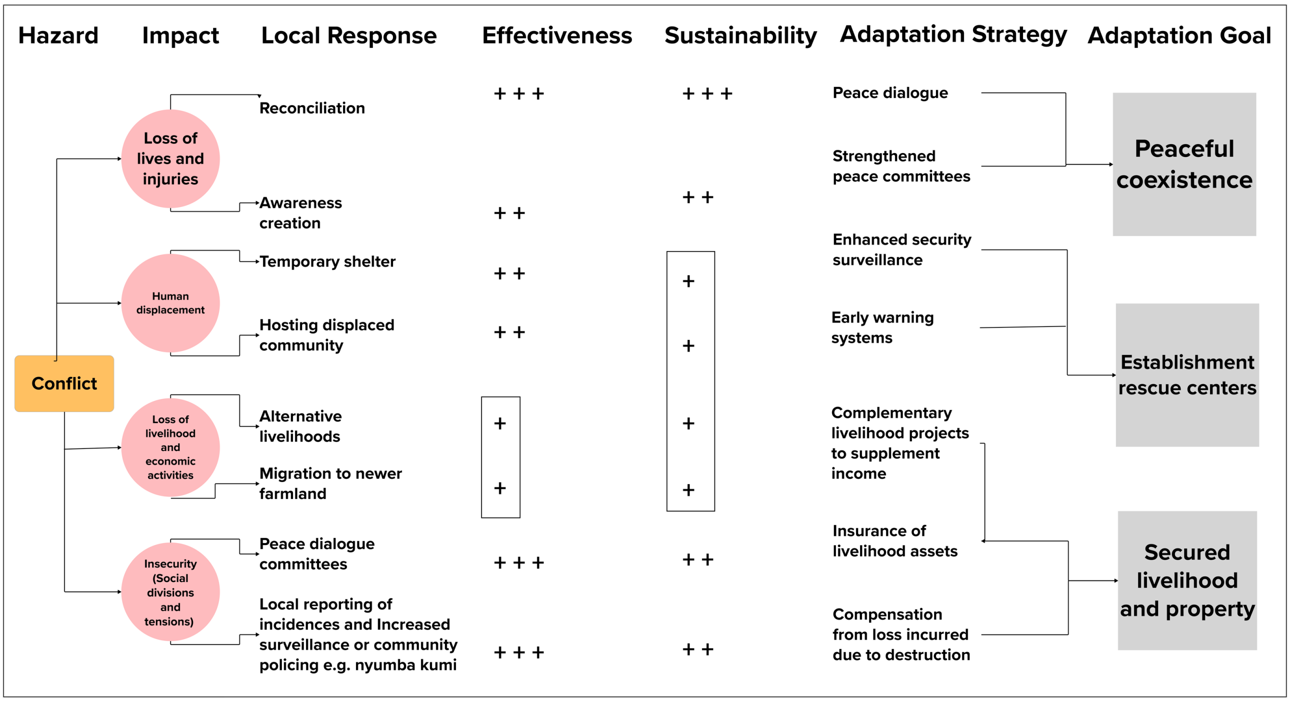


Figure 7. Hazard, impact, local response, effectiveness, sustainability, adaptation strategy, adaptation goal (short, long).

2.3. Spatial Rainfall and Temperature Distribution

The analysis of monthly climatological spatial rainfall patterns for Lamu County reveals non-uniformity in the distribution of precipitation from January to December (Figure 8). Throughout this temporal span, distinct some parts of the county experience varying levels of rainfall intensity. During January, more rainfall (180 - 200 mm) is observed in the northwestern parts of the county, surpassing that in other areas. Transitioning into February, there is a shift in the distribution, with rainfall becoming prominent in the eastern and northeastern portions of the county. As the calendar progresses to March, April, and August, a marked convergence of rainfall is evident in the central and southern parts. Conversely, May and July exhibit an altered pattern, with precipitation primarily favoring the central areas, while the remainder of the months display a relatively even distribution of rainfall. Notably, a departure from this regularity is observed in the northeastern extremities of the county, bordering with Somalia (20 - 40 mm). This heterogeneity rainfall distribution across the county was also confirmed by the community perception.

The insights drawn from Figure 9 for the climatological temperature analysis, spanning from 1991 to 2020, indicates a spatial gradient of temperature variation across the county, characterized by a progressive shift from "warm" to relative "cooler" moving from west to east. For example, the western Wards of Witu, Mkunumbi, Hongwe, Bahari, Mkomani, Hindi, and Shella exhibit a higher level of warmth, and the eastern side consisting of Kiunga, Basuba, and Faza Wards, have a lower temperature. However, the central region covering the Islands (Shella and Mkomani) wards have a transitional moderate temperature variation.

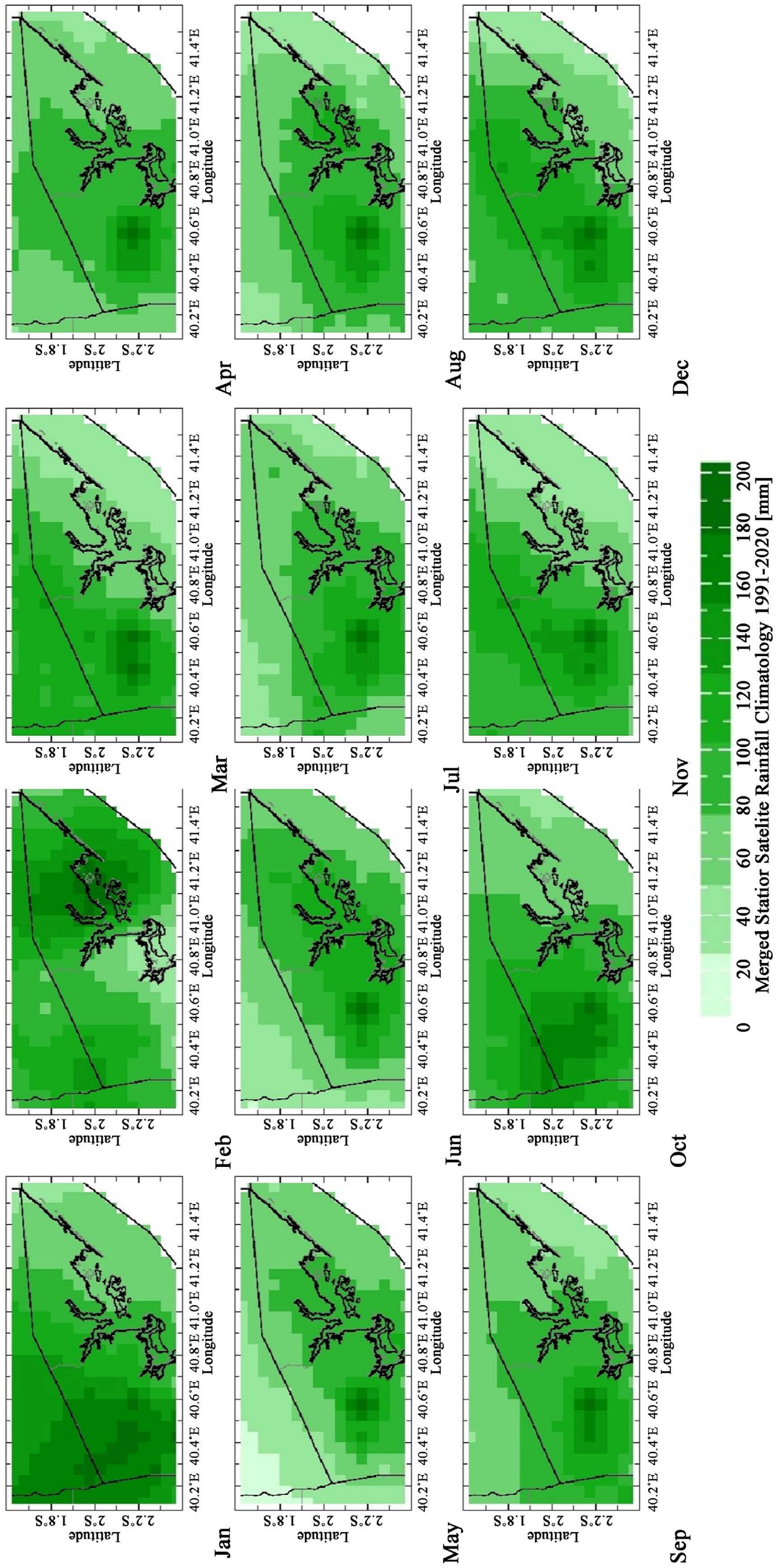


Figure 8. Climatological monthly spatial (Merged ground-based & satellite) rainfall between 1991 to 2020 in mm. Source: KMD Maproom).

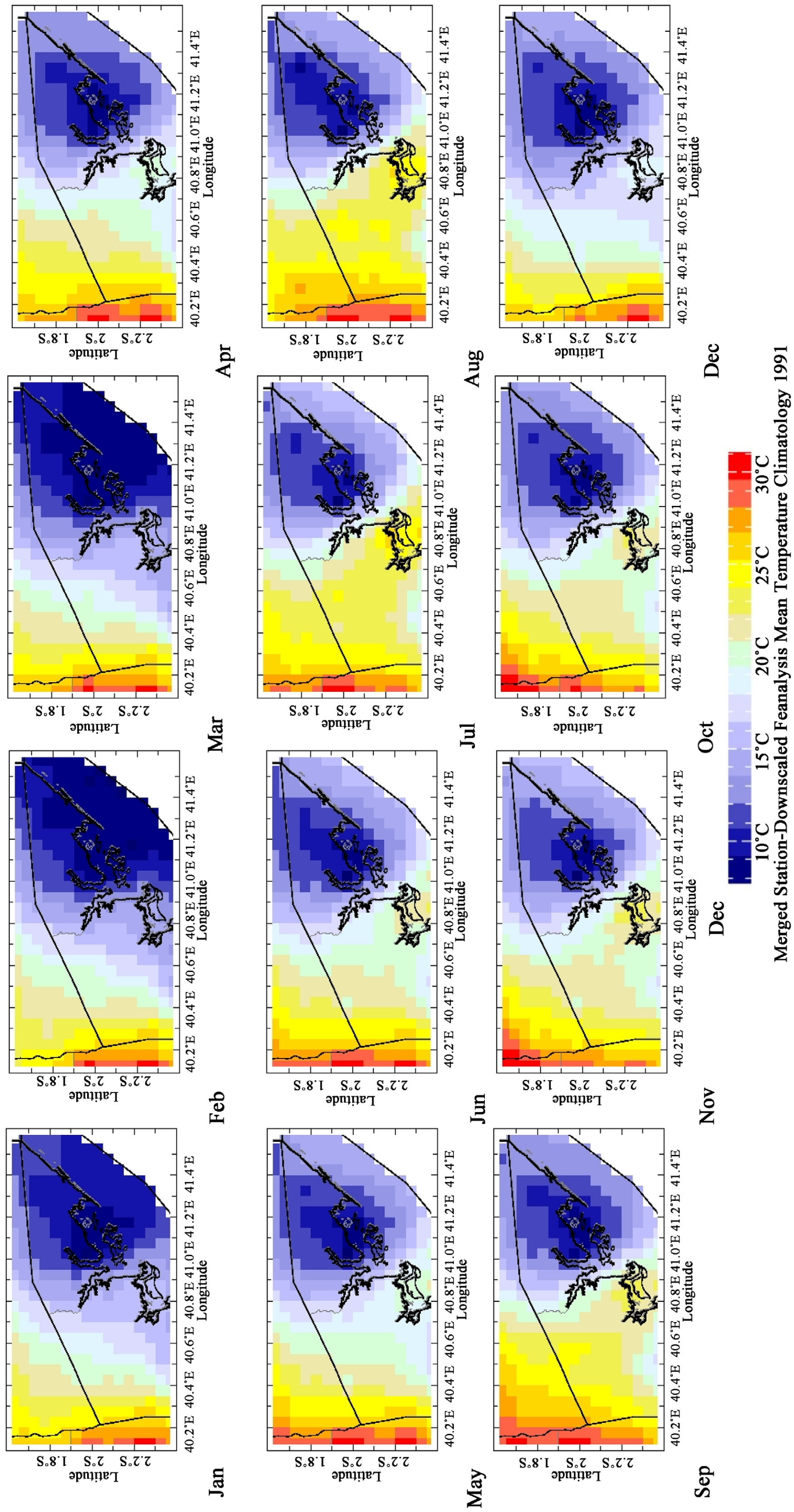


Figure 9. Climatological monthly spatial (Ground-based downscaled reanalysis) mean temperature between 1991 to 2020 in (˚C).

According to the Köppen-Geiger climate classification, Lamu county is categorized as having a climate that falls between Tropical Monsoon and Arid Steppe Hot climates [16]. The county experiences a bimodal rainfall pattern with an annual precipitation of 540 mm, (KMD). The rainfall in the area is influenced by the NE and SE Monsoon winds, with the main rainy season occurring from late March to early June, followed by a decrease in rainfall from August to September. The short rainy season takes place October to December, with a rapid decline in precipitation during January and February **Figure 10** (right) and a mean temperature of 28˚C (map left). Between December and early March, Lamu county experiences a mostly dry weather system known as the Northeast monsoon (NEM). As March and April arrive, a transition phase occurs, during which the wind shifts in a direction from east to south. This brings in maritime air from the Indian Ocean, resulting in substantial rainfall referred to as the "long rains." This rainy period extends from mid-April to the conclusion of June. Moving into July and August, the South-Easterly Monsoon (SEM) takes over, stabilizing the weather and ushering in cooler temperatures. From September to December, the dominance of the northeast monsoon returns, leading to the onset of the "short rains" between October and December. The pattern of rainfall is significantly impacted by the Monsoon winds **Figure 1**. Temperatures closely follow the rainfall patterns. While the temperature range spans from 23˚C to 32˚C across the county, the highest temperatures arise from January to March, while the coldest months between July and August.

The March-April-May (MAM) "long rain" seasonal trend depicted in the graph **Figure 11** (left) for Lamu county from 1981 to 2022 reveals a concerning pattern of a linearly decreasing trend in rainfall. For a coastal community heavily reliant on agriculture and pastoralism, this negative trend in decreasing rainfall poses significant challenges. Reduced precipitation during the long rain season usually results in a prolonged drought, water scarcity, and diminished pastureland, leading to decreased agricultural yields and livestock productivity. The declining trend may also disrupt traditional farming and pastoral practices, impacting

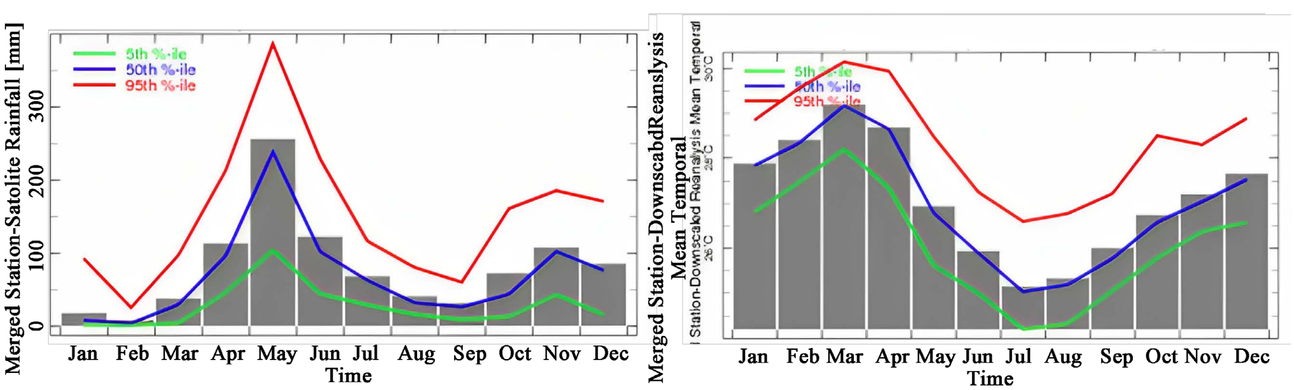


Figure 10. Observations for Lamu county monthly rainfall climatology merged station-satellite in (mm) and monthly mean temperature climatology merged station-downscaled reanalysis mean in (˚C). The Red line represent the 95th percentile, blue line represents 50th percentile and green line represent 5th percentile (Source KMD MapRoom).

food security, income generation, and overall community well-being. The October-November-December (OND) "short rain" seasonal trend displayed in the graph **Figure 11** (right) for the same period demonstrates a positive and encouraging pattern of a linearly increasing trend in rainfall. This upward trend in precipitation has a good significant benefit for a coastal community who depends on agriculture and pastoralism. With increasing rainfall during the short rain season, there is a higher likelihood of improved water availability for crop irrigation and livestock watering, leading to enhanced agricultural yields and better pasture conditions. The surplus water can also help replenish groundwater reserves, which is crucial for sustaining the community's water supply during the drier months. Additionally, the increase in rainfall can foster an environment conducive to diversifying crops, promoting better farming practices, and enhancing the resilience of the community's agricultural and pastoral livelihoods.

The temporal monthly variation of the sea level anomaly, as depicted in the graph (**Figure 12**) highlights the alternating impacts of positive and negative anomalies on coastal areas and communities throughout the year. During the months with positive sea level anomalies (January, February, March, April, June,

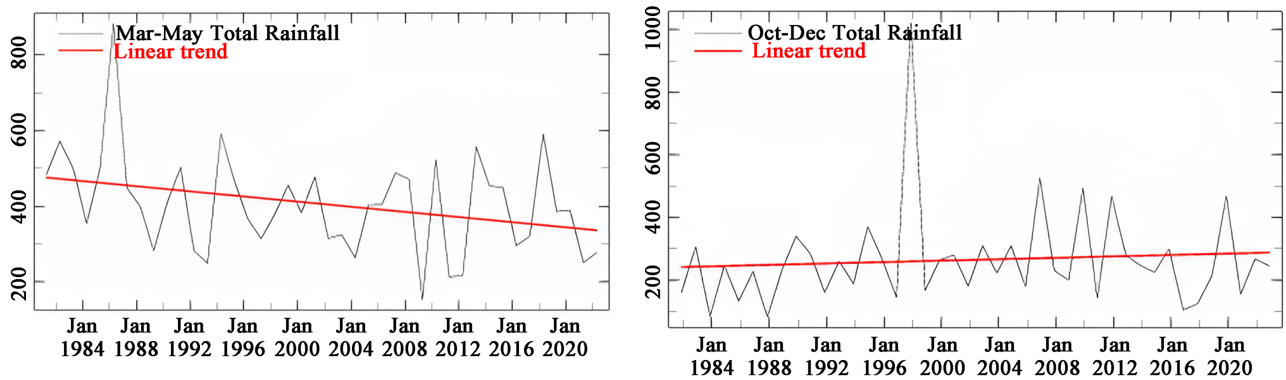


Figure 11. Temporal graph for "Long" rain season March to May (MAM) and the "short" rain season October to December (OND) for the period 1981-2022. (Source: KMD Maproom).

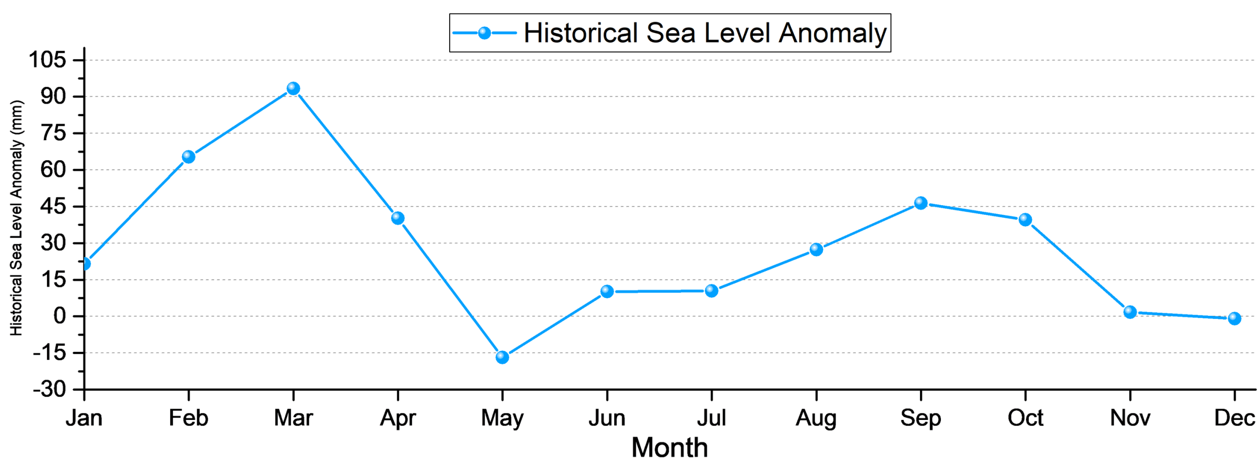


Figure 12. Monthly historical Sea Level for coastal Kenya (1993-2015), observed anomalies relative to mean of 1993-2012. Data Source: Climate Change Knowledge Portal.

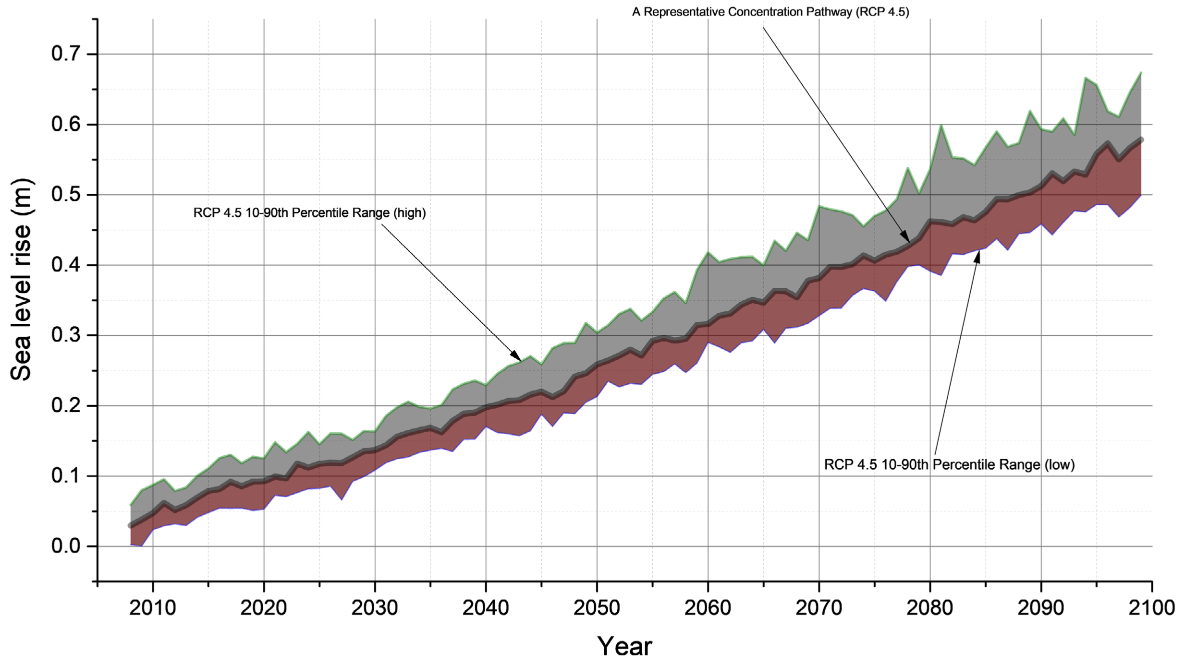


Figure 13. The projected sea level rise for Lamu county. Data Source: Climate Change Knowledge Portal.

July, August, September, and October), coastal regions experience elevated sea levels, leading to increased risks of coastal erosion, flooding, and salinization of freshwater sources. These challenges can threaten infrastructure, disrupt livelihoods, and trigger displacement in low-lying areas. On the other hand, during the months with negative sea level anomalies (May, November, and December), coastal areas face lower-than-average sea levels, potentially causing shallow water conditions and impacting navigation and access to *jetty's* and landing sites.

Figure 13 shows the mean sea level rise for Lamu county between 2008 to 2100. It indicates an increasing trend. This projection has the possibility of some regions being submerged in future. This will cause some communities to be homeless, arable land, livelihood and properties destroyed, especially places along the coastline starting from Mkunumbi all the way to Ishakani. Currently the sea level in Lamu is at 0.12 m according to Representative Concentration Pathway 4.5.

3. Discussion

The security challenges posed by climate change are multifaceted and affect human, community and the county at large. Climate change has also its short, medium and long-term impacts, which makes the time perspective an adopted key. In addition, the impacts for instance, food, health or water security are heavily dependent on socio-economic conditions, which implies that the same impact might have diverse consequences depending on the context. Hence, climate change puts additional pressures on current vulnerabilities for humans and societies and has particularly adverse effects in already fragile contexts. The security implications of climate change arise due to both its direct impacts and measures taken to address it. During the study most hazards affecting the community were identified as drought, pests and diseases, resource based and human wildlife conflict, floods, storms and rising sea levels. Security concerns linked to climate change include impacts on food, health and water due to drought, increased competition over resources, loss of livelihoods—fishing, farming, livestock keeping, increased drug substance abuse due to mental issues, increased crime rates and forced migration/displacement to look for water, food and pasture.

4. Conclusion

One of the six coastal counties affected by climate change, the County of Lamu has seen long-term changes in temperature and weather patterns. Lamu County has experienced a number of climate-related disasters. The study has shown that the most frequent hazards are drought, pests and diseases, severe winds, resource-based conflicts, flooding, and increasing sea levels. Due to these dangers, there have been more cases of crop failures, livestock deaths, water shortages, pest and disease outbreaks, property damage, loss of vegetation, human emigration, and instability. These have occasionally led to severe human injuries and fatalities. Through the PCRA process, communities were able to identify and prioritize the most notable hazards and were able to match with their seasonal calendars and how these changes in the seasons affect their resources and livelihoods. There are a number of recommendations and limitations that the study has highlighted that will enable the community to be able to form resilience in mitigation and adaptation in their livelihoods. It is through the community participation that the study was able unbundle and explore the relations between climate change and security.

5. Limitations and Future Work

During the focused group discussions, it was evident that the silent voices of the significant non-active members were largely swallowed by the voices of the gatekeepers and the dominant members despite the efforts to properly facilitate the process of data collection by the facilitators. Future research should employ more inclusive data collection methods to ensure that the voices of non-active members are heard. This can be achieved by conducting one-on-one interviews or using anonymous surveys to encourage honest responses from those who may feel marginalized in group settings.

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Author Contributions

The research was conceptualized and written by MISIANI Zachary, LINET Onyango and BONEYA Hindada. The study design and data analyses were undertaken by MOHAMED Abubakar, AMOS Okello, SIMEON Mwadiga, LINET Onyango, BONEYA Hindada, ABDALLA Nassor, MWARINGA Bonface and OKELLO Amos under the supervision of MOHAMED Rashid Dirie and MISIANI Zachary. Additionally, MONICA Orero provided project oversight and supervision.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Abbreviations

The following abbreviations are used in this manuscript:
BMUs: Beach Management Units
CBOs: Community-Based Organizations
CCKP: Climate Change Knowledge Portal
FGD: Focus Group Discussion
ICHA: International Center for Humanitarian Affairs
ICRC: International Committee of the Red Cross
IPCC: Intergovernmental Panel on Climate Change
KEFRI: Kenya Forestry Research Institute
KIIs: Key Informant Interviews
KMD: Kenya Meteorological Department
KNBS: Kenya National Bureau of Statistics
KRCS: Kenya Red Cross Society
KRCTI: Kenya Red Cross Training Institute
LAPSSET: Lamu Port, South Sudan, Ethiopia Transport Corridor
MAM: March to May
NDMA: National Drought Management Authority
NE: Northeast
NEM: Northeast Monsoon
NGOs: Non-Governmental Organization
OND: October to December
PLWD: Persons Living with Disabilities
SE: Southeasterly
SEM: South-Easterly Monsoon
TWG: Technical Working Group
WWF: World Wide Fund