

Turkana's Boiling Bowl: Extreme Heat and Social Norms fuel Gender Inequality

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Abstract

Climate change impedes human and economic development globally. The frequency, intensity, and duration of climate extremes, including droughts, floods, heatwaves and cyclones, pose significant threats to health, nutrition, water access, livelihoods and ecosystems. Due to escalating extreme weather events, more populations are becoming vulnerable with women and girls increasingly exposed to adverse impacts. This mixed-methods study examines how entrenched social norms exacerbate the impacts of extreme heat on women in Turkana County, Kenya. Findings highlight gendered disparities in exposure, coping and support access, calling for gender-responsive, localized adaptation measures to address climate inequity and injustice.

Keywords: Extreme heat exposure, gender inequality, adaptation, coping, climate extremes, Turkana, Kenya

Introduction

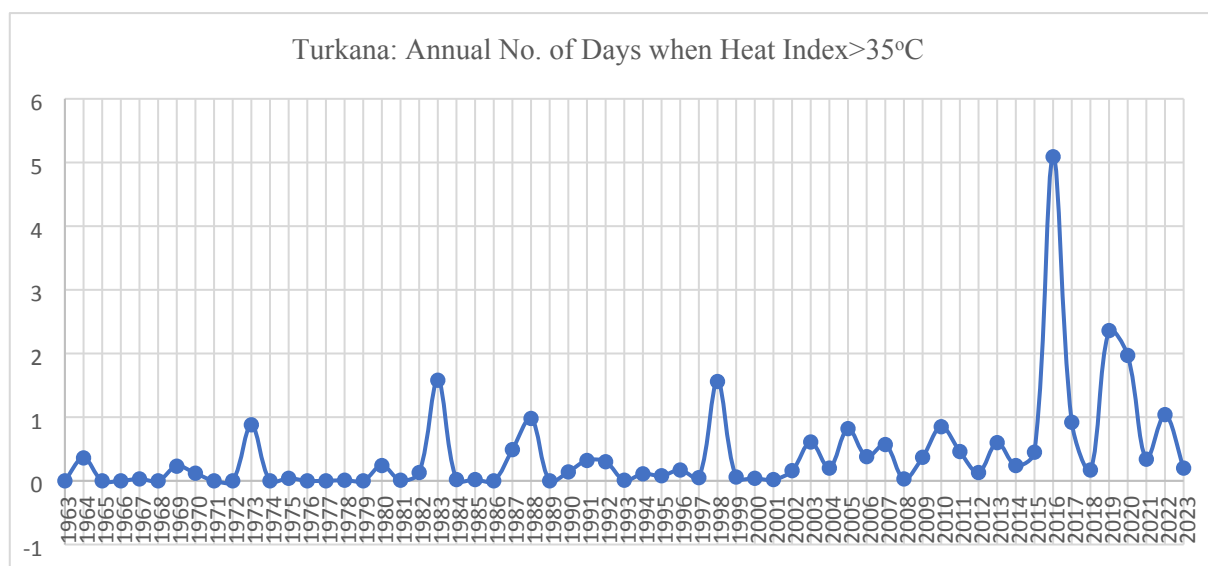
Temperature variability refers to the fluctuations in mean temperature over decades or months or other shorter periods. The effects of temperature variability are becoming salient as extreme weather hazards become commonplace globally. Rising temperatures and anthropogenic causes are responsible for global warming and increased greenhouse gas emissions.

Vulnerable communities, especially those in developing countries continuously find themselves on the receiving end of climate hazards such as cyclones, wildfires, floods, droughts and heatwaves. For instance, India endured a 70-day heatwave and nearly continuous extreme weather events for nine months in 2023 (The Times of India, 2023). During the same year, Europe lost an estimated 47,000 older persons due to heatwaves (Le Monde, 2023) while the little island of Madagascar remains highly prone to cyclones. In 2024 South Sudan experienced extreme temperatures of up to 45°C with learners experiencing acute heatstroke and exhaustion. The heatwave led to government's decision to close all schools indefinitely (BBC News, 2024). Meantime, escalating conflicts experienced in the horn of Africa in recent years can be correlated to prolonged droughts (WFP, 2023; UNOCHA, 2023). In 2023-24, Kenya suffered devastating flooding events during the short and long rainy seasons with losses in human lives, livestock, property, farmlands, livelihoods and infrastructure (KRCS, 2024). A humanitarian report attributed to UNOCHA, (2024) observed over 500 fatalities and half a million displacements due to floods in Kenya and Tanzania in the same year.

Socio-cultural and gender norms have interacted to increase vulnerability and risks for some communities such as indigenous and pastoralists and those dependent on rain-fed agricultural production. Social norms are also key in climate change discourse as they determine adaptive capacities of men and women in several settings.

Despite proper documentation and a handful of research work, extreme heat events are becoming frequent, intense and prolonged and Turkana County – one of three counties in Kenya with high aridity exposure has recorded increasing temperatures over several decades. According to World Bank Group (2024), Turkana presents scenarios of increasing extreme and noticeable heat exposure as presented in Graph 1 showing number of days per year when heat index exceeded 35°C: It is observed that 2016 recorded the highest number of days (5) when the heat index was above 35°C.

Graph 1: Annual Number of Days with Heat Index above 35°C in Turkana County



Source: Generated from the WBG Climate Knowledge portal, 2025

Thesis: In Turkana, women bear the brunt of extreme heat due to gendered social roles, limited resources and cultural norms that increase inequality and exposure to extreme weather hazards.

Purpose: This study aims to assess the effects of heat exposure by gender and explore coping and adaptation mechanisms among the Turkana community in Kenya.

Literature Review

There has been substantial growth and interest in research around the intersection of climate change and gender especially due to the increasing risks that climate and heat exposure place on women and girls. Several studies highlight variances and disparities on effects of climate change on men, women, boys and girls bringing into sharp focus issues of gender inequalities placing women at higher risk of vulnerability than men.

In a study on gender and climate change (WBG, 2024) observed a number of challenges and risk exposure for women. For example, the study highlighted women’s limited access to early warning information, financial resources, burden of care work during a climate hazard, limited coping mechanisms, among others. While women are the highest consumers of natural resources, they are the most impacted in case of scarcity. During droughts, it is women who trek the distances to find water and in food scarce households, they eat last.

In Asia and the Pacific, most women find employment in the informal sector, mostly under poor working conditions. Due to their physiology, extreme heat exposure put women at risk of lower productivity due to exhaustion (ADB, 2024). In a study in Asia, (UN Women, 2025) women were found to be at risk of dehydration due to extreme heat exposure's link to proper sanitation. Due to lack of toilet facilities, women avoided taking a lot of water as a preventive measure. Habibi, et al., (2024) discussed occupational heat exposure risks among female workforces and identified fatigue, dehydration, focus loss and reduction in brain functionality as effects of climate change. During heatwaves, women are fatigued leading to relinquishing some livelihood activities.

Constant conflicts were observed at water points where women would congregate to access water during droughts. Similarly, increased cases of sexual and gender violence were observed among girls as they sought wood fuel and water.

Increasingly, women are pushed into poverty and disempowerment due to having to take up other roles or taking too long on a role such as accessing drinking water during droughts. A study by Nguyen, (2023) found that intimate partner violence (IPV) became more frequent and intense as the weather grew warmer. Meantime, in most pastoralist settings, droughts and loss of livestock exacerbate child marriages as a source of income to cushion the family as well as support restocking. UN Women underscores violence against women and girls as the most prevalent human rights violation globally.

In a systematic review study looking at gender differences in heat-related epidemiology and risk factors among men and women serving in the armed forces, Alele, et al. (2020) found that men faced a higher risk of heat stroke than women – similar observations made by Gifford, et al., (2019) in Zavala, et al., (2024). Alele, et al., (2020) also noted incidences of other heat-related illnesses were more prevalent among females than males. In terms of heat tolerance, males reported higher tolerance (74%) than their female counterparts (33%). Despite the lack of significant relationship, Cheng, et al., (2019) meta-analysis found that men were more susceptible to cardiovascular diseases during heatwaves.

Data and Methods

This is a cross-sectional mixed method study using both primary and secondary data. Long term temperature data is sourced from the World Bank Climate portal complemented by monthly averages generated from daily i-button data collected for three months in Turkana Central and Turkana West sub counties. A total of 20 i-buttons were installed across the two

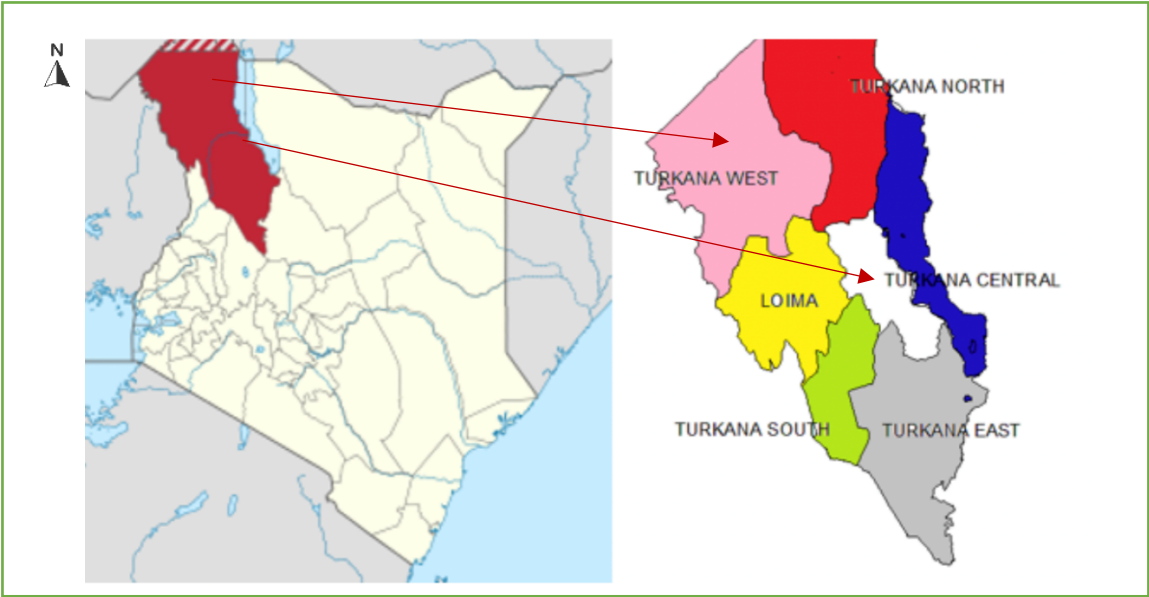
sub counties with each sub county receiving 10 devices. Majority of the i-buttons (9 in Turkana Central and 8 in Turkana West) were installed in households to record temperature and humidity data at 30-minute intervals for three months. In Turkana Central, one device was installed at the Kenya Meteorological office and in Turkana West Kenya Meteorological office and the Kalobeyi Health Centre (refugee camp) received one i-button each. The three were set as controls. The study uses qualitative data collected through a household survey (576 respondents), 63 Key Informant Interviews (KIIs), 34 Focus Group Discussions (FGDs) and 33 Indepth Interviews (IDIs). Descriptive and inferential analyses were done using SPSS V25 and thematic analysis used for qualitative data. Personal quotes collected from the FGDs and IDIs are used to paint a compelling picture of gender inequality and the struggle that women and girls live with, in a rapidly changing climate.

Key Findings

Study Area

With over 70,000 Km² of land, Turkana County stands out as the largest county in Kenya located in northwest of the country. Apart from its size, Turkana County has many outstanding features: it is the cradle of mankind and also boasts of hosting the largest desert lake in the world. The county borders South Sudan to the North, Ethiopia to the Northeast and Uganda on the west. Within the country borders, Turkana neighbours West Pokot and Baringo counties to the South, Samburu and Marsabit counties to the Southeast and East, respectively. The county has 11 sub counties but this study covered only two sub counties – Turkana Central and Turkana West. The population is majorly rural-based eking livelihoods out of fishing and pastoralism with pockets of farmlands. The county is inhabited by the indigenous people of Turkana. The 2019 Kenya Population and Housing Census enumerated the population of Turkana County as 926,976 of which 478,087 (51.6%) were male and 448,868 (48.4%) were female and another 21 were intersex (GoK, 2023). A map of Kenya showing location of Turkana County and the two sub counties of the study.

Map of Study Area (Turkana Central and Turkana West sub counties)



Source: AMPATH, 2019

(<https://www.ampathkenya.org/news-blog-feed/2019/11/30/ampathplus-hits-the-ground-running-in-turkana-county>)

Study Population

The baseline survey reached 576 respondents comprising 56% (322) male, 34.5% (199) female and 0.3% (2) transgender and 9.2% (53) did not indicate their gender. In terms of educational attainment, 64 male had primary education compared to 25 female; 46 men and 12 women had secondary education; 23 men and 4 women had university level of education while 12 men and 3 women gained skills through vocational training. Considering the total study population (576), 30.7% (177) males and 26.9% (155) females had no education.

More men than women reported to be in a marriage (61.7% or 201 men) and (30.1% or 98 women) while 60 men and 40 women reported to be widowed. Phone ownership was reported by 58.3% (242) men and 34% (141) female with only a handful having smart phones.

Turkana County has been ranked one of the poorest counties in Kenya. About 91% (523) responses were given on perception on income stability (56% men; 34.5% women; 0.5% intersex). Of the 523 respondents, 34.8% male, 28% female and 0.2% intersex considered their income to be very unstable while 25.2% male and 10.2% female felt they had moderately stable income. No female considered themselves in the stable income category as presented in Table 1.

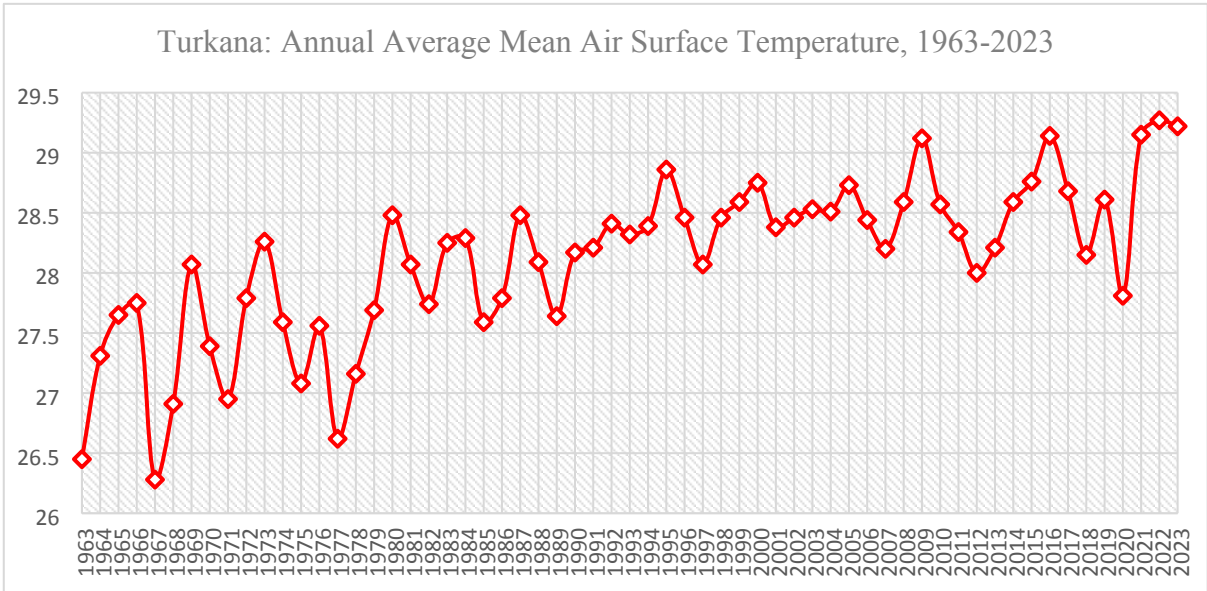
Table 1: Income Stability

Perception of Income Stability	Male	Female	Other
Very Unstable	182	146	1
Moderately stable	132	53	0
Stable	8	0	1
Total	322	199	2

Source: Generated by Author, 2025

Annual average temperature has been rising since independence (1963) as portrayed in Graph 2. Annual average temperature rose from 26.5°C to 29.22°C in six decades – 1963 to 2023. Turkana has consistently recorded temperatures above 27°C since 1979.

Graph 2: Annual Average Mean Air Surface Temperature in Turkana County



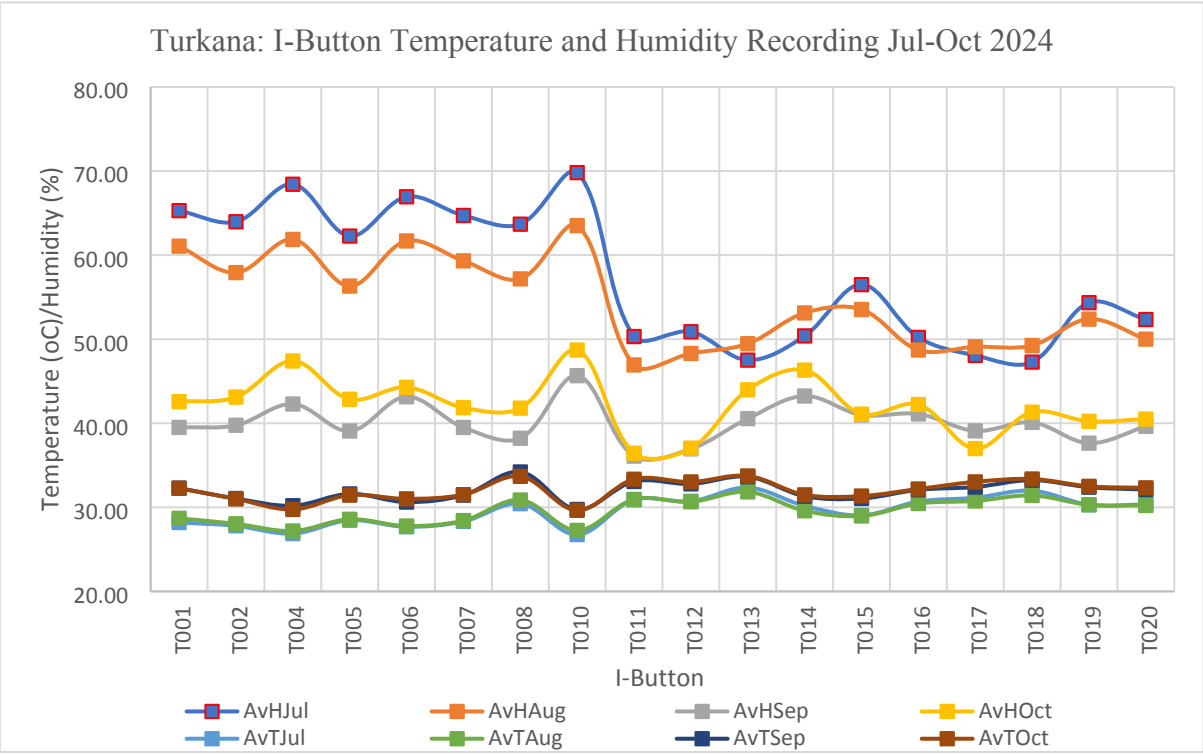
Source: Generated from the WBG Climate Knowledge portal, 2025

Climate Stressors

From the annual average temperature trends, it can be deduced that Turkana County experiences high temperature. There is an observed upward trend meaning temperatures have been rising. The County suffered a devastating drought in 2021-2022 leading to water and food insecurity as well as massive livestock losses.

This study also used primary temperature and humidity data collected using i-buttons. The i-buttons were set to collect temperature and humidity data at 30-minute intervals. The data was then averaged on a monthly basis. The data covers a four-month period with Aug and Sept being full months of data collection. On average, i-button T010 recorded the highest humidity in the period July – October 2024 as shown in Graph 3.

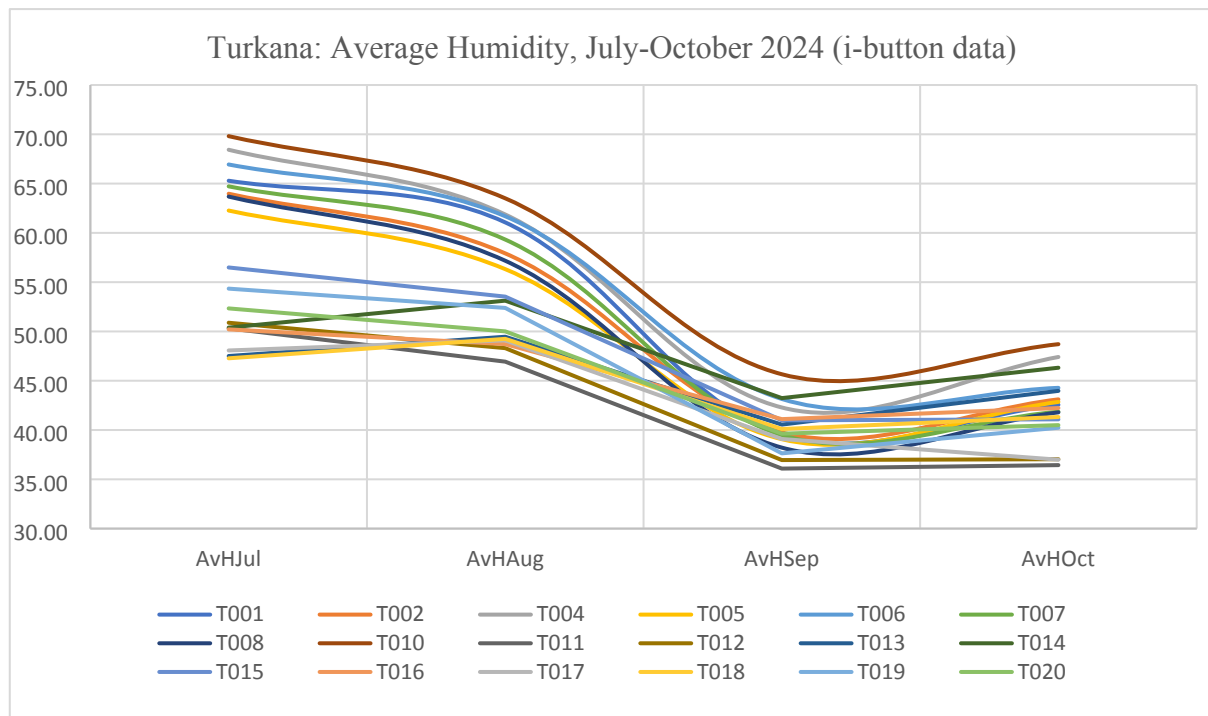
Graph 3: I-Button Temperature and Humidity Recordings



Source: Generated using primary data from i-button recordings, 2025

According to <https://www.weather.gov/ffc/hichart> daily temperature above 27°C and humidity above 40% have potential of causing heat disorders such as heat exhaustion, muscle cramps, fatigue and eventually, heat stroke. Graph 4 presents average humidity in the period July to October 2024. It can be observed that July and August humidity remained colossally higher than the 40% threshold bearing potential for an extreme heat exposure.

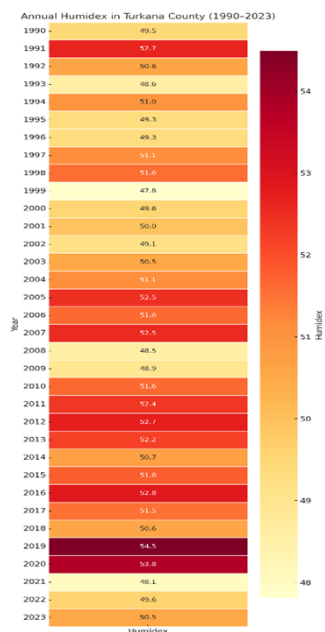
Graph 4: Average Humidity in Turkana, July-October 2024 (i-button data)



Heat Exposure Map

This study developed a humidex (humidity index) which is a good visualization of heat exposure in a given area. In Turkana, the humidex ranges between 48°C and 55°C. In 2019, Turkana’s humidex was 54.6°C, the highest and indicating extreme heat exposure. In addition, 2005, 2011-2013 and 2020 also reported high humidex as per Graph 5.

Graph 5: Turkana County Heatmap (1990-2023)



Humidex (°C)	Perceived Heat Level	Health Implications
20–29	Comfortable	No concern
30–39	Noticeably hot	Fatigue possible; caution advised
40–45	Very hot, dangerous	Heat exhaustion likely; vulnerable groups at risk
>45	Extremely hot, life-threatening	Immediate danger of heat stroke

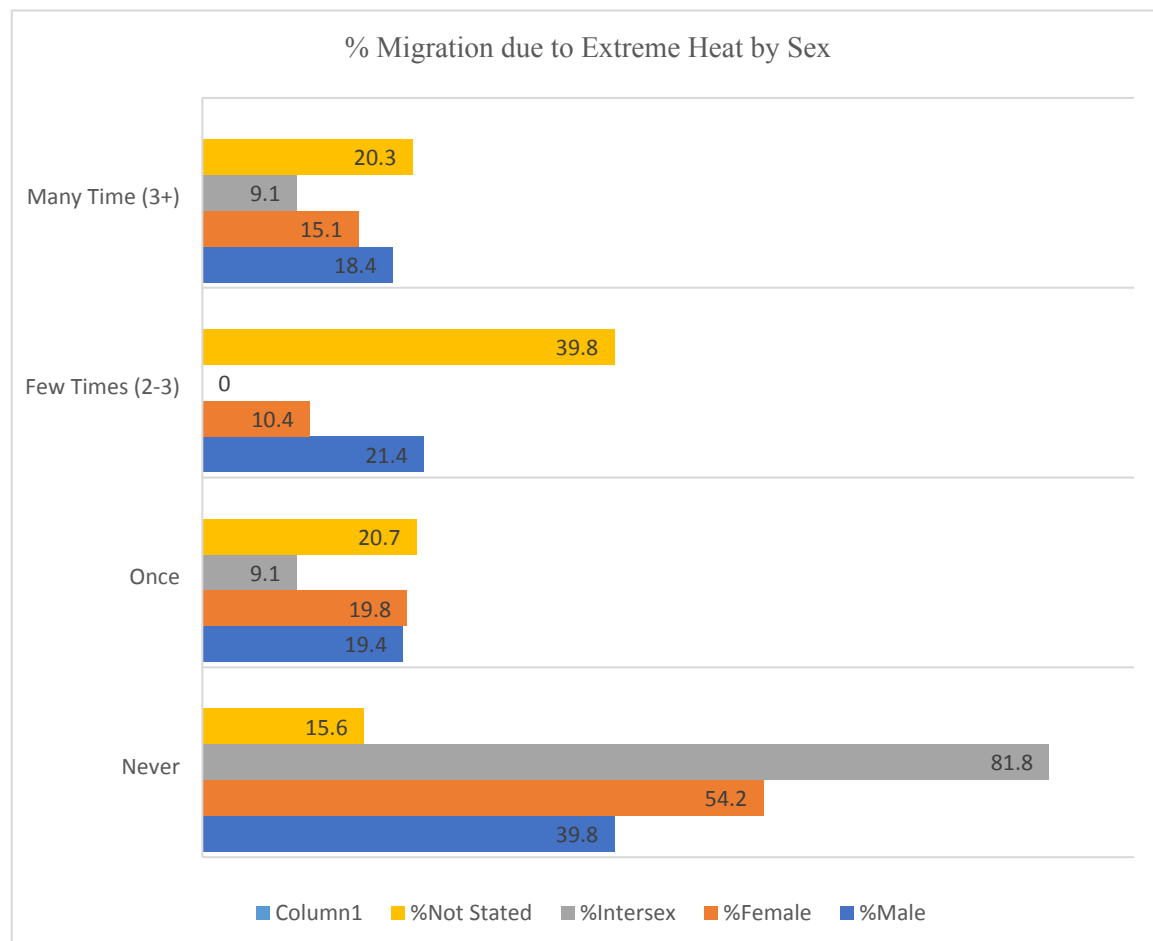
Source:<https://www.awu.net.au/wp-content/uploads/2019/10/Humidex-Rating-and->

Source: Heatmap generated by Author

Personal Impact of Heat Exposure

The study sought information on extreme heat exposure effects on individual lives. In terms of whether extreme heat affected their work or that they could not go to work, 8.5% (49) women, 4.3% (25) men and 0.2% (1) intersex affirmed that this happened many times in the last 12 months. In addition, 30 (5.2%) females, 20 (3.5%) males and 6 (1%) intersex stated inability to do some tasks during extreme heat periods. While 21.4% male and 10.4% female indicated they had to migrate a few times, 18.4% male, 15% female and 9.1% intersex said they migrated several times in an effort to escape the harsh weather conditions. However, among those who never migrated were more women 54.2% (115) compared to 39.8% (39) men as presented in Graph 6.

Graph 6: Migration due to Extreme Heat by Sex (%)



Source: Generated by Author

Gendered Social Norms

Women in Turkana face higher risk of exposure to climate-related adverse effects exacerbated by societal norms. This study found that Turkana women are the providers for their families. They are responsible for ensuring families meet their basic needs – including construction of dwelling places, providing water for both the family and livestock, caring for children, the sick and elderly people among other chores. Given the high temperatures experienced in Turkana, women suffer extreme heat exposure while men sit under tree shades. During harsh climatic conditions, men and youth migrate in search of pasture to save their livestock leaving women with the duty of caring for the families, aged and the sick and young and aged livestock. Climate migrations happen globally in times of scarcity. However, in most instances, women carry extra responsibilities on behalf of their husbands or men who migrate. For example, in Senegal, the introduction of modern agricultural practices and food insecurity pushed men to migrate leaving production and care work to women (Dankelman, 2010).

“In Turkana, married women can be likened to the beast of burden. They do all the work including watering the livestock at the shallow wells. It is the women’s duty to dig wells on river beds and scoop the water for the livestock when rivers dry up.” KII with a Project Manager of a Civil Society Organization, Turkana Central

“Our land is just rocks so we eke a living from the rocks. Women brave the scorching sun to break rocks into chippings. But sometimes, when it is too hot, young people are unable to load the trucks. We have to look for buyers of our ballast during early morning.” Women FGD in Kawalase, Turkana Central

As women go through the struggles of daily family life, men can be spotted sitting on their ‘Acholong’ (a tiny T-shaped stool that men tag along) under acacia trees.

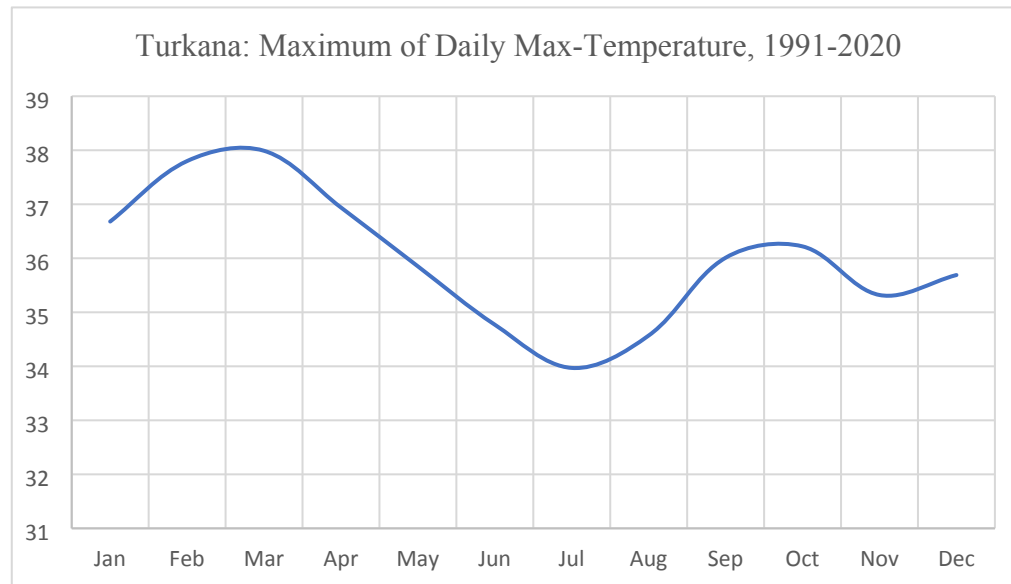
Health Effects of Heat Exposure

In relation to the health, none of the respondents indicated suffering from heat rash or dizziness that could be connected to extreme heat exposure.

From Graph 7, Turkana suffers very high temperatures (+_38°C) between February and March. The study data picked in a few houses (17No.) in Turkana Central and Turkana West reported extreme temperatures (+40°C) in some households. However, from discussions during FGDs, IDIs and KIIs, most respondents indicated that during hot days they spend time under shades and sleep outside their living quarters. Also, extreme high temperatures were connected to

dwelling structure – “manyattas” (traditional dwelling structure) covered with polythene paper accumulated extreme heat while those covered with grass or palm-thatched remained cool.

Graph 7: Trends in Average Monthly Maximum Temperature in Turkana, 1991-2020



Source: WBG-CKP, accessed on 23.06.2025

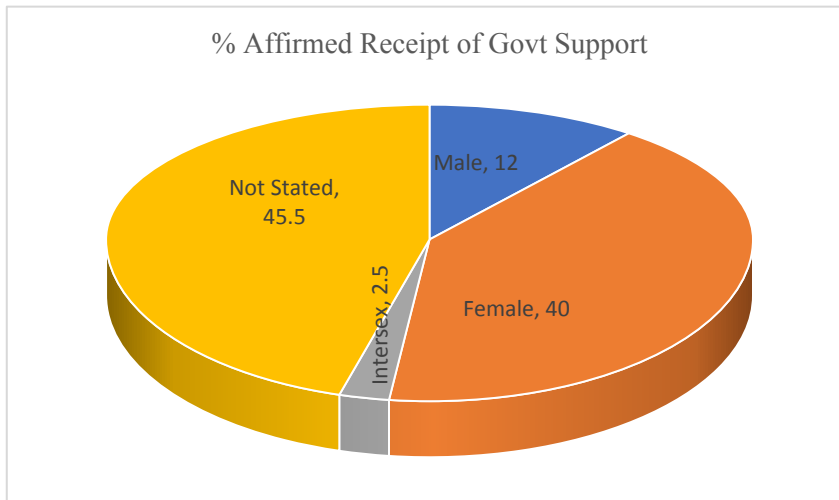
More female respondents indicated they suffered from headaches compared to males. This result affirms that of Alele, et al., (2020) who made similar observations in their study of heat related epidemiological study. Health related impacts were mostly felt by women during extreme heat exposure period of January and February.

Government Support during Heat Exposure

Only 29 (12%) men, 6 (2.5%) intersex and 96 (40%) women indicated they had received support from government during extreme heat exposure. However, as shown in Graph 8, 108 (45.4%) who affirmed receipt of government support did not indicate their gender. In Focus Group Discussions most women indicated relief food from the county government was infrequent and at very limited quantities.

“There is no water in this area. We depend on the KDF truck which passes by once a week to collect water in town. The soldiers empty their bowser as they go to town to replenish. It is just a form of goodwill.” Female Respondent, Turkana Central

Graph 8: Receipt of Government Support by Sex (%)



Source: Generated by Author

Coping and Adaptation to Extreme Heat

Adaptation is a crucial element in building resilience from household to national level. IPCC calls on countries to prioritize localized adaptation strategies in order to build resilient societies in the face of climate change.

Of the 572 responses on adaptation, almost half (49.2%) indicated that they had adapted to extreme heat exposure – majority (29.2%) being female. From Table 2, it can be deduced that due to the burden of heat exposure women are likely to prioritize adaptation measures to mitigate the situation.

Table 2: Extreme Heat Exposure Adaptation by Sex

Sex	Yes	No	DK/Refused
Male	34 (5.9%)	62 (10.7%)	0 (0%)
Female	111 (29.2%)	98 (17%)	3 (0.5%)
Intersex	8 (1.4%)	3 (0.5%)	0 (0%)
Not Stated	131 (22.7%)	116 (20.1%)	6 (1%)
Total	284 (49.2%)	279 (48.4%)	9 (1.6%)

Source: Generated by Author

“During extreme heat periods, we all sleep outside the house except children. Everyone finds their own sleeping place. Some go to the “laggar” (water trench) – it is much cooler”. Female interviewee, Turkana Central

Conclusion and Recommendations

The study observed high temperature and humidity in the two sub counties with annual averages of 30°C in temperature and annual humidity of 60% and above. Social norms significantly increase women’s exposure and vulnerability to extreme heat in Turkana. Their coping strategies—though resourceful—highlight systemic gender inequities in resource access, decision-making, and public support.

Although there is a growing body of knowledge around gender, extreme heat exposure and climate change nexus globally, gaps still exist in Kenya calling for prioritized research in the area.

Implication for Policy

This study underscores the need for gender-transformative heat action plans that recognize unpaid care work and enable women-led adaptation. County governments need to integrate women's voices in planning and policy making as well as promote targeted resource distribution to cushion communities during extreme weather events.

Acknowledgement

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Data Availability Statement

Temperature, humidity and rainfall variability data for Kitui county were sourced from the World Bank Climate Knowledge Portal specifically ERA5 Land dataset which is data is derived from reanalysis datasets of the European Centre for Medium Range Weather Forecasts (ECMWF) – an open data source. In addition, primary data on temperature and relative humidity, collected using 20 iButton recording devices have been compiled and are available

as a MSEXcel datasheet. The datasets generated and analyzed during the current study are available from the corresponding author upon request. Weather diaries were compiled in MSEXcel spreadsheets. Data analysis was mainly performed using MSEXcel and SPSS v25.

Declaration: The authors declare no conflict of interest.

References

Alele, F., Malau-Aduli, B., Malau-Aduli, A., & Crowe, M. (2020). Systematic review of gender differences in the epidemiology and risk factors of exertional heat illness and heat tolerance in the armed forces. *BMJ open*, 10(4), e031825. <https://doi.org/10.1136/bmjopen-2019-031825>

Asian Development Bank (ADB), (2024). Extreme heat, regional impacts and why we need gender-transformative heat action plans. Asian Development Bank. <https://www.adb.org/news/features/extreme-heat-regional-impacts-gender-transformative-heat-action-plans>

BBC News. (2024, March 20). *South Sudan shuts schools amid heatwave reaching 45°C*. <https://www.bbc.com/news/world-africa-68649012>

Cheng, J., Xu, Z., Bambrick, H., Prescott, V., Wang, N., Zhang, Y., Su, H., Tong, S., & Hu, W. (2019). Cardiorespiratory effects of heatwaves: A systematic review and meta-analysis of global epidemiological evidence. *Environmental Research*, 177, 108610. <https://doi.org/10.1016/j.envres.2019.108610>

Dankelman, I. (Ed.). (2010). *Gender and climate change: An introduction* (1st ed.). Earthscan.

GoK, (2023). Turkana County Integrated Development Plan (CIDP) III, 2023-2027

Habibi, P., Heydari, A., Dehghan, H., Moradi, A., & Moradi, G. (2024). Climate Change and Occupational Heat Strain Among Women Workers: A Systematic Review. *Indian journal of occupational and environmental medicine*, 28(1), 4–17. https://doi.org/10.4103/ijoem.ijoem_320_21

Le Monde. (2023, July 10). *Europe records 47,000 heat-related deaths in 2023, elderly most affected*. https://www.lemonde.fr/en/environment/article/2023/07/10/europe-records-47-000-heat-related-deaths-in-2023-elderly-most-affected_6087212_114.html

KRCS, (2024). 2024 March-April-May Rains Floods Update.

Nguyen, M. (2024). Temperature and intimate partner violence. *Scottish Journal of Political Economy*, 71(2), 197–218. <https://doi.org/10.1111/sjpe.12365>

The Times of India. (2023, July 10). *India experienced 70-day heatwaves in 2023: IMD data*. <https://timesofindia.indiatimes.com/india/india-experienced-70-day-heatwaves-in-2023-imd-data/articleshow/101604679.cms>

United Nations Office for the Coordination of Humanitarian Affairs. (2023). *Horn of Africa: Drought and conflict situation update*. <https://reliefweb.int/report/world/horn-africa-drought-situation-update-2023>

United Nations Office for the Coordination of Humanitarian Affairs. (2024, May 6). *Kenya–Tanzania floods: 522 deaths, 500,000 displaced*. <https://reliefweb.int/report/kenya/kenya-tanzania-floods-humanitarian-snapshot-may-2024>

UNWomen, (2025). How gender inequality and climate change are interconnected. <https://www.unwomen.org/en/articles/explainer/how-gender-inequality-and-climate-change-are-interconnected>

World Food Programme. (2023). *Horn of Africa drought crisis*. <https://www.wfp.org/emergencies/horn-africa-drought-crisis>

World Bank Group, (2024). Heat and gender: Enhancing her resilience to rising temperatures. <https://blogs.worldbank.org/en/endpovertyinsouthasia/heat-and-gender--enhancing-her-resilience-to-rising-temperatures>

World Bank, Climate Change Knowledge Portal (2025). URL: <https://climateknowledgeportal.worldbank.org/>. Date Accessed: from 04.06.2025; 23.06.2025

Zavala, M. D., Cejas, C., Rubinstein, A., & Lopez, A. (2024). Gender Inequities in the Impact of Climate Change on Health: A Scoping Review. *International Journal of Environmental Research and Public Health*, 21(8), 1093. <https://doi.org/10.3390/ijerph21081093>