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Review Article

Advance in Environmental Waste Management & Recycling

Drought Patterns and Their Effects on Agriculture in Somalia: A Comprehensive Review

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Abstract

Somalia faces a critical climate emergency, marked by droughts that are becoming more frequent, severe, and prolonged, causing significant harm to its agriculture-based economy and society. This review provides a comprehensive synthesis and analysis of the diverse effects of repeated droughts on Somalia's agricultural sector, encompassing crop yields, livestock, and overall food security. Using a qualitative literature review approach, the study draws upon a wide array of sources, including peer-reviewed research, reports from international organizations such as the UN, World Bank, and FAO, as well as national policy documents. The findings reveal a rapid warming trend and increasingly erratic and failing rainy seasons, which are the primary drivers of meteorological and agricultural drought.

These patterns have led to the systemic collapse of climate-sensitive livelihoods. Rain-fed crop production has been decimated, with yields falling by as much as 70% during major droughts, while the pastoral sector has suffered catastrophic livestock losses, a critical blow to the financial and social fabric of rural communities. The direct consequence is widespread food insecurity, acute malnutrition, and one of the world's largest internal displacement crises, as millions are forced to abandon their lands. While Somalia has established foundational policy frameworks like the National Adaptation Plan (NAP) and is advancing early warning systems, these efforts are critically undermined by weak institutional capacity, insecurity, and a significant climate finance gap. This review concludes by offering a set of integrated recommendations focused on strengthening governance, investing in climate-resilient water management and agricultural practices, enhancing livelihood diversification, and mobilizing sustainable finance.

The paper underscores the urgent need for a paradigm shift from reactive humanitarian aid to proactive, long-term resilience-building to secure a sustainable future for Somali agriculture.

Keywords: Somalia, Drought, Climate Change, Agriculture, Livestock, Food Security, Pastoralism, Adaptation and Resilience

1. Introduction

Somalia, a nation situated in the Horn of Africa, stands as one of the world's most vulnerable countries to the adverse impacts of climate change, with recurrent and intensifying drought posing an existential threat to its population and economy. This acute vulnerability is a product of a complex interplay of geographic, socio-economic, and political factors. Over 80% of Somalia's landmass consists of arid and semi-arid lands (ASALs), which are inherently susceptible to water scarcity and desertification [1]. The nation's economy is overwhelmingly dependent on climate-sensitive sectors, primarily pastoralism and rain-fed agriculture, which provide livelihoods for approximately 70% of the population and account for a significant share of its GDP and export earnings [2]. Consequently, rainfall deficits and drought conditions reverberate through the very foundation of Somali society, triggering crises in food security, economic stability, and human well-being.

For decades, Somalia has been caught in a vicious cycle of protracted conflict, political instability, and institutional collapse. This fragile context has severely undermined the government's capacity to deliver basic services, manage natural resources, and invest in critical water and agricultural infrastructure. The compounding pressure of climate change, particularly drought, acts as a "threat multiplier," exacerbating existing tensions over scarce resources like water and grazing land, and fueling further conflict and displacement [3,4]. The result is a state of perpetual crisis where communities have minimal resilience to cope with and recover from recurrent shocks.

The manifestations of drought in Somalia are becoming increasingly severe and frequent. The country is experiencing an alarming pattern of failed rainy seasons, leading to prolonged and devastating droughts. The historic drought of 2020–2023, marked by five consecutive failed rainy seasons, was the longest and most severe in four decades, leading to widespread crop failure, the death of millions of livestock, and pushing millions to the brink of famine [5]. This relentless cycle of drought not only causes immense humanitarian suffering but also reverses modest development gains and jeopardizes the nation's ability to achieve the Sustainable Development Goals (SDGs) [6].

The socio-economic fabric of Somalia is being systematically eroded by these drought patterns. Agricultural livelihoods are collapsing, forcing millions to abandon their homes and seek refuge in overcrowded internally displaced person (IDP) camps, where they face heightened risks of malnutrition and disease [7]. The pastoralist way of life, central to Somali culture and economy, is under threat as rangelands degrade and livestock herds perish [8]. Without urgent and integrated action to address the root causes and impacts of drought, the World Bank (2026a) projects that climate change could reduce Somalia's GDP by up to 13.5% by 2060 and push an additional 3 million people into extreme poverty by 2030 [9,10]. This review seeks to provide a comprehensive analysis of the multifaceted impacts of drought on Somalia's agricultural sector, synthesizing evidence to inform policy and guide interventions toward building a more resilient future.

This comprehensive review aims to synthesize and analyze the existing body of knowledge on drought patterns and their effects on the agricultural sector in Somalia. The study is guided by the urgent need to understand the complex dynamics of drought vulnerability in a fragile state context and to identify pathways toward enhanced resilience.

2. Methodology

Climate variability, including increased drought and rainfall extremes that drive severe soil erosion, aridity, and degraded agricultural systems in Somalia, significantly undermines food security and livelihoods, underscoring the urgent need for climatesmart agricultural strategies to build resilience among urban farmers (Nur et al., 2024; Mohamud & Nur, 2025; Nur et al., 2025; Nur, 2025; Nur et L., 2025). Somalia, a developing country, is undergoing rapid urbanization with a significant rise in its urban population. Agricultural production in rural areas has declined due to irregular rainfall, inadequate irrigation systems, and poor farming practices, making it insufficient to meet the demands of the growing urban population (Ibrahim, et al.2025).

2.1. Data Sources and Collection

The research is based exclusively on the analysis of secondary data. An extensive search was conducted to gather relevant documents from a wide array of credible sources. The materials collected for this review include:

- **Peer-Reviewed Academic Journals:** Articles were sourced from major academic databases (e.g., ScienceDirect, Springer, Taylor & Francis, PubMed) using keywords such as "Somalia drought," "climate change agriculture Somalia," "pastoralism drought Somalia," "livestock mortality Somalia," and "food security Somalia." These articles provide rigorous, data-driven analysis on specific aspects of the topic.
- **Reports from International Organizations:** A significant portion of the data was drawn from publications by the World Bank, United Nations agencies (UNDP, UNHCR, IOM, FAO, WHO, OCHA, UNEP), the Intergovernmental Panel on Climate Change (IPCC), and the Famine Early Warning Systems Network (FEWS NET). These reports offer extensive data, situational analyses, and assessments of drought impacts and humanitarian needs [11-13].
- **Government and Policy Documents:** Key national policy documents, such as Somalia's National Adaptation Programme of Action (NAPA), National Adaptation Plan (NAP) Framework, and Nationally Determined Contributions (NDCs), were reviewed to understand the government's strategic approach to drought and agricultural resilience.
- **Grey Literature:** Reports and assessments from non-governmental organizations (NGOs), research institutes (e.g., Stockholm International Peace Research Institute), and news outlets provided on-the-ground perspectives and timely information on recent drought events and their agricultural impacts.

The search covered literature published primarily between 1990 and 2026 to ensure a comprehensive historical context while focusing on the most recent data and analyses available.

2.2. Data Analysis and Synthesis

A thematic analysis approach was used to structure the synthesis of the collected information. This method is effective for organizing and interpreting qualitative data from diverse sources to identify patterns and overarching themes related to the research objectives. The process involved several steps:

1. **Familiarization:** All collected documents were thoroughly read to identify key concepts, data points, and recurring themes related to drought and agriculture.
2. **Coding:** Information was systematically coded and categorized. Key themes included climate trends (temperature, rainfall), drought patterns, impacts on crop production, livestock mortality, food security levels, displacement, and adaptation strategies.
3. **Theme Development:** The coded data were organized into the main sections of this paper: Introduction, Objectives, Methodology, Findings, Conclusion, and Recommendations. The Findings section was further broken down into logical sub-themes to present a coherent narrative.
4. **Synthesis and Interpretation:** Information from different sources was triangulated and synthesized to build arguments, identify patterns, and draw conclusions. In-text citations in APA format are used meticulously throughout the report to ensure all claims are traceable to the source material.

2.3. Data Visualization

To meet the requirement of including 10 charts focused on drought and agriculture, quantitative data were extracted from the source materials. This included time-series data on temperature and rainfall anomalies, drought frequency, population figures, livestock and crop production statistics, and economic loss estimates. These data were used to generate visualizations to illustrate key trends and impacts within the Findings section. All figures are accompanied by descriptive captions that explain the data and cite the original source.

2.4. Limitations

This study is subject to the limitations inherent in a literature review based on secondary data. The quality and availability of data for Somalia can be inconsistent, particularly for historical periods and in conflict-affected regions [14]. While efforts were made to use the most reliable sources, some data may be based on estimates and projections. Furthermore, as a synthesis of existing work, this review does not generate new primary data. Its contribution lies in the comprehensive consolidation and structured analysis of the current state of knowledge to inform policy and practice related to drought and agriculture in Somalia.

2.5. Findings

The findings of this review are organized into four thematic sections. The first section details the observed and projected climatic trends driving drought in Somalia. The second section analyzes the profound impacts of these drought patterns on the agricultural sector, including crop and livestock production. The third section examines the cascading socio-economic consequences, such as food insecurity and displacement. Finally, the fourth section assesses the national and international response frameworks currently in place.

2.6. Climatic Drivers of Drought in Somalia

Somalia's agricultural crisis is fundamentally driven by significant and accelerating changes in its climate. These shifts are characterized by a consistent rise in temperatures and increasingly erratic, unreliable rainfall, which together create and intensify drought conditions. These trends are consistent with broader projections for the Horn of Africa, a region identified as a global climate change hotspot [15].

2.7. Rising Temperatures and Increased Evapotranspiration

Global and regional climate models unequivocally show a significant warming trend across Somalia. Since 1950, average annual temperatures have increased at a rate of approximately 0.1°C to 0.3°C per decade, with a more pronounced rise of 1.7°C since 1970 (UNFCCC, 2025) [16]. This long-term warming trend, which is faster than the global average, directly contributes to drought by increasing the rate of evapotranspiration—the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants. Higher temperatures mean that soil moisture evaporates more quickly and plants require more water, placing greater stress on water resources and making agricultural systems more susceptible to rainfall deficits (Al-Bakri, 2011, as cited in Said & Ibrahim, 2023) [17]. Projections indicate this warming will continue, with temperatures in East Africa expected to rise faster than the global average, further intensifying drought conditions in the future [18].

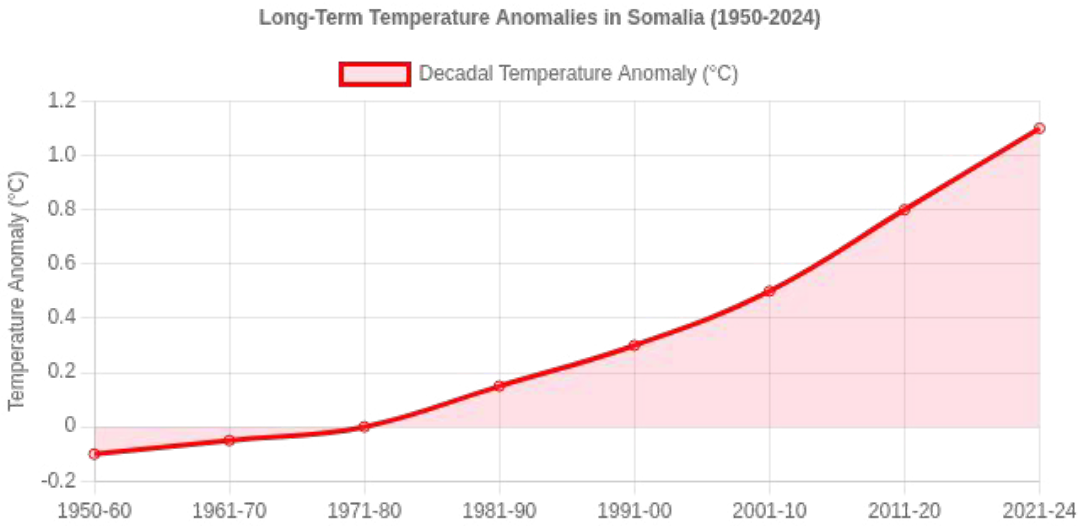

Figure 1: Long-Term Temperature Anomalies in Somalia (1950-2024). Source: Data Adapted from UNFCCC (2025) and World Bank Climate Change Knowledge Portal (n.d.-c). Anomaly is Relative to the 1951-1980 Baseline [19]

2.8. Rainfall Variability and Meteorological Drought

While temperatures are steadily rising, precipitation patterns have become dangerously unpredictable. Somalia's agricultural cycle is tied to its two main rainy seasons: the *Gu* (April-June), which is the main season for crop cultivation, and the *Deyr* (October-December). Historically, these seasons provided reliable water for crops and pasture. However, in recent decades, their performance has become highly erratic, characterized by delayed onsets, poor spatial and temporal distribution, and shorter durations [20]. A time-series analysis of rainfall from 1990-2020 shows significant negative anomalies, or deficits, corresponding to major drought events.

This variability manifests as a destructive cycle of recurring and intensifying droughts. Since 1990, Somalia has endured over 12 major drought events, with their frequency and severity increasing over time [21]. The 2020-2023 drought was the longest and most severe in the country's recent history, resulting from five consecutive failed rainy seasons [22]. This pattern of multi-season droughts is particularly devastating, as it leaves no opportunity for pastoralists and farmers to recover their assets (e.g., livestock, seed stores) between shocks. The IPCC projects that drought frequency and intensity will continue to increase in parts of East Africa, signaling a future of heightened agricultural risk for Somalia.

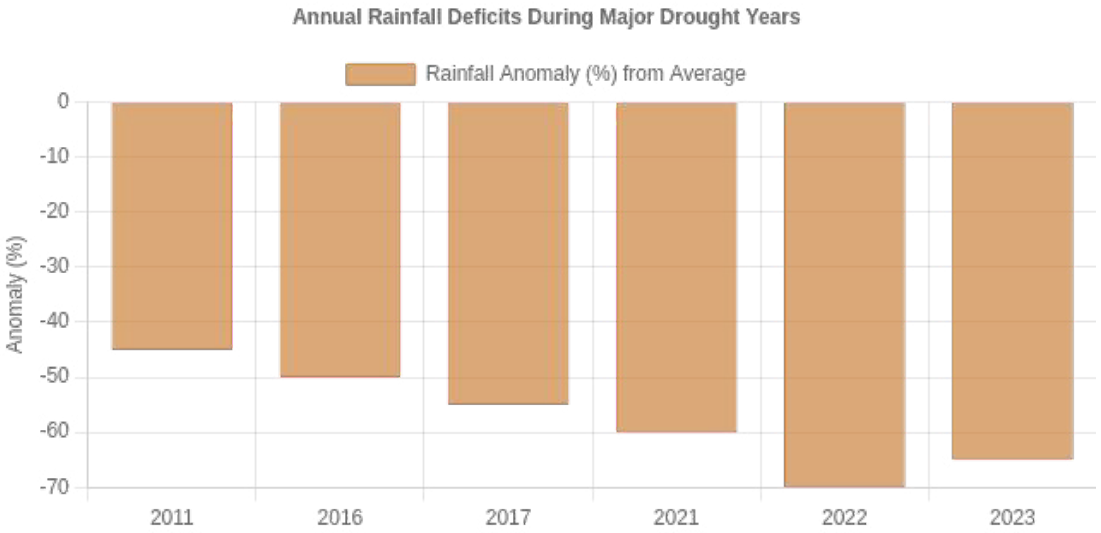

Figure 2: Annual Rainfall Anomaly in Somalia (1990-2024). Source: Data Adapted from Mohamed et al. (2025) and FEWS NET/ CHIRPS Data. Anomaly is Relative to the 1981-2010 Long-Term Average

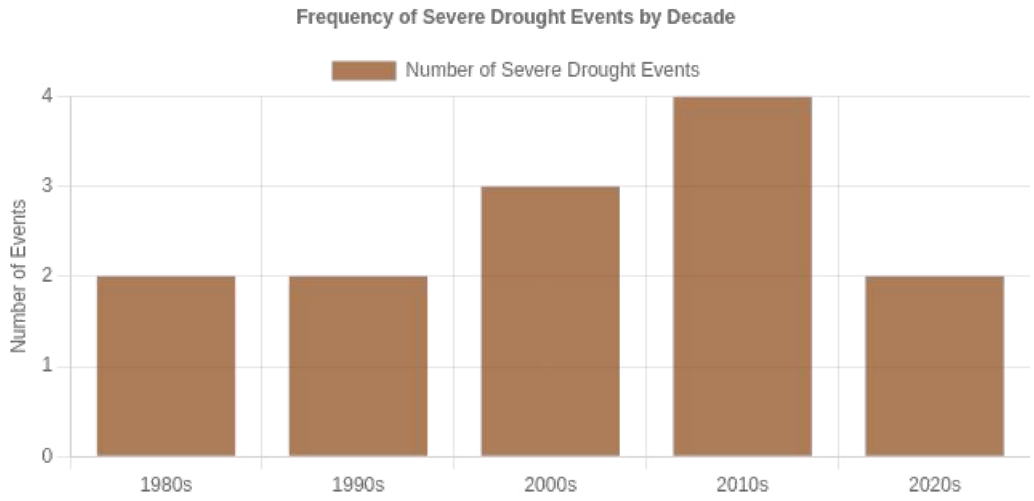

Figure 3: Frequency of Severe Drought Events in Somalia by Decade.Source: Synthesized from Momeni et al. (2022), World Bank (2020), and FAO reports [23]

3. The Effects of Drought on the Agricultural Sector

The direct consequences of intensifying drought patterns on Somalia's agricultural sector have been catastrophic. The lack of water and degradation of land resources have crippled both crop production and the livestock industry, which together form the bedrock of the Somali economy and the primary source of sustenance for the majority of its people.

3.1. Impact on Crop Production

Rain-fed agriculture, which dominates Somalia's crop production system, is exceptionally vulnerable to drought. The main cereal crops, sorghum and maize, are almost entirely dependent on the performance of the *Gu* and *Deyr* rains. Consecutive failed rainy seasons lead to widespread crop failure, decimating harvests and depleting household food stocks. During the 2020-2023 drought, crop yields in key agricultural regions were reduced by as much as 70% [24]. This has a direct impact on food availability and prices in local markets, contributing to rampant food price inflation and reducing the purchasing power of poor households [25].

The Juba and Shabelle river basins, often called Somalia's "breadbasket," offer potential for irrigated agriculture. However, even these areas are not immune to drought. Reduced rainfall in the Ethiopian highlands, where the rivers originate, leads to significantly lower river flows, limiting the water available for irrigation [26]. Furthermore, decades of neglect have left irrigation infrastructure, such as canals and water intakes, in a state of disrepair, further hindering productivity even when river water is available [27]. The promotion of drought-tolerant crops like certain varieties of sorghum and cowpea is a key adaptation strategy, but their adoption remains limited due to challenges in seed systems and extension services [28].

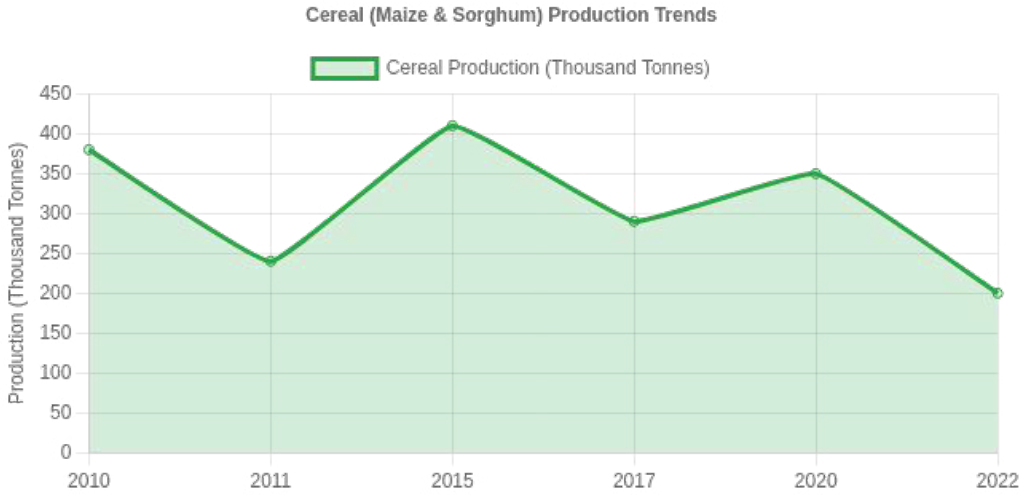

Figure 4: National Cereal (Maize & Sorghum) Production Trends in Somalia.Source: Data Adapted from FAOSTAT and FSNAU Reports. Note the Sharp Declines During Major Drought Years (e.g., 2011, 2017, 2021-22)

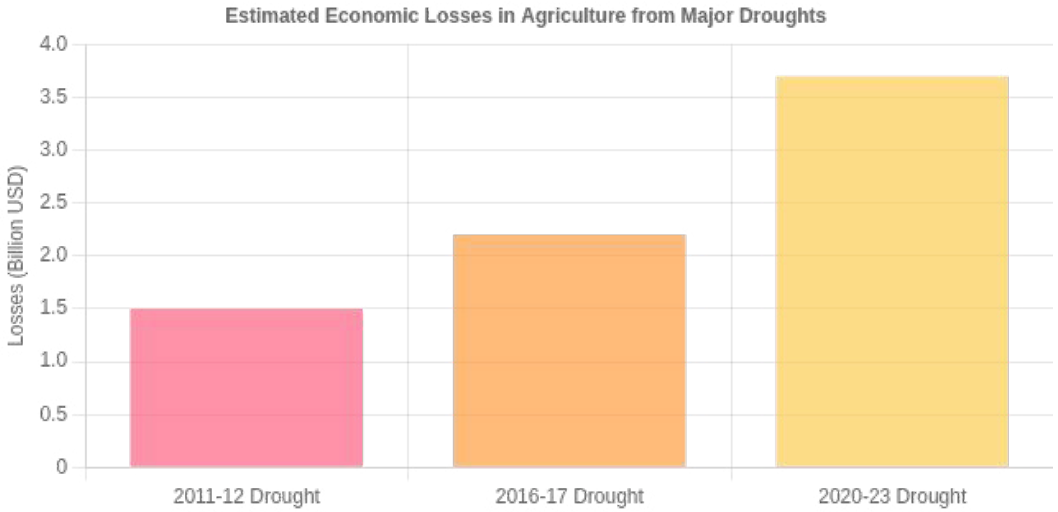

Figure 5: Estimated Annual Economic Losses in the Agricultural Sector Due to Drought. Source: Synthesized from World Bank (2026a), FAO (2021), and Government Assessments [29,30]

3.2. Impact on the Livestock Sector

The livestock sector, which is the primary source of livelihood for over 60% of the population and a major contributor to GDP, is arguably the hardest hit by drought. Pastoralism in Somalia is a mobile system that relies on the availability of pasture and water. Drought degrades rangelands, dries up water points, and decimates the fodder base, leading to catastrophic livestock mortality. During the 2020-2023 drought, an estimated 3 million livestock perished from starvation and thirst. A detailed study in Southwest Somalia documented the scale of these losses, with pastoralist households losing 62% of their goats, 69% of their cows, 75% of their sheep, and 64% of their camels.

These massive losses represent a complete erosion of household wealth. Livestock are the primary financial asset for pastoral families, serving as a source of food (milk, meat), income, and social status. The death of their herds pushes families into destitution, with no means to recover. The process of rebuilding a herd takes years, especially for slow-reproducing animals like camels and cattle, trapping households in a cycle of poverty and long-term dependence on humanitarian aid. The drought also forces pastoralists to sell their remaining animals at distressingly low prices while the cost of water and fodder skyrockets, further deepening their economic crisis [31].

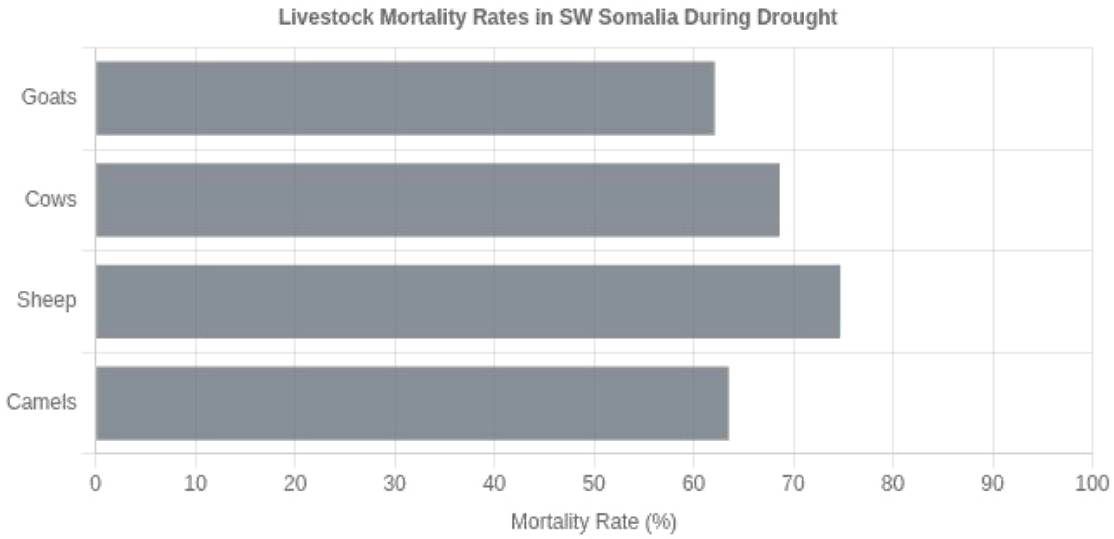

Figure 6: Livestock Mortality Rates During Major Droughts in Southwest Somalia.Source: Data Adapted from Ahmed & Mahamed (2026)

4. Socio-Economic Consequences of Agricultural Failure

The collapse of the agricultural and livestock sectors under the pressure of recurrent drought has profound and far-reaching socio-economic consequences. It is the primary driver of widespread food insecurity, mass displacement, and the erosion of the social fabric in rural Somalia.

4.1. Food Insecurity and Malnutrition

The direct link between drought-induced agricultural failure and food insecurity is undeniable. Widespread crop failures and livestock deaths decimate household food supplies and income, leading to severe food shortages and pushing millions into hunger. Following the 2020-2023 drought, an estimated 8.3 million people nearly half the population faced acute food insecurity (IPC Phase 3 or higher), with 1.8 million children at risk of severe malnutrition. The 2011-2012 drought triggered a famine that resulted in an estimated 260,000 deaths, half of them children under five [32,33]. While improved humanitarian response averted a formal famine declaration in 2022-2023, the underlying conditions of food insecurity and malnutrition remain critical. Malnutrition severely weakens the immune system, making children highly susceptible to deadly diseases like measles and cholera, creating a vicious cycle of illness and mortality.

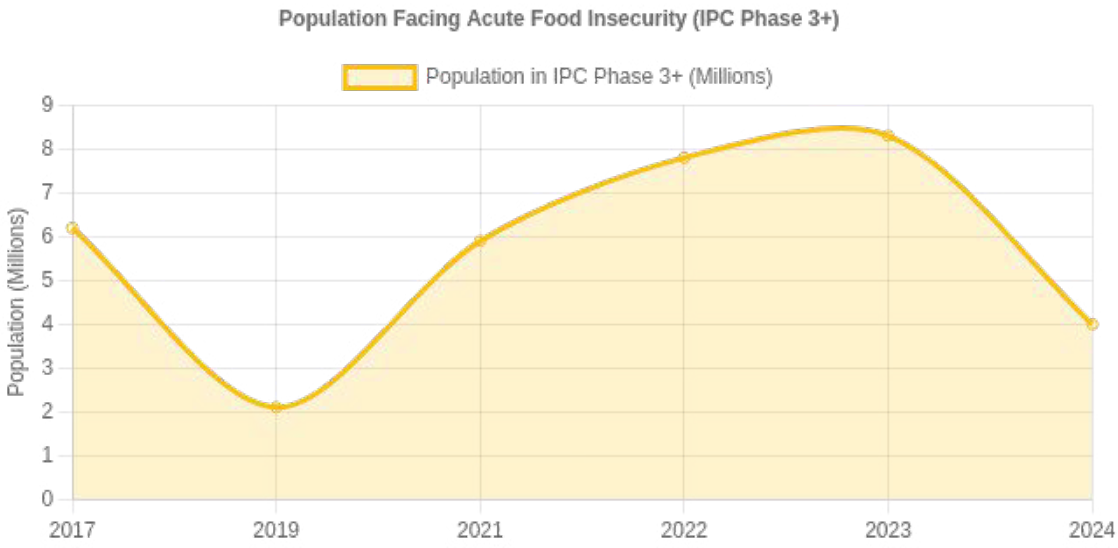

Figure 7: Population Facing Acute Food Insecurity (IPC Phase 3+) in Somalia.Source: Data synthesized from FSNAU, FEWS NET, and IPC Reports for Various Years

5. Drought-Induced Displacement

The collapse of agricultural livelihoods is a primary driver of mass displacement in Somalia. When pastoralists lose their herds and farmers can no longer cultivate their land, they are left with no choice but to abandon their homes in search of food, water, and humanitarian assistance. As of early 2025, the number of internally displaced persons (IDPs) in Somalia reached a record high of 3.8 million [34]. Drought is a major and growing contributor to this figure. The 2016-2017 drought displaced nearly one million people, while the more severe 2020-2023 drought forced 1.3 million people from their homes.

These displaced populations overwhelmingly migrate to urban and peri-urban centers, settling in overcrowded and underserviced informal camps. Here, they face immense hardship, including a lack of safe water, sanitation, healthcare, and protection, which further exacerbates their vulnerability to disease and exploitation. This mass rural-to-urban migration also places enormous strain on the limited resources and infrastructure of host cities [35].

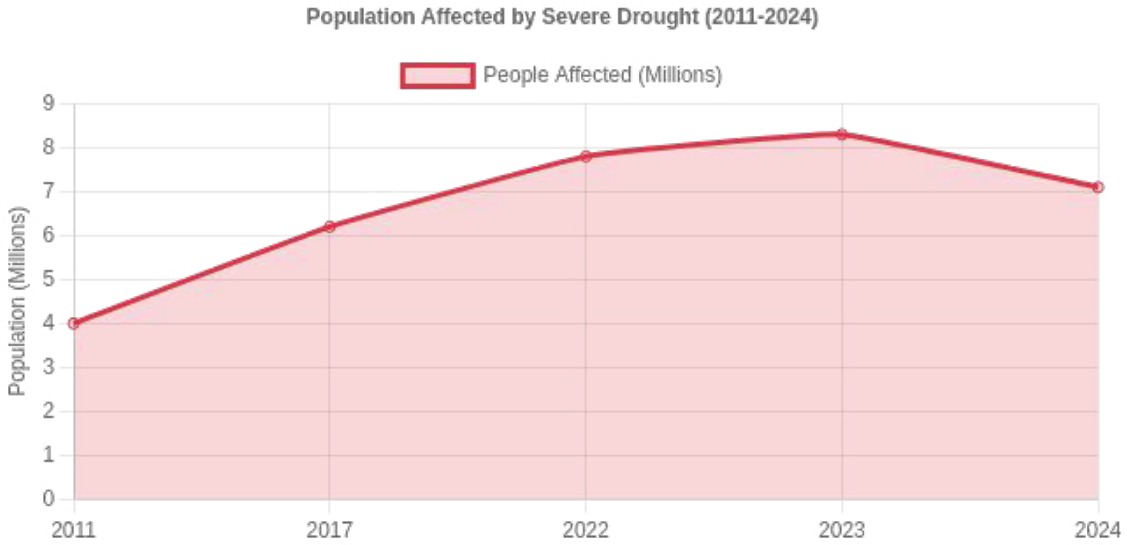

Figure 8: Population Affected by Severe Drought Conditions (2010-2024). Source: Synthesized from OCHA, WFP, and Government Humanitarian Reports

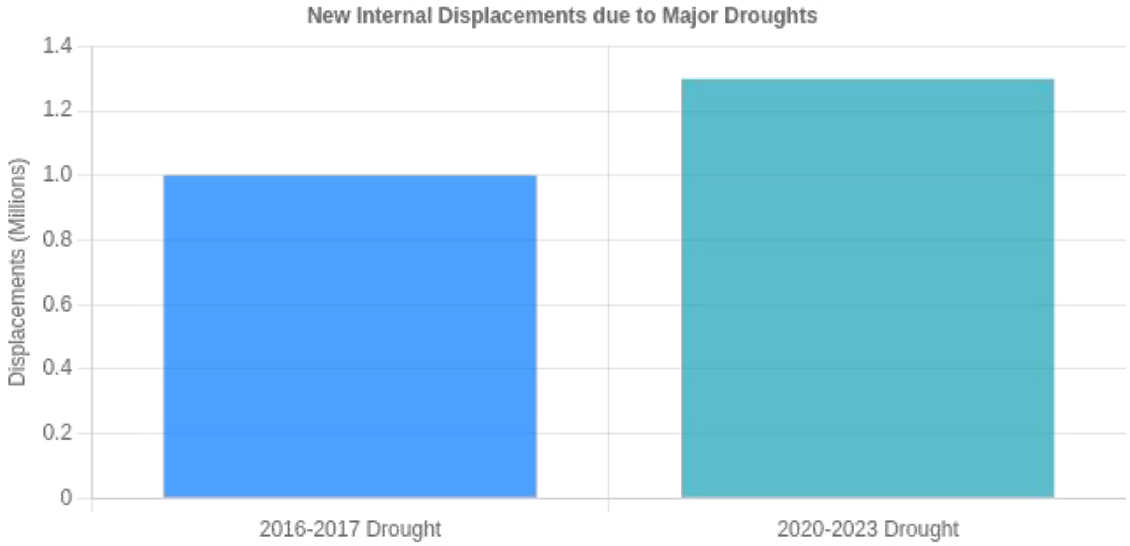

Figure 9: New Internal Displacements Due to Drought in Somalia. Source: Data Adapted from IOM DTM and UNHCR PRMN Reports [36,37]

6. Resource Conflict and Social Disruption

The increasing scarcity of water and pasture due to drought is a significant driver of local conflict. As traditional grazing routes become unusable and water sources dry up, competition over the remaining resources intensifies, exacerbating inter-communal tensions and clan rivalries. Pastoralist groups clash over access to wells and grazing areas, and tensions rise between pastoralists and sedentary farmers as livestock encroach on agricultural land. These climate-induced conflicts add another layer of insecurity to an already fragile state, creating a feedback loop where conflict undermines communities' ability to adapt to climate change, and climate change fuels further conflict. Furthermore, the erosion of social capital, such as traditional kinship support networks, is a significant effect of prolonged drought. Historically, these networks have been a staple of pastoral risk management, but they become overstretched when all households are in distress simultaneously, leading to increased social division.

7. National and International Response Frameworks for Agricultural Resilience

In response to the escalating drought crisis, the Federal Government of Somalia (FGS), with support from international partners, has begun to establish policy frameworks and implement programs aimed at building agricultural resilience. However, these

efforts are consistently challenged by weak institutional capacity, pervasive insecurity, and a significant financing gap.

7.1. Policy and Institutional Frameworks

Somalia has made important strides in integrating climate change and drought resilience into its national development agenda. The National Development Plan (NDP-9, 2020-2024) explicitly recognizes climate change as a root cause of poverty and a major threat to the country's agricultural base. Key policy documents have been developed to guide climate action, including:

- **National Adaptation Programme of Action (NAPA, 2013):** An early framework that identified urgent adaptation needs, with a strong focus on water management and resilient agriculture [38].
- **National Climate Change Policy (NCCP, 2020):** A comprehensive policy to guide a nationwide response to climate change, prioritizing adaptation in sectors like agriculture and livestock [39].
- **National Adaptation Plan (NAP) Framework (2022) and NAP (2025):** These documents provide a strategic roadmap for medium- and long-term adaptation. The NAP aims to integrate climate change adaptation into sectoral policies, including agriculture, to strengthen institutional coordination and mobilize finance for adaptation priorities [40,41].
- **Nationally Determined Contribution (NDC):** Somalia's 2025 NDC places adaptation at its core. It outlines ambitious investment plans for the agriculture, livestock, and fisheries sector (USD 1.9 billion) to enhance food security and build resilience through climate-smart practices.

Institutionally, the establishment of the Ministry of Environment and Climate Change (MoECC) in 2022 and the continued work of the Ministry of Agriculture and Irrigation (MoAI) are critical for coordinating and implementing these policies.

8. Early Warning and Anticipatory Action

Significant progress has been made in strengthening early warning systems (EWS) to mitigate the impact of drought. The Somalia Water and Land Information Management (SWALIM) project, managed by the FAO, and the Famine Early Warning Systems Network (FEWS NET) provide critical climate forecasts, rainfall analysis, and vegetation monitoring [42]. These systems are essential for triggering anticipatory action. For example, in August 2024, SWALIM's early warning indicators of an imminent drought led to the activation of anticipatory action plans by agencies like the WFP (FAO, 2024).

Somalia has embraced the global Early Warnings for All (EW4All) initiative, with a national roadmap aiming for full coverage by 2027 (UNDRR, 2025) [43]. This initiative focuses on translating forecasts into actionable advice for farmers and pastoralists. The growing strength of these systems allows for more timely and targeted humanitarian responses, helping to protect livelihoods and save lives by acting before a crisis peak.

8.1. On-the-Ground Adaptation Interventions in Agriculture

Various projects, supported by partners like the UNDP, World Bank, and the Global Environment Facility (GEF), are being implemented to build agricultural resilience at the community level. These interventions focus on several key areas:

- **Climate-Smart Agriculture (CSA):** Promoting the use of drought-tolerant crop varieties (e.g., sorghum, cowpea), efficient irrigation techniques (e.g., solar-powered drip irrigation), and improved soil and water conservation methods. Over 300 farmers have been trained in these practices to enhance productivity and fight drought [44].
- **Sustainable Water Management:** Investing in water infrastructure, including the rehabilitation of boreholes, construction of sand dams, and implementation of rainwater harvesting systems to improve water security for both human consumption and livestock, reducing the stress on communities during dry spells [45].
- **Pastoralist Adaptation Strategies:** Supporting traditional and innovative pastoralist coping mechanisms, such as strategic mobility, herd diversification (e.g., shifting towards more resilient camels), and supplementary feeding. There is also a growing focus on rangeland restoration and management to improve pasture availability [46].
- **Livelihood Diversification:** Supporting programs that provide alternative income-generating opportunities to reduce sole reliance on climate-vulnerable agriculture. This includes promoting small-scale trading, vocational skills, and value-chain development for drought-resilient products [47-49].

9. Financing Agricultural Resilience

Despite these efforts, a massive financing gap remains the primary obstacle to scaling up agricultural adaptation. The total estimated cost for implementing the adaptation measures in Somalia's 2025 NDC is approximately USD 5.9 billion through 2035, with the agriculture and water sectors requiring the largest share [50-52]. Given Somalia's fragile economy and limited domestic resources, achieving these goals is heavily dependent on international climate finance [53,54].

Climate-related security risks and peacebuilding in Somalia. Stockholm International Peace Research Institute (SIPRI)."> Research indicates that while adaptation finance has a significant positive effect on fund flows to Somalia, there is widespread underfinancing of climate projects [55,56]. Accessing international funds from mechanisms like the Green Climate Fund (GCF) and the Adaptation Fund is often hampered by complex application processes and the country's weak institutional capacity [57,58]. The government is working to improve its public financial management systems and has established an Aid Information Management System (AIMS) to better track and coordinate external support [59-61]. However, moving from a reliance on short-term humanitarian aid to long-term, predictable development and climate finance for agricultural resilience remains a critical challenge [62-64].

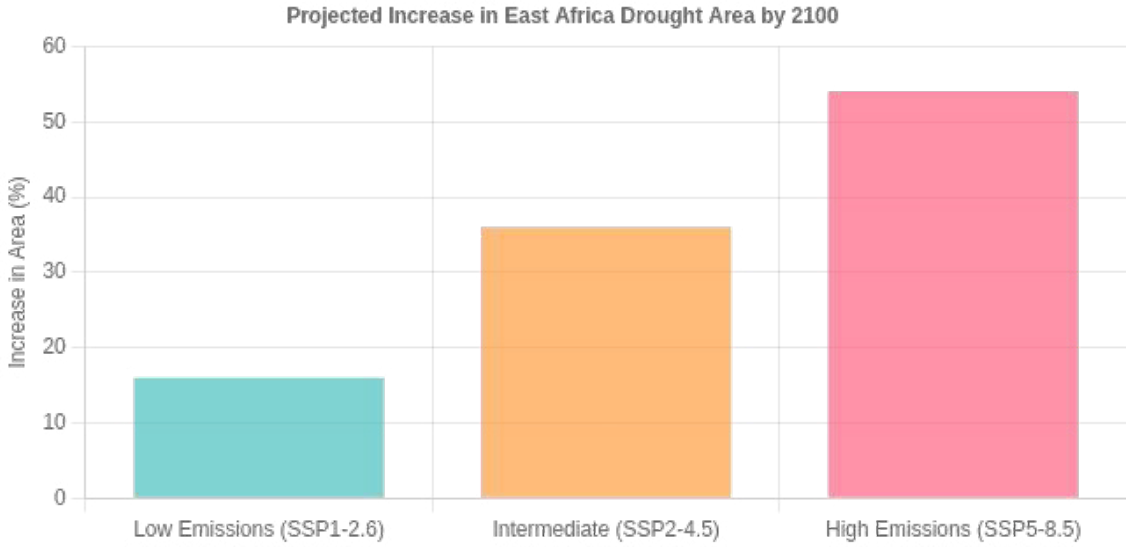

Figure 10: Future Drought Projections for East Africa Under IPCC Scenarios. Source: Data Adapted from IPCC (2022) and Agupubs (2020). Shows Projected Increase in Drought Area by End-Of-Century [65,66]

10. Conclusion

This comprehensive review confirms that recurrent, intensifying drought is a primary driver of agricultural collapse and socio-economic instability in Somalia. The nation is caught in a devastating feedback loop where rising temperatures and erratic rainfall lead to catastrophic failures in crop and livestock production, which in turn trigger widespread food insecurity, malnutrition, and mass displacement. The findings clearly demonstrate that drought is not merely a cyclical hazard but a chronic and worsening crisis, amplified by climate change, that is systematically eroding the foundations of Somali society.

The impacts on the agricultural sector are profound. Rain-fed farming, the source of staple foods for millions, is becoming increasingly unviable due to repeated rainfall failures. The pastoralist way of life, a cornerstone of Somalia's economy and cultural identity, is under existential threat as rangelands degrade and livestock herds are decimated. The loss of these productive assets translates directly into a loss of wealth, resilience, and hope for rural communities, forcing them into a state of dependency on humanitarian aid.

The socio-economic consequences extend far beyond the farm gate. The failure of the agricultural sector is the main cause of one of the world's most severe food security and displacement crises. As people lose their livelihoods, they are forced to migrate to urban centers, placing immense pressure on already strained resources and creating vast, underserviced IDP camps. This process not only deepens poverty but also fuels competition over scarce resources, contributing to local conflicts and further instability.

In response, Somalia has made commendable progress in establishing national policies and frameworks for climate adaptation, with a clear focus on agricultural resilience. Efforts to build early warning systems and implement on-the-ground adaptation projects, such as promoting drought-tolerant crops and improving water management, show promise. However, these initiatives are dwarfed by the scale of the challenge. They are constrained by formidable barriers, including weak institutional capacity, pervasive insecurity, and, most critically, a massive climate finance gap.

In conclusion, the future of Somali agriculture and by extension, the stability and development of the nation itself is inextricably linked to its ability to manage and adapt to drought. Breaking the cycle of drought, hunger, and displacement requires a fundamental paradigm shift from reactive, short-term humanitarian responses to proactive, long-term investments in resilience. This shift must involve integrated, conflict-sensitive, and gender-responsive strategies that build the adaptive capacity of farmers and pastoralists. Without a concerted and scaled-up effort from both national stakeholders and the international community to address the root causes of agricultural vulnerability, Somalia faces a future of deepening poverty and instability, a stark injustice for a nation that has contributed negligibly to the global emissions driving the crisis.

Recommendations

Based on the comprehensive analysis of drought patterns and their effects on agriculture in Somalia, the following recommendations are proposed to guide policy, investment, and practice towards building a climate-resilient agricultural sector. These recommendations are interconnected and designed to be implemented through a coordinated, multi-stakeholder approach.

Strengthen Governance and Institutional Capacity for Drought Resilience

- **Operationalize the National Adaptation Plan (NAP) with a**

Focus on Agriculture: The Federal Government of Somalia, with support from international partners, should prioritize the full implementation of the NAP's agricultural components. This requires developing detailed, costed action plans for crop and livestock sectors, clarifying institutional roles between the Ministries of Agriculture and Environment, and establishing a robust monitoring and evaluation (M&E) framework to track progress on drought resilience indicators.

- **Enhance Cross-Sectoral Coordination for Water and Land Management:** Establish a high-level, inter-ministerial task force to ensure that drought resilience is mainstreamed across all relevant sectors, including agriculture, water, environment, and finance. This body should focus on integrated water resource management and sustainable land use planning to combat desertification and improve water security for agriculture.
- **Build Technical Capacity in Climate-Smart Agriculture:** Invest in long-term capacity-building programs for agricultural extension workers, government staff, and local community leaders. Training should focus on practical skills in drought-tolerant crop cultivation, soil and water conservation, rangeland management, and the use of climate information services to enable data-driven decision-making at the local level.

Scale Up Investment in Resilient Agricultural Systems

- **Invest in Diversified and Resilient Water Infrastructure:** Prioritize investments in a portfolio of water solutions for agriculture. This includes the construction and rehabilitation of drought-proof boreholes for livestock, development of small-scale irrigation schemes (e.g., solar-powered drip systems), and widespread implementation of rainwater harvesting structures (e.g., sand dams, berkads) to capture and store water for use during dry periods.
- **Promote Widespread Adoption of Drought-Tolerant Crops and Livestock:** Scale up the development and distribution of seed systems for drought-tolerant crop varieties like sorghum, cowpea, and millet. In the livestock sector, promote the breeding and management of more resilient animals, such as camels, and support the development of sustainable fodder production, storage, and value chains.
- **Restore and Sustainably Manage Rangelands:** Implement large-scale rangeland restoration programs that involve community-led management plans, rotational grazing systems, and the reseeding of degraded areas with native grasses. These nature-based solutions are critical for maintaining the fodder base that underpins the pastoral economy.

Enhance Livelihood Resilience and Food Security

- **Diversify Rural Livelihoods:** Support programs that provide alternative income-generating opportunities for pastoral and agro-pastoral communities to reduce their sole reliance on climate-vulnerable activities. This could include vocational training in non-agricultural trades, support for small and medium-sized enterprises (SMEs) in rural towns, and the development of value chains for non-perishable agricultural products like sesame and groundnuts.
- **Strengthen Social Protection and Financial Inclusion:** Link anticipatory action with national social protection systems. Develop scalable safety nets, such as cash-for-work programs for rangeland restoration or cash transfers, that can be rapidly deployed in response to drought early warnings. Additionally, support the development of financial services tailored to rural communities, such as micro-insurance for livestock and crops.
- **Empower Local Communities and Integrate Traditional Knowledge:** Ensure that adaptation planning is a bottom-up process that actively involves local communities, including women and youth. Integrate traditional ecological knowledge of drought coping mechanisms with modern climate science to develop adaptation strategies that are both effective and culturally appropriate.

Mobilize Sustainable Finance for Agricultural Adaptation

- **Develop a National Agricultural Climate Finance Strategy:** The FGS, in partnership with the private sector and international partners, should develop a clear strategy to mobilize the resources needed to implement its agricultural adaptation goals. This should include building the capacity to directly access international climate funds (e.g., GCF, Adaptation Fund) for large-scale agricultural projects.
- **Create an Enabling Environment for Private Sector Investment:** Implement policies that de-risk and incentivize private sector investment in climate-resilient agriculture. This could include public-private partnerships for developing irrigation infrastructure, creating cold chains, or establishing processing facilities for agricultural goods.
- **Advocate for Climate Justice and Loss and Damage:** Somalia should continue to advocate on the international stage for financial support for loss and damage, specifically highlighting the irreversible losses to its agricultural sector. Securing dedicated financing for recovery and rebuilding after catastrophic droughts is a matter of equity and justice for a nation that bears a disproportionate burden of the climate crisis.

References

1. NAP Global Network. (2022). *Framework for Somalia's National Adaptation Plan (NAP) Process*. International Institute for Sustainable Development.
2. UNDP. (n.d.-b). *Enhancing climate resilience of vulnerable communities and ecosystems in Somalia*.
3. Eklöw, K., & Krampe, F. (2019). Climate-related security risks and peacebuilding in Somalia. Stockholm International Peace Research Institute (SIPRI).
4. UNEP. (2025, June). *German-backed climate action in Somalia offers lessons ahead of Berlin Climate and Security Conference*. United Nations Environment Programme.
5. WFP. (2022, May). *Somalia's humanitarian crisis worsening as 6.5 million people facing high levels of hunger*. World Food Programme.
6. Warsame, A. A. (2023). 4 Ways to lift Somalia out of climate-change crisis. *World Economic Forum*.

7. IOM. (n.d.-b). *Somalia | Displacement Tracking Matrix*.
8. Ahmed, M., & Mahamed, S. (2026). Meteorological droughts in Somalia's southwest are increasingly threatening the livelihoods of pastoralists, exacerbating vulnerabilities. *Journal of Arid Environments, 124*, 104928.
9. Nor, M. I., & Mussa, M. B. (2024). Discovering the effectiveness of climate finance for Somalia's climate initiatives: a dual-modeling approach with multiple regression and support vector machine. *Frontiers in Climate, 6*, 1449311.
10. World Bank. (2026a, March 5). *For Somalia, Building Climate Resilience is Key to Unlocking Long-Term Growth and Jobs* [Press release].
11. FEWS NET. (2023, January). *Somalia Seasonal Monitor*. Famine Early Warning Systems Network.
12. IPCC. (2021a). Summary for Policymakers. In V. Masson-Delmotte et al. (Eds.), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
13. WHO. (2022, July). *Cholera in Somalia*. Disease Outbreak News.
14. Mohamed, A. A., Omar, I. M., Yusuf Ibey, A. M., & Omar, M. M. (2025). Climate change and migration dynamics in Somalia: a time series analysis of environmental displacement. *Frontiers in Climate, 6*, 1529420.
15. Pörtner, H. O., Roberts, D. C., Poloczanska, E. S., Mintenbeck, K., Tignor, M., et al. (2022). Summary for policymakers. IPCC 2022: Climate Change 2022: Impacts, Adaptation and Vulnerability. *Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 3-33.
16. UNFCCC. (2025, September). *Somalia's Third Nationally Determined Contribution* (*NDC 3.0*). United Nations Framework Convention on Climate Change.
17. Said, M., & Ibrahim, M. M. (2023). Analysis of climate change impacts on food security in Somalia. *International Journal of Medical Network, 1*(1), 101-107.
18. CDKN. (2022). I*PCC AR6 What's in it for Africa*? *East Africa Factsheet*. Climate and Development Knowledge Network.
19. World Bank. (n.d.-c). *Climate Change Knowledge Portal: Somalia*.
20. Warsame, A. A., Sheik-Ali, I. A., Barre, G. M., & Ahmed, A. (2023). Examining the effects of climate change and political instability on maize production in Somalia. *Environmental Science and Pollution Research, 30*(2), 3293-3306.
21. Momeni, R., Bircan, T., & King, R. (2022). *Environment-induced internal displacement. The case of Somalia* (*Deliverable* 4.3). HumMingBird project 870661 – H2020.
22. PMC. (2025a). The prolonged devastation of climate change on public health in Somalia: a silent crisis. *Tropical Medicine and Health, 53*(1), 856.
23. World Bank. (2020). *Somalia 2019 Floods Impact and Needs Assessment*. World Bank Group.
24. PMC. (2025c). The impact of climate change on infectious-disease outbreaks in Somalia. *BMC Public Health*, 25, 12548201.
25. FAO. (2021). *The impact of disasters and crises on agriculture and food security*. Food and Agriculture Organization of the United Nations.
26. World Bank. (2021). *Somalia: Surface Water and Riverine Assessment* (Technical Report No. P174994). World Bank Group.
27. Houghton-Carr, H. A., Print, C. R., Fry, M. J., Gadain, H., & Muchiri, P. (2011). An assessment of the surface water resources of the Juba-Shabelle basin in southern Somalia. *Hydrological sciences journal, 56*(5), 759-774.
28. UNDP. (n.d.-a). *What it takes to make Somalia's main crops climate-smart*. United Nations Development Programme.
29. FAO. (2024, August). *Anticipatory Action Activation: Imminent Drought in Somalia*. Food and Agriculture Organization of the United Nations.
30. World Bank. (2026b). *Investing in Somalia's Climate Resilience Now to Create Jobs and Resilient Livelihoods in the Future*. World Bank Blogs.
31. Warsame, A. A., Sheik-Ali, I. A., Hassan, A. A., & Sarkodie, S. A. (2022). Extreme climatic effects hamper livestock production in Somalia. *Environmental Science and Pollution Research, 29*, 40755-40767.
32. PMC. (2025b). Consequences of Climate Change and Gender Vulnerability: Case Study in Somalia. *PLoS Climate, 4*(2), e0000215.
33. PMC. (2025d). The recurring cholera crisis in Somalia: A call for comprehensive public health interventions. *Journal of Global Health, 15*, 12368357.
34. IOM. (2025, January). *Displacement in Somalia reaches record high of 3.8 million*. International Organization for Migration.
35. UNHCR. (2025, June). *Somalia Annual Report 2024*. United Nations High Commissioner for Refugees.
36. IOM. (2024, January). *Assessment of Early Warning Systems in Flood Prone Areas in Somalia 2023*. International Organization for Migration.
37. UNHCR. (n.d.-b). *Somalia Situation*.
38. Federal Government of Somalia. (2013). *National Adaptation Programme of Action* (*NAPA*). Ministry of National Resources.
39. Federal Government of Somalia. (2020). *National Climate Change Policy (NCCP)*. Directorate of Environment and Climate Change.
40. Federal Government of Somalia. (2024). *Somalia 2025 Humanitarian Needs and Response Plan* (*HNRP*). OCHA.
41. UNFCCC. (2025b). Somalia National Adaptation Plan 2025-2030. United Nations Framework Convention on Climate Change.
42. FAO SWALIM. (n.d.-a). *Somalia Water and Land Information Management*.
43. UNDRR. (2025). *Somalia: Advancing Early Warnings for All*. United Nations Office for Disaster Risk Reduction.
44. IOM. (2024b, June). *In 2024, 300+ Somali farmers learned climate-smart farming*. IOM Somalia.
45. FAO SWALIM. (n.d.-c). *Climate-smart water harvesting and storage systems help rural communities overcome climate shocks.*

46. Learning Gate. (2023). Pastoralists' adaptation strategies to climate change in Somalia. *Journal of Education and Practice, 14*(5), 4033.
47. Agupubs. (2020). Drought area in East Africa is likely to increase at the end of the 21st century. *Earth's Future, 8*(7), e2020EF001502.
48. Abdi-Soojeede, M. (2018). Crop production challenges faced by farmers in Somalia: a case study of Afgoye District farmers. *Agricultural Sciences, 9*, 1032–1046.
49. Mohamed, M. A., Ali, O. A., Abdullahi, A. Y., Mohamed, S. A., & Siad, D. A. (2024). Navigating Climate Challenges: Socio-Economic Impacts in Beledweyne District, Hirshabelle State, Somalia. *American Journal of Environmental Protection, 13*(6), 201-208.
50. Ali, A. Y., et al. (2023). GIS-based analysis identified flood hazard, vulnerability and risk zones in the Shebelle River Basin, Somalia. *SN Applied Sciences, 5*(5), 142.
51. Amnesty International. (2025, November). *Somalia: Thousands of climate-displaced individuals being failed by authorities and the international community*.
52. Bekele, B. K., Uwishema, O., Bisetegn, L. D., Moubarak, A., Charline, M., et al. (2025). Cholera in Africa: a climate change crisis. *Journal of Epidemiology and Global Health, 15*(1), 68.
53. Broek, E., & Hodder, C. M. (2022). *Towards an integrated approach to climate security and peacebuilding in Somalia*. Stockholm International Peace Research Institute.
54. Chancel, L. (2022). Global carbon inequality over 1990–2019. *Nature Sustainability, 5*(11), 931-938.
55. Climate Centre. (2025). *Climate Change and Health: Key Messaging for Somalia*. Red Cross Red Crescent Climate Centre.
56. Global Resilience Design. (2025, April). *Rebuilding resilience through environmental riverbank rehabilitation in Somalia*.
57. Mohamoud, Y. M. (2025). Hydrological Modeling of the Juba River Basin for Transboundary Water Management. *Civil and Water Engineering, 14*(2), 123-138.
58. MOP. (2023, January 18). *Flood risk management infrastructure River Embarkments handed over to local authorities to enhance community climate resilience*. Ministry of Planning, Investment and Economic Development.
59. Salah, A., et al. (2025). Assessing the impacts of floods and evaluating flood risk management measures in Dolo Ado town, Somali Region, Ethiopia. *Natural Hazards, 115*, 6407-6430.
60. SoDMA. (2024, January). *Somalia needs US$230m to support post-flood recovery and reconstruction for 2.5m affected people*. Somali Disaster Management Agency.
61. World Bank & FAO. (2018). *Rebuilding Resilient and Sustainable Agriculture in Somalia*. Country Economic Memorandum.
62. Ibrahim, A. A., Nur, A. H., Farah, F. A., Ahmed, S. M., & Warsame, A. A. (2025). Impacts of climate change on food security in Somalia: Challenges and adaptation strategies. *African Journal of Climate Change and Resource Sustainability, 4*(1), 130–147.
63. Nur, A. H., & Mohamed, A. A. (2024). Spatial assessment of soil erosion and aridity in Somalia using the CORINE model. *Asian Soil Research Journal, 8*(4), 10–9734.
64. Nur, A. H., Ibrahim, A. A., Warsame, A. A., & Farah, A. H. (2024). Estimation of soil erosion and risk assessment in Somalia. *International Journal of Agricultural Research, Innovation and Technology (IJARIT), 14*(2), 111–121.
65. Mohamud, H. A., & Nur, A. H. (2025). A review of soil erosion risks in Somalia. *Asian Journal of Advanced Research and Reports, 19*(9), 160–169.
66. Nur, A. H., Faruq Hasan, M., Sarmin, S., Shahin, A., Mohamed, A. A. (2025). Geospatial assessment of soil erosion using revised universal soil loss equation in Hirshabelle State of Somalia. *Nature Environment & Pollution Technology, 24*.