

Climate Change Impacts on Agricultural Productivity and Food Security in Somalia: An Integrative Narrative Review and Policy Analysis

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Systematic Review

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Abstract

Climate change is an escalating threat to agricultural production, rural livelihoods and food security in Somalia, where farming and pastoral systems are highly exposed to recurrent droughts, riverine floods, rainfall variability, extreme heat, land degradation and weak water infrastructure. This study synthesizes empirical and institutional evidence on the pathways through which climate hazards influence agricultural productivity and food-security outcomes in Somalia. An integrative narrative review design was used, combining a transparent, targeted search of peer-reviewed and institutional evidence with secondary analysis of published results. The core empirical evidence was drawn from a cross-sectional study of 205 respondents in Jowhar District and was triangulated with peer-reviewed studies, Food and Agriculture Organization and FAO-SWALIM assessments, Integrated Food Security Phase Classification analyses, and the World Bank's Somalia Country Climate and Development Report. The evidence shows that climate change affects agriculture through crop failure, livestock losses, water scarcity, flooding, soil degradation, pest pressure, disrupted planting calendars and damaged irrigation systems. In the Jowhar study, 99.5% of respondents reported noticeable climatic changes during the preceding five to ten years, 98.0% reported effects on household food availability, and 60.0% reported being often or always food insecure because of climate-related conditions. The perceived threat of climate change to agriculture and food security was strongly associated with the frequency of food insecurity (Spearman's $\rho = .934$, $p < .01$). Irrigation infrastructure was the most frequently identified priority for resilience investment, followed by climate-resilient seeds and livestock, weather forecasting, finance and adaptation training. National assessments in early 2026 likewise documented severe drought impacts, near-total failure of the 2025 Deyr harvest, livestock stress, rising cereal prices and widespread acute food insecurity. The synthesis concludes that Somalia's food-security crisis is produced by interacting climatic, economic and institutional pressures rather than climate exposure alone. It recommends integrated investment in irrigation and flood control, climate-resilient seed systems, early-warning services, extension, agricultural finance, market infrastructure and shock-responsive social protection. Future research should use nationally representative panel data combining farm production, household welfare and geospatial climate indicators.

Introduction

Climate change has become one of the most consequential threats to global food systems because agricultural production depends directly on temperature, precipitation, water availability, soil conditions and the timing of seasonal activities. Changes in these conditions influence crop germination, plant growth, livestock health, fisheries, agricultural labour, post-harvest handling and food distribution. Climate change therefore affects food systems not only through gradual shifts in mean temperature and rainfall, but also through the increasing frequency and intensity of droughts, floods, heatwaves, storms, pests and diseases (Muluneh, 2021; Yuan, 2024).

The agricultural effects of climate change are particularly severe in low-income and fragile settings because producers often rely on rain-fed farming, traditional technologies and limited financial

resources. Smallholder households may have little access to irrigation, improved seed varieties, extension services, insurance, formal credit or reliable climate information. As a result, a single failed rainy season can reduce both household food production and income, while repeated shocks can force families to sell productive assets, reduce meal frequency, migrate or become dependent on humanitarian assistance (Connolly-Boutin & Smit, 2016; Magesa, 2023).

Food security is affected through four interrelated dimensions: availability, access, utilization and stability. Climate hazards reduce availability when crops and livestock output decline; they weaken access when food prices rise or household income falls; they undermine utilization when water shortages, disease and poor diets affect nutritional outcomes; and they destabilize all three dimensions when shocks recur across seasons. Consequently, agricultural productivity and food security must be analysed as connected outcomes within a broader system of climate exposure, livelihood capacity, markets and public institutions (Schmidhuber & Tubiello, 2007; Toromade, 2024).

Sub-Saharan Africa is among the regions most exposed to these risks because agricultural systems remain strongly dependent on rainfall and smallholder production. Evidence across the region shows that rainfall deficits, extreme heat and flooding often reduce cereal yields, increase production volatility and worsen household food insecurity. However, the magnitude and direction of effects vary by crop, agroecological zone, access to irrigation and the adaptive capacity of farmers, making context-specific research essential (Schlenker & Lobell, 2010; Omotoso et al., 2023; Salifu & Garzo, 2026).

Somalia presents an especially important case because the country combines high climate exposure with poverty, conflict, displacement, weak infrastructure and limited institutional capacity. Crop production is concentrated in southern riverine and rain-fed zones, particularly along the Juba and Shabelle rivers, while pastoralism supports livelihoods across wide arid and semi-arid areas. These production systems are repeatedly disrupted by drought, river flooding, land degradation, water scarcity and market interruption (Warsame, 2021; Hassan & Mohamed, 2024; Osman, 2026).

Somalia's seasonal agricultural calendar depends heavily on the Gu and Deyr rainy seasons. The Gu season normally provides a large share of annual rainfall, while the shorter Deyr season supports secondary crop and pasture production. Variability in the onset, distribution and cessation of these rains directly affect planting decisions, crop establishment, pasture regeneration and water availability. In riverine areas, rainfall in the Ethiopian highlands also influences river levels and flood risk along the Shabelle and Juba systems (FAO-SWALIM, 2025; Osman, 2026).

Recent events demonstrate the continued urgency of the problem. The Food and Agriculture Organization of the United Nations (FAO) reported that the 2025–2026 drought intensified rapidly and was likely to become comparable in severity and geographic spread to major droughts in 2011, 2017 and 2022. The near-total failure of the 2025 Deyr harvest, severe pasture and water shortages, livestock losses and rising cereal prices contributed to a sharp deterioration in food security during early 2026 (FAO, 2026a; FAO, 2026b).

The Integrated Food Security Phase Classification estimated that approximately 6.5 million people faced Crisis-level or worse acute food insecurity during February-March 2026. Although the estimate later changed as seasonal conditions and analytical periods were updated, the scale of need demonstrated the sensitivity of household food security to climatic shocks, high food prices, conflict, displacement and declining humanitarian assistance (IPC, 2026a; IPC, 2026b).

The World Bank's Somalia Country Climate and Development Report further warns that climate change could impose substantial long-term economic costs. Without effective adaptation and development measures, climate impacts could reduce Somalia's gross domestic product by up to 13.5% by 2060 relative to a no-climate-impact scenario. The report emphasizes that resilience investment, economic diversification, improved disaster-risk management and climate-resilient livelihoods are essential for protecting growth and employment (World Bank, 2026).

Despite growing attention to these challenges, the evidence base remains fragmented. Some studies use national time-series models, whereas others examine local perceptions and adaptation practices in individual districts. Few studies integrate climate exposure, measured agricultural productivity, household food security, adaptation and institutional response within a single nationally representative framework. This paper therefore synthesizes available empirical and policy evidence to clarify the main relationships and identify priorities for research and policy in Somalia (Warsame, 2021; Hassan & Mohamed, 2024; Osman, 2026).

Agriculture and livestock remain central to livelihoods, food availability, employment and household income in Somalia. However, productivity is low and unstable because of recurrent droughts, riverine flooding, irregular rainfall, elevated temperatures, land degradation, deteriorated irrigation networks, limited access to inputs and weak extension and financial services. These pressures are most severe among smallholder farmers and pastoralists whose livelihoods depend directly on natural resources and who possess few assets with which to absorb shocks (Warsame et al., 2021; Hassan & Mohamed, 2024).

Climate shocks influence food security through multiple pathways. Drought reduces soil moisture, river flow, pasture and water availability, while floods destroy standing crops, damage canals and roads, increase waterlogging and interrupt market access. Production losses reduce the amount of food available for household consumption and sale, while higher prices reduce the purchasing power of both agricultural and non-agricultural households. The same shock may therefore cause simultaneous declines in food availability, income and dietary quality (Ahmed & Ali, 2024; Osman, 2026).

The effects are magnified by conflict, displacement, weak infrastructure and declining humanitarian financing. Households that lose crops or livestock may sell remaining assets, borrow at unfavourable terms, reduce meals, withdraw children from school or migrate. These strategies may protect immediate consumption but weaken future productive capacity, creating a cycle in which repeated shocks generate deeper vulnerability and prolonged dependence on assistance (World Bank, 2026; FAO, 2026c).

Although existing research establishes a relationship between climate variability and agricultural performance in Somalia, important limitations remain. National time-series studies can identify long-run associations but often lack household-level information on food access and adaptation. Local surveys provide detailed perceptions but cannot be generalized to all of Somalia and may not measure actual crop yield or climate exposure. This separation limits the design of policies that connect national climate investment with local agricultural and food-security outcomes (Warsame, 2021; Osman, 2026).

The research problem addressed by this paper is therefore the absence of a consolidated account of how climate hazards, agricultural productivity, household food insecurity and adaptation interact in Somalia. A careful synthesis is required to distinguish established findings from evidence gaps, to avoid presenting local results as national estimates, and to identify interventions that address the production, market and institutional dimensions of climate vulnerability.

Literature Review

Climate Change and Agricultural Productivity

Agricultural productivity describes the amount or value of output generated from agricultural inputs. It may be measured through crop yield per hectare, total agricultural output, production indices, labour productivity or total factor productivity. Yield per hectare captures land productivity, whereas total productivity measures how efficiently land, labour, seed, fertilizer, capital and other inputs are transformed into output (Sarma, 2024; Salifu & Garzo, 2026).

Rainfall affects agricultural productivity through its timing, intensity, spatial distribution, and seasonal reliability rather than through annual totals alone. A season may record near-normal total rainfall but still produce poor harvests if rain begins late, stops early or falls in a few intense events. Prolonged dry spells during germination or flowering can sharply reduce yields, while intense rainfall may cause erosion, waterlogging and crop damage. Seasonal and spatial rainfall analysis is therefore more useful for agricultural planning than national annual averages (FAO-SWALIM, 2025; Yuan, 2024).

Temperature affects crops by changing evapotranspiration, soil moisture, growing-period length and plant physiology. High temperatures increase crop water demand and may accelerate development before adequate grain formation occurs. Heat stress also reduces labour productivity and can increase pest and disease pressure. In arid and semi-arid environments, temperature effects are especially damaging when combined with rainfall deficits and inadequate irrigation (Schlenker & Lobell, 2010; Yuan, 2024).

Flooding has both direct and indirect consequences. Direct effects include crop destruction, livestock mortality, erosion, waterlogging and damage to canals, pumps and storage facilities. Indirect effects include transport disruption, market isolation, higher transaction costs, delayed planting and increased disease risk. Riverine farming systems can therefore experience severe losses even when water is generally considered an agricultural asset (Ahmed, 2022; Osman, 2026).

Food Security and the Entitlement Approach

The Food and Agriculture Organization conceptualizes food security through availability, access, utilization and stability. Availability concerns the physical supply of food; access concerns the economic and social ability to obtain it; utilization concerns nutritional quality, sanitation and health; and stability concerns the continuity of the other dimensions over time. Climate-related agricultural losses may affect all four dimensions simultaneously (Schmidhuber & Tubiello, 2007; Toromade, 2024).

Amartya Sen's entitlement approach provides a useful framework for understanding why reduced agricultural productivity can produce hunger. A household's entitlement is the bundle of food it can command through production, labour, trade, transfers or other resources. A farming household may be food insecure even when food is available in national markets if crop failure and income loss prevent it from purchasing that food (Sen, 1981; Salifu & Garzo, 2026).

The entitlement framework is highly relevant to Somalia because rural households often combine own-production, livestock sales, casual labour, remittances, trade and humanitarian transfers. Climate shocks can reduce several entitlements at once: crop yields fall, livestock prices deteriorate during distress sales, wage opportunities decline and food prices rise. Food insecurity therefore reflects both production failure and a breakdown in purchasing and exchange capacity (Ahmed & Ali, 2024; FAO, 2026b).

Somalia's Agricultural and Climatic Context

Somalia contains diverse livelihood systems, including riverine and rain-fed crop production, agro-pastoralism, pastoralism, fisheries and urban market-based livelihoods. Crop cultivation is concentrated in southern regions, particularly the Juba and Shabelle river basins. Major crops include sorghum, maize, sesame, cowpea, rice and horticultural products, although production patterns differ by location and season (Osman, 2026; FAO-SWALIM, 2025).

Agricultural production generally follows the Gu and Deyr rainy seasons. The Gu season is particularly important and contributes a substantial share of annual rainfall in many parts of the country. The dry Jilaal and Hagaa seasons create water and pasture stress, while poor performance of consecutive rainy seasons can cause multi-season drought. The timing of rainfall and river levels therefore determines planting, irrigation demand, livestock mobility and market supply (FAO-SWALIM, 2025; FAO-SWALIM, 2026).

Jowhar District illustrates the interaction between riverine opportunity and climate risk. Fertile alluvial soils and access to the Shabelle River support crop production, but damaged embankments, canal blockages and high river levels create repeated flood risks. Historical floods have inundated farms, damaged irrigation infrastructure, displaced households and increased dependence on aid (Duale & Owour, 2016; Ahmed, 2022; Osman, 2026).

Somalia's climate vulnerability is not solely environmental. Inadequate roads, storage, electricity, irrigation governance and financial services increase the economic effect of each climatic shock. Conflict and displacement constrain access to farms and markets, while weak administrative capacity limits maintenance of public infrastructure. Climate adaptation therefore requires institutional and development investment, not only changes in farm practices (World Bank, 2026).

Empirical Evidence from Somalia

Warsame. (2021) used an autoregressive distributed lag approach to investigate the climate change-crop production relationship in Somalia. Their findings support a long-run connection between climatic conditions and crop production, demonstrating the value of time-series methods for national analysis. However, aggregate models cannot fully explain how impacts differ across households, crops and livelihood zones.

Hassan and Mohamed (2024) examined the dynamic effects of economic and environmental factors on agricultural productivity in Somalia using an ARDL technique. Their analysis highlights the importance of treating agricultural productivity as an outcome influenced by both environmental pressures and economic conditions. The study reinforces the argument that climate policy should be linked with broader agricultural development, market reform, and institutional strengthening.

Osman (2026) provides recent household-level evidence from Jowhar District. Using a cross-sectional survey of 205 respondents, the study examined climate awareness, perceived agricultural impacts, food insecurity, adaptation and institutional response. The results show widespread recognition of climate impacts and strong associations between perceived agricultural threats and reported food insecurity. Because purposive sampling was used, the findings are analytically valuable for Jowhar but should not be interpreted as nationally representative.

The Jowhar evidence also demonstrates an important adaptation gap. Respondents reported high awareness and some access to training, yet food insecurity remained widespread. This suggests that information alone is insufficient when farmers lack irrigation, finance, resilient inputs and reliable institutions. Adaptation must therefore address both knowledge and the material capacity to act (Osman. 2026).

Adaptation and Climate-Smart Agriculture

Climate-smart agriculture seeks to improve productivity and incomes, strengthen adaptation and, where appropriate, reduce greenhouse-gas emissions. Relevant practices in Somalia include drought-tolerant and early maturing seeds, crop diversification, water harvesting, soil and water conservation, agroforestry, improved irrigation, integrated pest management and better post-harvest storage (Lipper, 2014; Magesa, 2023).

Adaptation decisions depend on education, farm size, credit, extension services, climate information, market access and perceptions of risk. Farmers with greater resources can invest in irrigation, machinery and improved inputs, while poorer farmers may rely on low-cost measures such as changing planting dates or diversifying crops. This creates unequal adaptive capacity even among households exposed to the same hazard (Hassan & Nhemachena, 2008; Magesa., 2023).

Local and indigenous knowledge remains important because communities possess detailed understanding of seasonal indicators, water systems and locally adapted crops. However, historical knowledge may become less reliable as climate patterns shift beyond previous experience. The most effective approach combines local knowledge with scientific forecasts, extension guidance and accessible technology (Ajuang, 2016; Osman, 2026).

The reviewed literature confirms that climate variability affects agricultural production and food security in Somalia, but the evidence remains methodologically divided. National studies provide temporal coverage but limited household details, whereas local surveys provide rich contextual evidence but limited generalizability. There is no regularly updated nationally representative panel dataset linking farm-level output, household food security, adaptation and geospatial climate exposure.

A second gap concerns causal inference. Cross-sectional perceptions can establish associations but cannot determine whether climate exposure caused the reported outcome. Time-series models can estimate dynamic relationships but may be affected by measurement limitations, omitted variables and structural breaks. Future research should combine household panels, objective yield measurements, market prices, conflict data and satellite-derived rainfall and vegetation indicators.

This paper addresses a narrow but important gap by organizing the available evidence into a coherent framework. It does not claim to generate new primary data or national causal estimates. Instead, it identifies findings that are consistent across sources, distinguishes local evidence from national assessments and develops policy implications from the combined evidence.

This study employed an integrative narrative review and policy-analysis design. The approach was selected because the available evidence uses heterogeneous research designs, populations, variables, and statistical methods that do not support a valid meta-analysis. The review integrated household survey evidence, national time-series studies, climate-monitoring products, and food-security assessments while retaining the methodological limitations of each source (Snyder, 2019).

Evidence was identified through two peer-reviewed seed articles supplied for the study and targeted searches of peer-reviewed and institutional sources completed through 2 August 2026. Searches focused on combinations of the terms Somalia, climate change, climate variability, drought, flooding, agricultural productivity, crop production, irrigation, adaptation, and food security. Institutional searches prioritized the Food and Agriculture Organization of the United Nations, FAO-SWALIM, the Integrated Food Security Phase Classification, and the World Bank because these organizations publish the principal national climate, agriculture, and food-security assessments for Somalia.

Sources were included when they (a) examined climate, agriculture, livestock, food security, or adaptation in Somalia or a directly relevant African setting; (b) provided a clearly identifiable methodology or institutional analytical framework; and (c) contributed empirical, conceptual, or policy evidence to at least one study objective. Sources were excluded when their relevance to Somalia was indirect, their methods or provenance could not be established, or they duplicated a more authoritative source. The review was integrative rather than systematic; consequently, it does not claim exhaustive coverage of all published literature.

The core empirical source was Osman. (2026), which collected primary data in Jowhar District in 2025. That study surveyed 205 participants selected purposively from five stakeholder groups: 100 farmers, 26 agricultural traders, 23 government employees, 26 NGO workers and 30 community leaders. It used a structured questionnaire and analysed responses through descriptive statistics and Spearman's rank correlation.

The Jowhar instrument covered socio-demographic characteristics, climate awareness, observed agricultural impacts, household food-security experiences, adaptation practices and institutional responses. The study reported Cronbach's alpha coefficients of 0.88 for climate awareness, 0.78 for agricultural and food-security impacts, 0.92 for community adaptation and 0.90 for institutional response, indicating acceptable to excellent internal consistency (Osman., 2026).

Complementary evidence was drawn from peer-reviewed studies on Somalia and comparable African contexts, FAO and FAO-SWALIM climate and agricultural assessments, IPC acute food-security analyses and the World Bank's Somalia Country Climate and Development Report. Priority was given to original research and official institutional sources with clear methodology and direct relevance to climate, agriculture or food security.

The analytical framework organized the evidence into four domains: climate exposure; agricultural productivity and livelihood effects; household food-security outcomes; and adaptation and institutional responses. Results were compared across sources to identify convergence, contradiction and evidence gaps. Quantitative statistics from the Jowhar study were reproduced only when directly supported by the published article.

Results and Findings

Characteristics of the Jowhar Evidence Base

The Jowhar sample was predominantly male: 151 respondents (73.6%) were men and 54 (26.4%) were women. The largest age category was 31–40 years, representing 33.6% of respondents, followed by 21–30 years at 29.8%. More than half of the sample (55.1%) had no formal education, while 26.3% had college or university education. Farmers formed the largest occupational group at 48.8% (Osman., 2026).

The composition of the sample reflects the agricultural and institutional focus of the study, but it also limits generalization. Women, youth and people outside the selected stakeholder categories may experience climate vulnerability differently. The predominance of respondents with little formal education also has practical implications: climate information and extension services must be delivered through accessible language, radio, demonstration plots and community-based training rather than written technical material alone (Osman, 2026).

Indicator	Frequency	Percentage
Male respondents	151	73.6
Female respondents	54	26.4
No formal education	113	55.1
Farmers	100	48.8
Total sample	205	100.0
<i>Note. Data reproduced from Osman. (2026).</i>		

Climate Awareness and Experienced Change

Awareness of climate change was almost universal in the Jowhar sample. A total of 197 respondents (96.1%) had heard about climate change, 203 (99.0%) believed that it was affecting their community and 204 (99.5%) had noticed climatic changes during the previous five to ten years. These figures indicate that climate change was understood as a lived experience rather than an abstract scientific concept (Osman, 2026).

Radio and television were the most frequently reported information sources, accounting for 47.8% of respondents who had heard about climate change. Schools and workshops accounted for 26.3%, social media for 19.5%, and community discussions for a smaller share. This pattern supports continued investment in radio as a rural early-warning and agricultural-advisory platform while also demonstrating the potential value of schools, extension workshops and mobile services (Osman, 2026).

High awareness did not necessarily translate into adequate adaptation. Nearly universal recognition of climate risk existed alongside widespread food insecurity and continued demand for irrigation, resilient inputs and financial support. This distinction is important because policies that focus only on awareness campaigns may have limited effect where the binding constraints are infrastructure, finance and institutional capacity.

Perceived Threats to Agricultural Production

Most respondents considered climate change a serious agricultural threat. Specifically, 110 respondents (53.7%) classified it as a major threat and 56 (27.3%) as a moderate threat. Only 16 respondents (7.8%) considered it no threat. Thus, more than four-fifths of the sample perceived at least a moderate threat to agricultural production and food security (Osman, 2026).

The reported mechanisms included unpredictable rainfall, drought-related water shortages, riverine flooding, crops and livestock losses, rising production risk and disrupted food supply. These findings are consistent with national studies that link climate variables to crop production and with official assessments documenting the effects of rainfall deficits and high temperatures on crops, livestock and water availability (Warsame et al., 2021; FAO, 2026a).

The simultaneous occurrence of drought and flooding is especially important in riverine areas. Drought reduces river flow and irrigation availability, whereas heavy rainfall can cause river breakages, inundation and waterlogging. Resilience investment must therefore combine water storage and irrigation with drainage, embankment protection and flood management rather than treating water scarcity as the only hazard (Ahmed, 2022; Osman, 2026).

Food Availability and Food Insecurity

A total of 201 respondents (98.0%) reported that climate change had affected food availability in their households. The most frequently reported consequence was higher food prices, identified by 96 respondents (46.8%), followed by crop and livestock losses at 39.5% and deterioration in nutritional status at 13.7% (Osman, 2026).

The prominence of food prices demonstrates that climate impacts extend beyond households directly engaged in farming. Production shortfalls reduce market supply, while damaged roads, insecurity and higher transport costs may widen the price effect. Households that depend on markets for most of their food can therefore experience severe food insecurity even if they do not cultivate crops or own livestock (FAO, 2026b; IPC, 2026a).

Climate-related food insecurity was persistent within the Jowhar sample. Seventy respondents (34.1%) reported that they were always affected, while 53 (25.9%) reported being often affected. Together, 60.0% were often or always food insecure because of climate-related conditions. Only 11.2% reported never being affected (Osman, 2026).

Food assistance was received by 66.8% of respondents during climate-related crises. This assistance was essential for immediate survival, but the high level of reliance indicates that many responses remain reactive. Repeated emergency assistance without restoration of productive assets, irrigation and market access may save lives but cannot by itself reduce long-term vulnerability.

Frequency of climate-related food insecurity	n	%
Never	23	11.2
Rarely	17	8.3
Sometimes	42	20.5
Often	53	25.9
Always	70	34.1
Total	205	100.0
<i>Note. Data reproduced from Osman. (2026).</i>		

Adaptation Priorities

Traditional or community-led adaptation practices were reported by 69.8% of respondents, while 72.2% reported receiving some form of support or training. Common practices discussed in the Jowhar study included crop diversification, adjustment of planting calendars, use of early-maturing varieties, local water management and maintenance of communal irrigation systems (Osman., 2026).

Respondents nevertheless identified substantial unmet needs. Improved irrigation infrastructure was selected by 46.3% as the most important support, followed by climate-resilient seeds and livestock at 24.9%, better weather forecasting at 14.6%, grants or loans at 8.8%, and adaptation training at 5.4%. The ranking shows that respondents prioritized productive infrastructure and technology above additional awareness activities (Osman., 2026).

Irrigation investment should not be understood simply as the expansion of water extraction. Sustainable irrigation requires functioning canals, equitable water allocation, drainage, maintenance systems, watershed management and protection against salinity and waterlogging. In Jowhar, these measures must be linked with riverbank protection and off-stream storage because the same river system produces drought and flood risk (Johnston & Lemaitre, 2024; Osman., 2026).

Priority support	n	%
Improved irrigation infrastructure	95	46.3
Climate-resilient seeds and livestock	51	24.9
Better weather forecasting	30	14.6
Financial support	18	8.8
Adaptation training	11	5.4
<i>Note. Data reproduced from Osman. (2026).</i>		

Statistical Associations

The strongest reported association was between the perceived threat of climate change to agriculture and food security and the reported frequency of food insecurity ($p = .934, p < .01$). This exceptionally strong positive correlation indicates that respondents reporting greater agricultural threat also tended to report more frequent food insecurity (Osman et al., 2026).

Awareness of climate change was strongly associated with perceived effects on household food availability ($p = .700, p < .01$), while belief that climate change affected the community was similarly related to food-availability effects ($p = .704, p < .01$). These findings suggest that awareness was grounded in experienced changes to livelihoods and food access rather than exposure to information alone (Osman et al., 2026).

Adaptation support or training was positively correlated with food-insecurity frequency ($p = .640, p < .01$). This result should not be interpreted as evidence that support caused food insecurity. A more plausible explanation is targeting or reverse causality: institutions may direct training and assistance to communities already experiencing severe vulnerability. Cross-sectional correlation cannot establish the direction of causation.

Government action and adaptation support were highly correlated ($p = .925, p < .01$), indicating that respondents who recognized adaptation support also tended to recognize government involvement. However, the strength of this association does not establish the effectiveness, coverage or equity of the interventions (Osman, 2026).

National Conditions in 2025–2026

National evidence confirms that the local findings are part of a wider climate and food-security crisis. FAO reported that the 2025 Deyr season produced a near-total harvest failure, while water and pasture shortages severely affected livestock. Poor production contributed to surging cereal prices and a substantial deterioration in food security during early 2026 (FAO, 2026b).

FAO also warned in January 2026 that the drought was intensifying rapidly and could become comparable with severe drought episodes in 2011, 2017 and 2022. Severe to extreme drought conditions affected large portions of South and Central Somalia and other livelihood zones, driven by rainfall deficits and unusually high temperatures (FAO, 2026a; FAO-SWALIM, 2026).

IPC estimated that 6.5 million people faced high levels of acute food insecurity during February–March 2026. Subsequent projections changed as the analysis period and conditions evolved, but millions continued to face Crisis-level or worse outcomes. These estimates demonstrate the scale of the interaction between poor rains, rising prices, conflict, displacement and reduced assistance (IPC, 2026a; IPC, 2026b).

The World Bank's climate-development analysis places these short-term crises within a longer structural risk. Climate change threatens growth, jobs, infrastructure and human capital, potentially reducing GDP by up to 13.5% by 2060 without effective action. The report argues that climate resilience should be

embedded in economic planning and livelihood development rather than treated solely as an emergency or environmental issue (World Bank, 2026).

Discussion

The combined evidence supports the conclusion that climate change affects food security in Somalia through a chain of connected impacts. Rainfall deficits, heat and flooding reduce crop and livestock productivity; lower productivity reduces household food and income; reduced market supply and damaged infrastructure raise prices; and diminished purchasing power worsens food access and dietary quality. These pathways correspond with the availability, access, utilization and stability dimensions of food security (Schmidhuber & Tubiello, 2007; Osman., 2026).

The findings also support Sen's entitlement approach. Climate shocks reduce production-based entitlement when harvests fail, trade-based entitlement when livestock or crops lose value, labour entitlement when agricultural employment declines, and transfer-based entitlement when humanitarian resources are inadequate. Hunger therefore cannot be explained only by aggregate food supply; it also reflects whether households retain the resources and institutional support required to obtain food (Sen, 1981; Salifu & Garzo, 2026).

The Jowhar results show that high awareness is not equivalent to resilience. Respondents clearly recognized climate change, yet many remained food insecure. These finding challenges interventions that treat lack of awareness as the principal problem. Information is necessary, but the capacity to use that information depends on irrigation, seeds, credit, extension, roads, storage and secure access to land and markets (Magesa, 2023; Osman., 2026).

Irrigation emerged as the highest priority because water management directly influences production in both drought and flood conditions. However, poorly planned irrigation can contribute to unequal access, salinity, waterlogging and conflict. Investment must therefore include governance arrangements, routine maintenance, community participation, drainage and watershed protection in addition to physical construction (Johnston & Lemaitre, 2024; World Bank, 2026).

Climate-resilient seed systems are another critical area. Drought-tolerant and early maturing varieties may reduce exposure to short rainy seasons, while flood-tolerant and locally adapted varieties can improve performance in specific riverine environments. Seed interventions must be accompanied by quality control, local multiplication, farmer testing and extension guidance; distributing unsuitable seed varieties may provide little benefit (Lipper, 2014; Magesa., 2023).

Early-warning information can reduce losses when forecasts are timely, trusted and connected to action. General forecasts are less useful than location-specific advice on planting dates, expected dry spells, flood risk, livestock movement and water management. Radio, mobile communication and extension networks can translate technical forecasts into practical decisions, but households also require resources to act before a shock occurs (Coughlan de Perez et al., 2019; Osman., 2026).

Further evidence indicates that emergency assistance and development investment should be connected. Food and cash transfers protect immediate consumption, while livelihood packages can restore productive capacity through seeds, tools, animal health, water infrastructure and market support. Shock-responsive social protection offers a mechanism for expanding assistance rapidly while maintaining a longer-term resilience objective (FAO, 2026c; World Bank, 2026).

Finally, the reviewed evidence exposes a major data limitation. Somalia lacks a continuous nationally representative farm-household panel that connects climate exposure, farm inputs, output, income, food consumption, nutrition and adaptation. Without such data, policy relies on fragmented surveys and emergency assessments. Investment in agricultural statistics and geospatial data integration is therefore itself a resilience priority.

Conclusion

This paper synthesized empirical and institutional evidence on the impacts of climate change on agricultural productivity and food security in Somalia. The evidence consistently identifies drought, flooding, erratic rainfall, extreme heat, water scarcity, land degradation and weak infrastructure as major threats to crop production, livestock and rural livelihoods.

Household evidence from Jowhar demonstrates high awareness of climate change, widespread effects on food availability and a strong association between perceived agricultural threats and food-insecurity frequency. The findings are not nationally representative, but they provide detailed insight into the experience of a strategically important riverine farming district. National assessments from 2025–2026 confirm that climate shocks continued to produce crop failure, livestock stress, rising food prices and severe acute food insecurity.

The central conclusion is that Somalia's food-security crisis cannot be addressed through a single-sector intervention. Climate hazards interact with poverty, conflict, displacement, weak markets and institutional limitations. Effective policy must therefore protect immediate food access while strengthening the productive and institutional foundations of agriculture.

The study also concludes that future publishable empirical research should move beyond perception-only and single-location designs. Nationally representative longitudinal research combining objective climate indicators, measured farm output, household food consumption, prices, conflict and adaptation is needed to estimate causal relationships and compare effects across livelihood zones.

Recommendations

1. **1.** Rehabilitate irrigation, drainage and flood-control infrastructure. Priority investments should include canal rehabilitation, river embankments, off-stream storage, small-scale irrigation, drainage and routine maintenance systems. Water-user organizations and local authorities should participate in governance and conflict resolution (Johnston & Lemaitre, 2024; Osman., 2026).
2. **2.** Expand locally appropriate climate-resilient seed systems. Government and partners should support drought-tolerant, early-maturing, flood-tolerant and locally adapted varieties through community seed multiplication, quality assurance, demonstration trials and reliable distribution networks (Lipper et al., 2014; Magesa., 2023).
3. **3.** Strengthen climate services and early-warning action. Forecasts should be translated into district-level agricultural advice and delivered through radio, mobile platforms, extension agents and community organizations. Early-warning thresholds should automatically trigger anticipatory support before households lose assets (Coughlan de Perez et al., 2019; FAO, 2026a).
4. **4.** Increase the reach and quality of agricultural extension. Extension services should cover crop management, soil and water conservation, livestock health, pest management, post-harvest handling and business skills. Materials should be accessible to people with limited formal education and should deliberately include women and youth (Osman., 2026).
5. **5.** Develop agricultural finance and risk-sharing instruments. Affordable seasonal credit, grants, savings mechanisms and carefully designed weather-index insurance can enable farmers to invest in inputs and recover from shocks. Products must be transparent, Sharia-compliant where required, and adapted to the realities of smallholder and pastoral livelihoods.
6. **6.** Improve market, road and storage infrastructure. Better feeder roads, warehouses, cold storage and market information can reduce post-harvest losses, stabilize supply and improve farm-gate prices. Market resilience is essential because climate shocks affect food security through prices as well as production (World Bank, 2026).
7. **7.** Integrate humanitarian assistance with livelihood recovery. Emergency food and cash support should be combined with seeds, tools, water rehabilitation, veterinary services and restoration of productive assets. This approach can prevent repeated assistance from becoming disconnected from long-term resilience (FAO, 2026c).
8. **8.** Strengthen national agricultural and climate data systems. Somalia should establish a recurring farm-household survey and link it with rainfall, temperature, vegetation, river, market and conflict data. Open, documented datasets would improve policy targeting and allow independent research.
9. **9.** Promote inclusive governance. Women, youth, displaced communities, smallholders and pastoralists should participate in water management, adaptation planning and programme evaluation. Participation improves relevance and helps identify unequal access to land, finance, information and public resources.
10. **10.** Align climate action with the National Transformation Plan and national adaptation frameworks. Agricultural resilience should be treated as an economic-development and job-creation priority, with clear implementation responsibilities, budgets and monitoring indicators (World Bank, 2026).

Study Limitations

This paper is a narrative evidence synthesis rather than a systematic review or original national empirical analysis. Although the evidence-search process prioritized relevant and authoritative sources, it did not apply a registered systematic-review protocol, formal risk-of-bias scoring or meta-analysis.

The principal household statistics originate from one district-level study that used purposive sampling. They should not be interpreted as national prevalence estimates. The correlations are cross-sectional and cannot establish causality or temporal direction.

Official food-security estimates refer to specified analytical and projection periods and may change as rainfall, prices, conflict and humanitarian assistance change. They should therefore be reported with their dates and not treated as permanent national statistics.

The study nevertheless provides a transparent and policy-relevant synthesis, clearly distinguishing local empirical evidence from national institutional assessments.

Declarations

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