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Review Article

Drought Risk Management in Ethiopia: A Systematic Review

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Abstract

Ethiopia faces significant vulnerability to climate change due to its limited adaptive capacity and heavy reliance on rain-fed agriculture for livelihoods. Drought, a critical aspect of climate change, is a persistent and silent disaster that gradually affects extensive areas across the country. Unlike sudden natural disasters such as floods or tornadoes, the impacts of drought develop slowly and are not immediately apparent. This paper examines the critical drought impacts and its risk management in Ethiopia, a country that faces recurrent droughts fanned by climate change, significantly impacting millions of people, particularly in rural areas. The aim of the paper is to investigate the socio-environmental challenges raised by water scarcity, which affects agricultural productivity, food security, and public health. The study emphasizes the importance of integrated drought management strategies that combine government initiatives, community engagement, and international support to enhance resilience among vulnerable populations. The implementation of the Productive Safety Net Program (PSNP), community-driven adaptation measures, and the role of social capital in fostering cooperation and resource sharing during crises is a key strategy of short term drought adaptation. Advanced monitoring and predictive technologies to improve preparedness and response to drought events is crucial. By addressing both the technical and social dimensions of drought risk management, this research contributes to the development of sustainable solutions that aim to mitigate the impacts of drought and promote long-term resilience in Ethiopia.

Keywords

Drought Risk Management, Social Capital, Climate Change Adaptation

1. Introduction

Drought is a normal, recurring feature of climate [60]. Drought doesn't have immediate, dramatic visuals like earthquakes, floods or storms, it can be harder to garner attention or prompt action, even though it has far-reaching consequences that may persist for years [52]. Drought ranks among the most widespread natural hazards worldwide, significantly affecting various sectors, including energy production, household water consumption, agricultural output, and numerous other water-dependent industries [66]. Drought poses a persistent threat, especially in water-scarce regions, where it severely impacts essential services and economies, often causing greater and more prolonged suffering than other climate-induced events like heat waves, floods, or cyclones [2]. This is due to drought quietly and slowly damages lives,

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livelihoods, and ecosystems on a huge scale.

Ethiopia is one of the Horn of African countries that have been repeatedly affected by drought. Drought in Ethiopia occurs during the different seasons that occur in different regions in the country and it exists when seasonal rainfall drops below normal by almost 30% to 50% [40], happens every 3–5 years and 6–8 years in the northern regions of the country, and once every 8–10 years across the entire country. As reported by Gemeda and his colleagues, Ethiopia faced severe droughts in 2015, which significantly impacted its economy and people's livelihoods [30]. Ethiopia faces frequent meteorological droughts that disrupt rainfall and cause agricultural drought, leading to crop failures and food insecurity [6, 59]. Rainfall shocks also harm agricultural production, leading to poverty and food insecurity in many regions [45]. These recurring droughts challenge the agriculture-dependent economy, threatening millions of livelihoods and exacerbating poverty.

Different countries use different methods to adapt to climate change and drought impact on humans and nature, depending on their country's realities. Decentralization (local and central) is one approach for drought risk management. Decentralizing drought risk management roles and responsibilities to local levels involves empowering local institutions to develop and carry out drought-focused programs [31]. This approach requires building local capacity to identify risk management strategies and adaptive measures based on specific drought risk profiles, ultimately enhancing the community's coping abilities. Literatures indicate that droughts are challenging to assess and predict, complicating disaster response efforts [34]. Drought Risk Assessment (DRA) is essential for identifying key risk factors to reduce drought impacts with an understanding of the complex relationships between components necessary to meet assessment goals [56].

Historically, drought management has focused on reacting to events as they occur. However, a shift toward proactive management is needed to enhance preparedness and resilience [66]. Proactive measures include drought monitoring, water usage regulations, community education, and social protection programs for vulnerable populations. In recent years, governments have prioritized developing drought management plans and policies, which serve as tools to implement mitigation and prevention strategies to reduce drought impacts on society, the economy, and the environment [32].

Ethiopia has made significant strides in climate (drought) adaptation, launching key initiatives like the 2007 National Adaptation Program (NAP) and the 2011 Growth and Transformation Plan II (GTP II) [32]. These efforts, including the Livestock Master Plan and the 2019 Climate Resilient Green Economy – National Adaptation Plan, aim to enhance resilience and sustainable development. The Productive Safety Net Program (PSNP) plays a central role in drought management, with expanded capacity during the 2015 drought to respond quickly to early warning signs, strengthening Ethiopia's approach to managing climate risks and reducing drought impacts [43, 74].

2. Material and Methods

This review examines current research on drought risk management in Ethiopia. A literature search using Google Scholar, Scopus, and Web of Science targeted peer-reviewed studies on drought risk and management strategies was employed. Search strategies include defining appropriate search terms and identifying key words, phrases, and terms. Relevant keywords and terms were identified using the most cited literature reviews, yielding 61 publications. Only 51 articles were selected for review based on their relevance to the study's objective.

3. Drought and Green Legacy Initiative

Many researchers have examined the impact of green legacy initiatives globally, arriving at diverse conclusions. For instance, [50] demonstrated that green legacy policies positively affect climate change efforts in Asia. Similarly, studies by [5, 48] indicated that green legacy initiatives contribute to a healthier environment in Africa. Additionally, [20] research suggested that Europe's energy and climate change strategies foster a greener environment.

Ethiopia, with a population of 120 million is highly vulnerable to droughts and hydro-meteorological hazards, few researches addressed the importance of green legacy [43]. As reported by several of scholars, Green Legacy initiative in Ethiopia significantly contributes to climate change mitigation and enhances air quality; hence tree planting and ongoing monitoring of planted trees is very important to support increased diversity and abundance of animal species, as well as improved air freshness [26, 27]. In response, the country launched the Green Legacy initiative to combat environmental degradation and promote green practices nationwide in 2011 [28]. This campaign emphasizes ecosystem restoration, biodiversity conservation, renewable energy, and building a sustainable green economy, raising public awareness about the urgency of environmental issues.

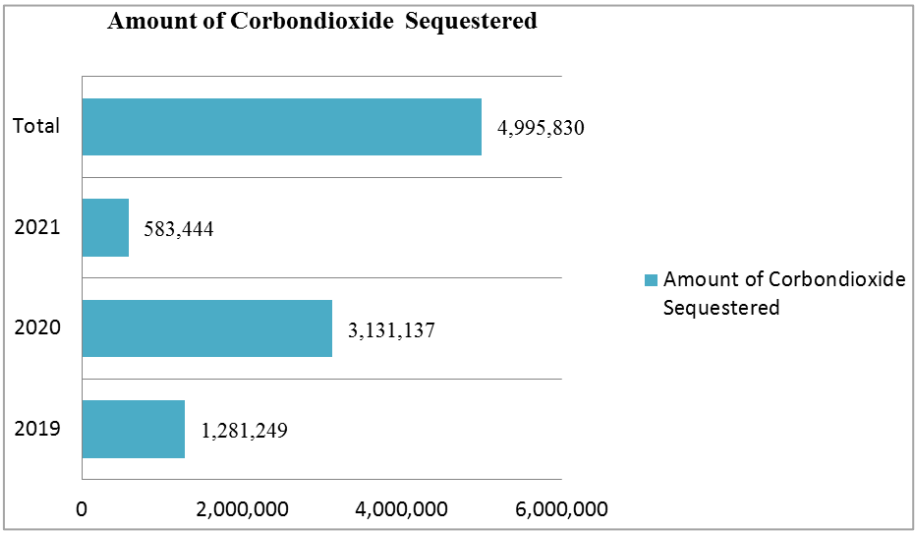
The Green Legacy program also stresses the importance of grassroots involvement and community ownership in environmental conservation, integrating reforestation and restoration efforts into broader national development goals to secure long-term sustainability [38]. Ethiopia’s reliance on climate-sensitive sectors such as agriculture, water, tourism, and forestry along with high poverty levels, further increases its susceptibility to climate change impacts. The Green Legacy initiative aims to address these vulnerabilities while aligning environmental conservation with socioeconomic development to reduce drought shock.

Table 1. Seedling planting Detail (2000-2023).

Year	National target	Nationally planted	Performance
2000	160,000,000	86	0%
2021	590,840,747	611,247,016	103.45%
2022	707,776,852	766,452,264	108.29%
2023	657,842,673	741,509,115	112.72%

Source: Green Legacy Day. Retrieved from https://greenlegacy.et/green-legacy/campaign-day on Nov. 12, 2024

As depicted on (Table 1), Ethiopia recorded impressive progress in meeting and exceeding its national seedling planting targets over recent years in order to assure green legacy initiatives. In 2000, although the target was set at 160 million seedlings, there is insignificant achievement, resulting in a 0% performance primarily due to the COVID-19 pandemic, which significantly impacted large-scale public gatherings and community activities necessary for such initiatives [28]. The restrictions on movement, social distancing measures, and health concerns limited the ability of communities to organize mass tree-planting events as they had in previous years. Additionally, logistical challenges, resource limitations, and a shift in government priorities towards addressing the health crisis likely contributed to the reduced focus and limited outcomes in the Green Legacy initiative during that period. However, from 2021 onwards, Ethiopia has not only met but consistently exceeded its annual goals. In 2021, the target was approximately 590.8 million seedlings, with actual plantings reaching 611.2 million achieving 103.45% of the goal. This trend continued in 2022, when the target was raised to around 707.8 million seedlings, and 766.5 million were ultimately planted, yielding a performance rate of 108.29% [44]. In 2023, the target was adjusted to 657.8 million seedlings, with the actual number planted reaching about 741.5 million representing 112.72% of the target. These achievements reflect Ethiopia's strong national commitment to reforestation and environmental restoration.



Source: Adopted from (Abebe and Arega, 2023).

Figure 1. Amount of carbon dioxide sequestered (tons of CO_2) by program year at National level.

Although Ethiopia achieved overall significant success with its Green Legacy initiatives, the outcomes vary greatly from region to region. While all Ethiopian regions, reported a success rate of more than 50%, Tigray region recorded less than 50% in 2021. In the same manner, in 2022 and 2023 Tigray region was unable to fully implement the Green Legacy initiative due to the ongoing conflict. While the Amhara and Oromia regions made progress in the initiatives in 2023. Other regions recorded little to no success, respectively.

4. Impacts of Drought

Literatures stated that, droughts have severely impacted nearly every sector in Ethiopia, including agriculture (crop and livestock losses), water resources (increased evaporation and decreased availability of fresh water leading to water stress), insufficient water for industries, and reduced hydropower production, including the loss of wetlands and lakes, deforestation, soil degradation, and increased erosion [1, 13, 40, 60]. The 2015–18 droughts over the Horn of Africa has put more than 15.6 million people in urgent need of food assistance, leading to a financial commitment from the European Commission of more than €300 million for humanitarian aid [28]. The social and economic consequences, such as the rise in human and livestock diseases, migration, water-related conflicts, and the decline in national GDP, are also

substantial. In Ethiopia, the most devastating and historically significant droughts occurred in 1984 and 2002, resulting in severe food shortages for large segments of the population, particularly those reliant on pastoralism and rain-fed subsistence farming. The 1984 drought, which persisted for a year, led to a famine that caused a severe shortage of food and water [23]. Millions of people across a large area of the country lost their livelihoods due to widespread hunger and disease [40].

4.1. Effects of Drought on Crop and Livestock Production

Drought has significant impacts on both crop and livestock production, particularly in regions that heavily depend on rain-fed agriculture, such as Horn of Africa in general and Ethiopia in particular. In crops, water stress from drought limits growth, reduces yields, and affects crop quality [25]. Prolonged drought conditions also damage soil health, as reduced moisture content leads to soil degradation and erosion, further undermining crop productivity [36]. Drought heightens the risk of disease outbreaks due to weakened animal immunity and overcrowded water points [29]. These effects emphasize the urgent need for sustainable drought-resilient strategies to protect agricultural productivity in vulnerable regions like Borena.

In Ethiopia, drought exerts severe consequences on both crop and livestock production, challenging the livelihoods of rural communities that rely on rain-fed agriculture. Water scarcity from prolonged drought reduces soil moisture, stunting crop growth and diminishing yields, especially for staple crops like maize, wheat, and teff. This disruption affects market stability in Ethiopia, as lower production leads to increased prices and reduced access to food for vulnerable populations [25]. Drought also affects soil health, causing degradation and erosion that reduce long-term productivity, which exacerbates poverty and food insecurity in rural areas [26].

Weather related extremes are frequent, both as droughts and floods that affect the largely agriculturally dominated livelihoods and economy [10]. For livestock, drought reduces available pastureland and water resources, forcing herders to migrate or reduce their herds, which diminishes both million and meat production [29]. The lack of nutrition weakens livestock, increasing their susceptibility to diseases and lowering reproductive rates. Such impacts are especially devastating in regions like the Borena Zone, where pastoralism is the primary livelihood, and communities face not only economic losses but also heightened food insecurity [29]. These combined effects underscore the need for drought-resilient strategies, such as improved irrigation systems and diversified livelihood strategies, to sustain Ethiopia's agricultural productivity and resilience.

4.2. Effects of Drought on Range Land

Rangeland degradation is a significant global environmental issue, particularly in pastoral and semi-pastoral regions, which are increasingly shrinking [19]. Droughts become more frequent and intense of animals death as a result of climate change (drought and shortage of grazing land); the 2020 drought in the Horn of Africa is one example [7]. Ethiopian pastoralists, like those in other parts of Africa, are severely impacted by climate change and various related environmental challenges [54]. The rangeland in Ethiopia, particularly in regions like Borena and Guji, is characterized by harsh climatic conditions, high temperatures, frequent droughts, and unreliable rainfall [19]. According to [71, 73] around 45.8 percent of the livestock were died due to drought induced grazing land shortage in Borena zone in 2022.

4.3. Drought Impact on Livelihood

Beginning in 250 B. C., Ethiopia has faced recurring famines and disasters, with over 30 documented periods of food shortages and high mortality [62]. Detailed records from the past 200 years reveal varying scales and impacts of these crises, reflecting their complex causes and consequences [11, 62].

Drought in Ethiopia has severely impacted livelihoods, primarily in rural areas where agriculture and livestock form the backbone of survival [39]. The 2002 drought affected over 20% of the population, while the deadliest occurred in the 1970s and 1984 and the events led to GDP declines of 9.7% in 1984–85 and 3.8% in 2002–03, with the eastern, northeastern, and central regions suffering the most severe agricultural losses [12]. Repeated failures of rainy seasons have led to extensive crop losses and livestock deaths, with some regions, such as the Somali area, experiencing a 28% reduction in livestock and a 35% drop in household income [25]. The 1983-1985 droughts caused up to an estimated million famine-related deaths. The droughts of 2002 2011 and 2015-2016 caused fewer deaths but left millions of Ethiopians without enough food [15].

Table 2. *Drought year and effects on livelihood of Ethiopian people.*

Year	Region affected	Effect
1957-1958	Tigray	100,000 died
1964-1966	Tigray and Wollo	About 1.5 million. People were affected and about 300,000 livestock died

Year	Region affected	Effect
1972-1973	Tigray and Wollo	Death of about 200,000 people and 30% of livestock in the area
1978-1979	Southern Ethiopia	1.4 million people were affected
1982	Northern Ethiopia	2 million People were affected
1983-1984	All regions	8 million. Were affected and 1 million people died
1987-1988	All regions	7 million. People were affected
1991-1992	North, East and South Ethiopia	4 million people were affected
1983-1984	Tigray and Wello	7.6 million. People were affected
2000	All regions	About 10.5 million people were affected
2002–2003	All regions	About 13 million people were affected
2006	Southern Ethiopia (Borena)	About 247 000 livestock died
2008	Southern Ethiopia (Borena)	About 26 000 livestock died
2008–2009	All regions	About 5 million people were affected

Source: Taken from (Degefu & Bewket, 2015), (Wolde-Georgis, 1997) and (Webb and Van Braun, 1990).

4.4. Drought and Water Scarcity

Water scarcity and droughts are socio-environmental hazards that affect the lives of millions of people every year [35]. In Ethiopia, drought and water scarcity are pressing socio-environmental hazards, impacting millions annually [16]. Prolonged droughts, intensified by climate change, have severely reduced the availability of surface and groundwater resources, leading to acute water shortages for domestic, agricultural, and livestock needs. Over 60% of Ethiopia's population lacks access to safe drinking water during drought periods, with rural communities being particularly vulnerable [34]. The arid and semi-arid regions, such as the Somali and Afar zones, face recurrent drought cycles that deplete water sources, disrupt livelihoods, and heighten food insecurity [12]. Water scarcity also worsening public health crises, as inadequate water access leads to poor sanitation and the spread of waterborne diseases [63]. The impacts have been notable on surface water resources, which are already under threat from massive abstractions due to increased demand, as well as poor conservation and unsustainable land management practices. Drought and climate variability, as well as their associated impacts on water resources, have gained increased attention in recent decades as nations seek to enhance mitigation and adaptation mechanisms [17].

5. Drought Risk Management Strategies

Drought risk management in Ethiopia is a critical focus for both the government and international agencies, especially in regions reliant on pastoral and agro-pastoral activities [1, 17] With recurring droughts severely impacting food security and livelihoods, particularly in the Oromia and Somali regions, Ethiopia has implemented strategies like the Productive Safety Net Program (PSNP), which offers food aid, cash transfers, and livelihood support to vulnerable communities during droughts [37, 53]. These initiatives aim to reduce the reliance on emergency relief while enhancing community resilience against recurrent climate stress [24]. However, localized adaptation strategies, such as community-driven drought risk management (DRM) efforts, are equally essential, emphasizing a bottom-up approach where local communities actively participate in developing and implementing solutions tailored to their unique challenges [1].

Ethiopia has developed extensive early warning systems, including the Disaster Risk Management and Food Security Sector (DRMFSS) and the Early Warning and Response Directorate (EWRD) in 2008 [60]. These systems use agro-meteorological data and tools like the Livelihoods Early Assessment and Protection (LEAP) index to predict drought impacts on crops and rangelands [1]. These initiatives are supported by collaboration between government agencies, NGOs, and international organizations to enhance real-time monitoring and communication to vulnerable communities [61].

The integration of disaster (drought) prevention into Ethiopia's long-term development policies is evident in its Growth and Transformation Plans (GTP I and II). These plans aim to reduce vulnerability and enhance resilience through various strategies, including sustainable infrastructure development, adaptive capacity building, and initiatives like water harvesting, irrigation expansion, and land restoration. The GTP II [32] emphasizes accelerating economic growth, improving agricultural productivity, and integrating climate-resilient measures. These strategies align with Ethiopia's broader vi-

sion of becoming a middle-income country by 2025 while addressing food security and disaster preparedness.

Drought risk management in Ethiopia increasingly integrates climate change adaptation into disaster planning. Programs like the Resilience in Pastoral Areas South (RIPA South) initiative work to enhance community resilience by strengthening local capacities and governance systems, utilizing climate data and ongoing monitoring to guide strategies that mitigate the effects of drought on agriculture and livestock. Despite challenges such as limited resources and inadequate data, Ethiopia's drought management approach continues to evolve, aiming for sustainable and locally tailored solutions [1, 15].

5.1. Role of Social Capital During Drought

Social capital has become a topic of considerable interest in climate change adaptation. It is believed that social capital is an important resource for farmers in building adaptation [18]. Social capital is commonly understood by scholars as a characteristic of society, focusing on elements such as social networks, trust, and shared norms that encourage cooperation. However, its precise definition remains a subject of ongoing debate and varies across different academic perspectives [48, 67]. These elements of social capital are seen as facilitating collective action by fostering social cohesion and mutual support, particularly in addressing common challenges.

During droughts, social capital plays a pivotal role in helping communities cope with the immediate and long-term challenges. It enables individuals and groups to share resources, such as water and food, and to provide mutual support through networks that facilitate the exchange of information, labor, and goods [47]. Communities with strong social capital can more effectively mobilize resources during crises, including organizing local responses, such as mutual aid groups or collective efforts for water management, which are critical when external aid is limited or delayed [7].

Social capital enhances community resilience by fostering cooperation between different actors, including local government bodies, NGOs, and neighboring communities. Strong social ties contribute to the rapid dissemination of early warning information and can improve the effectiveness of drought risk management strategies by ensuring more coordinated and timely responses [42]. Social capital also supports adaptive capacity**,** enabling communities to share knowledge about coping mechanisms, such as diversified livelihoods or improved water conservation techniques, which are essential for long-term drought resilience [3].

A strong example of social capital in Ethiopia's drought risk management (DRM) can be seen in the Borena Zone of the Oromia region. In this pastoral area, communities heavily rely on collective action to cope with recurrent droughts, and social networks play a pivotal role in sustaining livelihoods. Local social structures, such as the *"Gada system"*, provide a framework for communal decision-making and resource management. During droughts, these systems allow community members to share resources, including water and livestock, and engage in collective livestock management for instance, famillionies may pool their herds for better protection and access to grazing areas [3, 7]

In times of extreme drought, these networks help coordinate mutual aid, including the sharing of food and supplies, and also facilitate informal early warning systems that alert members to impending shortages or emergencies [7]. The success of these communities driven DRM strategies foster the importance of social capital in ensuring resilience in Ethiopia's drought-prone regions, especially in areas where institutional responses may be slow or inadequate.

5.2. Drought Adaptation Strategies

Adaptation to climate-related hazards (drought) is often shaped by prolonged exposure to extreme conditions, such as higher temperatures and decreased rainfall [22]. The most commonly reported adaptation strategies in Ethiopia include crop diversification, soil conservation, planting trees, changing crop planting dates and irrigation [8]. Many households recognize the climate hazards they face and understand their potential consequences, prompting them to develop coping and adaptation strategies. Identifying these strategies and the factors that influence their selection is essential for designing and scaling up effective climate adaptation interventions tailored to specific needs [65].

Different types of adaptation measures have been used by communities to overcome the challenges of climate change. These measures include altering the types of crops they grow, diversifying crop production, and adjusting planting and harvesting schedules, adopt early-maturing and pest-tolerant crop varieties and incorporate high-value fruit trees to enhance resilience and sustain agricultural productivity under changing climatic conditions [13, 58].

Pastoralists in Ethiopia (Afar and Borana) regions adopt diverse strategies to adapt to climate challenges [21, 72]. These include diversifying incomes by migrating to nearby towns or managing livestock for wealthier pastoralists, altering herd composition by favoring sheep and camels, and selling livestock. They also engage in opportunistic crop production and rely on traditional water management committees for resource planning. Additional measures during climate crises include feeding animals by lopping evergreen trees, consuming wild plants, and constructing shelters in towns during favorable periods to ensure resilience [46].

6. Challenges for Monitoring and Predicting Drought in Ethiopia

Because of the complex nature of drought, its monitoring and prediction remain challenging. Drought monitoring, and its impact management planning, has been a challenge for decision makers mainly because of lack of reliable infor-

mation and decision support tools [3]. Drought monitoring involves the systematic collection, analysis, and dissemination of data on drought conditions, serving as a fundamental basis for informing decision-makers and facilitating the development of effective early warning systems [14].

Drought monitoring typically involves using indices derived from water balance calculations and statistical analyses of time series data [11]. Water balance-based indices require multiple climatic and physical variables to assess the water deficit in the plant root zone. Common examples include the Palmer Drought Severity Index (PDSI), Standardized Moisture Deficit Index (SMDI), Evapotranspiration Drought Index (ETDI), Crop Moisture Index (CMI), Surface Water Supply Index (SWSI), and Reconnaissance Drought Index (RDI) [68, 69]. A significant drawback of these indices is that they depend on several input variables, and the process of their calculation can be complex. In contrast, statistical drought indices typically rely on a single parameter, such as rainfall, and in rare cases, use a combination of rainfall and temperature to characterize drought conditions.

The ability of dynamic models to predict precipitation diminishes rapidly beyond a two-week timeframe due to the inherent chaos of atmospheric systems, making meteorological drought prediction particularly challenging. This limitation also affects the prediction of agricultural and hydrological droughts [55]. The influence of climate change and human activities, such as irrigation, complicates drought forecasting. Hydrological drought, for instance, is closely tied to human interventions, necessitating models that incorporate these factors [17, 62]. Current efforts primarily focus on natural processes, with limited but growing research integrating human dimensions. To improve drought prediction, models must account for critical processes like land-atmosphere interactions, soil moisture, temperature variations, and human activities [49]. Additionally, refining ensemble forecasts from statistical and dynamical models is essential. This includes selecting appropriate ensemble members, combining forecasts, and properly quantifying uncertainties to enhance reliability and applicability.

Nowadays, the advancement of geospatial technology has revolutionized drought monitoring and prediction in Ethiopia, a country highly vulnerable to recurrent droughts. Satellite-based systems like MODIS, Landsat, and Sentinel provide critical data on vegetation health, soil moisture, and precipitation, enabling early identification of drought conditions across diverse agro-ecological zones [33]. Indices such as the Normalized Difference Vegetation Index (NDVI) and Standardized Precipitation Evapotranspiration Index (SPEI) are widely used to assess drought impacts on agriculture and water resources. Recent innovations, including machine learning and integration of remote sensing data with climate models, have improved the accuracy of drought forecasting. These tools empower decision-makers to implement timely interventions, minimizing the socioeconomic impacts of droughts in Ethiopia [11, 33]

Water harvesting systems, such as rainwater collection, micro-dams, and underground storage tanks, capture and store runoff during periods of rainfall for use in dry spells is critical action among the drought risk management strategies [41]. These methods are especially crucial in arid and semi-arid areas, improving water access for agriculture, livestock, and domestic needs [51]. Integrated with soil and water conservation practices like contour bunds and terracing, water harvesting reduces runoff, enhances soil moisture, and prevents land degradation. By stabilizing water supplies and supporting sustainable livelihoods, these approaches build resilience against drought impacts, particularly for rural and pastoral communities [57].

7. Discussion

Drought Risk Management in Ethiopia provides a comprehensive examination of the multifaceted challenges posed by recurrent droughts in Ethiopia, particularly in rural areas where the impacts are most severe [5]. The introduction sets the stage by highlighting the critical issue of water scarcity exacerbated by climate change, which significantly affects agricultural productivity, food security, and public health. Integrated drought management strategies that involve government initiatives, community engagement and international support to enhance resilience among vulnerable populations are required [1].

Drought have adverse effects on crop and livestock production, noting that drought leads to reduced yields and increased mortality rates among livestock [63]. It further explores the implications for rangeland, where overgrazing and water scarcity can lead to land degradation. The discussion on livelihood impacts reveals that drought not only threatens food security but also exacerbates poverty and undermines the coping mechanisms of rural communities [1]. Water scarcity is highlighted as a critical issue, affecting both domestic use and agricultural irrigation, which is vital for sustaining livelihoods in these regions.

Drought risk management strategies, with a particular focus on the role of social capital during drought events is the most advantageous mechanism. It discusses how community networks and cooperation can facilitate resource sharing and collective action, which are essential for effective adaptation to drought conditions [67]. There is also being specific drought adaptation strategies, including the implementation of the Productive Safety Net Program (PSNP), which aims to provide food and cash support to vulnerable households [9]. Community driven adaptation measures are emphasized as vital for building resilience and ensuring that local knowledge and practices are integrated into broader drought management efforts.

There are enormous challenges associated with monitoring and predicting drought in Ethiopia. Now a days, advanced technologies and methodologies to improve preparedness and response to drought are applied by many researchers. Both the technical and social dimensions of drought risk management,

advocating for sustainable solutions that mitigate the impacts of drought and promote long-term resilience in Ethiopia. Multi-disciplinary approach and emphasizing the role of social contributes to a deeper understanding of how to effectively manage drought risks in a changing climate.

8. Conclusion

Drought risk management in Ethiopia requires a comprehensive and integrated approach to effectively address the recurring challenges posed by drought and water scarcity. This involves the collaboration of government agencies, local communities, and international organizations to develop and implement strategies that enhance the resilience of vulnerable populations. Key components include improving water resource management, establishing early warning systems, and promoting sustainable agricultural practices that can withstand the impacts of climate variability is very important.

Resilience to drought is critical for ensuring the livelihoods of millions who depend on agriculture and natural resources. Strengthening local capacities through community-driven initiatives and empowering local institutions are essential for developing tailored solutions that address specific regional challenges. Programs such as the Productive Safety Net Program (PSNP) exemplify efforts to provide food aid and livelihood support, reducing reliance on emergency relief and fostering long-term resilience.

Monitoring and predicting drought events are vital for effective risk management. Utilizing advanced technologies, such as remote sensing and data analytics, can enhance the understanding of drought patterns and their impacts on water resources. Incorporating social capital into drought monitoring frameworks can lead to more effective and timely responses to drought conditions. I recommend future studies focus on the long-term economic impacts of drought on rural livelihoods and explore financial tools like climate insurance schemes, which were not addressed in this paper but could offer valuable insights for policy development and planning.

Abbreviations

DRM	Drought Risk Management
DRA	Drought Risk Assessment
GTP	Growth and Transformational Plan
GDP	Growth and Development Program

Author Contributions

Terefe Hundessa Bekana is the sole author. The author read and approved the final manuscript.

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Conflicts of Interest

I declare that the author do not have any known competing financial interests.

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