

Dryland Food Security in Ethiopia

Subjects: Area Studies

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Global drylands are expanding due to climate change, threatening global food security (FS), especially in Africa. Eastern Africa has 328 million hectares of drylands, 6% of which is covered by crops; most crops are rained on, and irrigated land accounts for only 5 million hectares (22%). In Ethiopia, 75% of the landmass is categorized as dryland, the majority of which experiences high risks of land degradation, natural hazards, and water and food shortages.

Keywords: drylands ; Ethiopia ; food security ; resilience

1. Introduction

Global drylands are expanding due to climate change ^[1], threatening global food security (FS), especially in Africa ^[2]. In Ethiopia, 75% of the landmass is categorized as dryland ^[3], the majority of which experiences high risks of land degradation, natural hazards, and water and food shortages ^[4]. Under the pressures of natural conditions and global environmental changes, drylands are regarded as areas of major climatic hazard, limited in terms of long-term sustainable development ^[5]. Significant advances have been made in detecting dryland expansion and measuring food security.

Thus, we review the literature related to food security status and introduce its causes in Ethiopia to present a complete and clear picture of food security. In addition, we synthesize previous research to find out the challenges and opportunities that currently exist in Ethiopian food security issues. Moreover, we hope to find out potential future research directions through combining the corresponding research to better assist the country's food security development.

2. Food Security Current Status

Food security is a flexible concept. Since the World Food Conference in 1974, there were more than 200 definitions and 450 indicators of food security created to describe food security issues ^[6], with the most authoritative and recognized definitions coming from the United Nations Food and Agriculture Organization (FAO). According to the definitions by FAO, the main goal of ensuring food security is to ensure that many people can buy and afford the basic food needed for survival and health at any time ^[7]. Therefore, ensuring food security has a three-dimensional goal, that is, to ensure maximum and stable food supply, to ensure that sufficient quantities of food are produced, and to ensure that those who need food can obtain food ^[8].

Since then, the country has been under a serious threat to food security. In Ethiopia, more than 33 million people suffer from chronic malnutrition and food insecurity, and the number of people suffering from hidden hunger may be even higher ^[9]. The Crop Prospects and Food Situation Report pointed out that more than 8.1 million Ethiopians are facing food shortages, including 400,000 children who are facing a severe food crisis in 2020, with 6% of these 8 million at 4 food security risks (emergency food security threats), 21% at Level 3 food security risk (in a food security crisis), 38% at a Level 2 food security risk (under food security pressure), and 34% at Level 1 food security risk (at a lower food security risk) ^[7]. For all the 8 million people in a food security crisis, 44% are in Oromia province, 22% are in Somali province, 13% are in Southern Nations, Nationalities, and Peoples' Region, 10% are in Amhara province, 5% are in Afar province, and 5% are in Tigray province ^[10].

The causes of famine in Ethiopia are also diverse. In general, this is a result of the combined influence of natural and social factors. Although the increase in drought caused by global warming is a generally accepted cause, the influence of social factors has become more prominent in recent years. After synthesizing the relevant literature, the following 7 main reasons are worthy of attention ^{[8][9][11][12][13][14][15][16]}.

Famine caused by drought has become a norm in Ethiopia ^[17]. Periodic droughts in the past 60 years have caused serious crop yields and livestock losses in Ethiopia, which has led to many international food aids (**Table 1**). The last aspect of the problem is related to the political economy theory, which includes land degradation, outdated agricultural

technology, weak agricultural infrastructure, and a single agricultural production structure ^{[18][19]}. Political and economic factors have accounted for a large proportion of Ethiopia's acceptance of international food aid since 2017, although drought and floods are an ongoing topic.

Table 1. Food aid for Ethiopia since 2017.

Time	Reasons
December 2016	Internal conflict/food prices
February, April, September 2017	Extreme drought in Eastern Ethiopia
August 2018	Conflict in Southwestern Ethiopia
August 2018	Violent riots in Eastern Ethiopia
September 2019	Severe drought in East Africa
December 2019	East African floods
February 2020	Conflict/disease outbreak/drought/flood
May 2020	COVID-19/desert locust plague
December 2020	Conflict in Tigray Region

3. Challenges and Opportunities

The core of the current Ethiopian food security problem is how to conduct more accurate and timely monitoring, how to conduct systematic causes analysis, and how to conduct the coping strategy.

There are two main ways to measure food insecurity in Ethiopia. The second is a short-term food security threat, which is caused by fluctuations in food prices, food production, or food supply chain channels ^[20]. A study by Sani in Western Tigray, North Ethiopia, showed that more than half of households in arid areas did not get enough food, and the proportion of people threatened by food security in areas with frequent floods and droughts was significantly higher than in other areas ^[21]. However, this approach is still insufficient because it is difficult to continuously monitor long-term food threats, and it is even more difficult to trace the driving mechanism that causes food security problems.

Previous research divided Ethiopia's food security into four main pillars: food availability, access to food, food utilization, and stability of supply and access ^[22]. Ensuring food security is a systematic task because the determinants of each pillar significantly impact manageability ^[23]. For example, some researchers aimed at improving crop varieties to increase food production ^[24], while some improved farmland management to ensure food security ^[25]. Some researchers want to improve food storage and transportation capacity after receipt to ensure better food supply ^[26], and some studies want to improve the stability of food production through the feedback mechanism under climate change ^[27].

The newly launched science project—Global Dryland Ecosystem Programme The Global-DEP project is intended to facilitate actionable interdisciplinary research on drylands ^[28]. The frameworks of G-DEP highlight the need for a number of elements, such as dryland social-ecological systems (SESS) drivers, structure and functions, ecosystem services, and management to achieve the SDGs' zero hunger goal. Ethiopian food security researches is similar to the logical sequence of in working process of dryland SESS, i.e., detecting famine driving forces, analyzing the linkages and interactions of food shortage, forming comprehensive management and policies against famine.

Research themes and priorities of G-DEP can bring us inspiration and reference to build a comprehensive understanding of the research on Ethiopian food issues (**Figure 1**). For example, the food security issue in Ethiopia can be divided into 4 main research directions. The first is food supply system dynamics and driving forces, the second is household and macroscopic mechanism or structure for food security, the third is food security adapting to a changing environment and society, and the final one is transforming the food supply system to meet sustainable livelihoods in drylands.

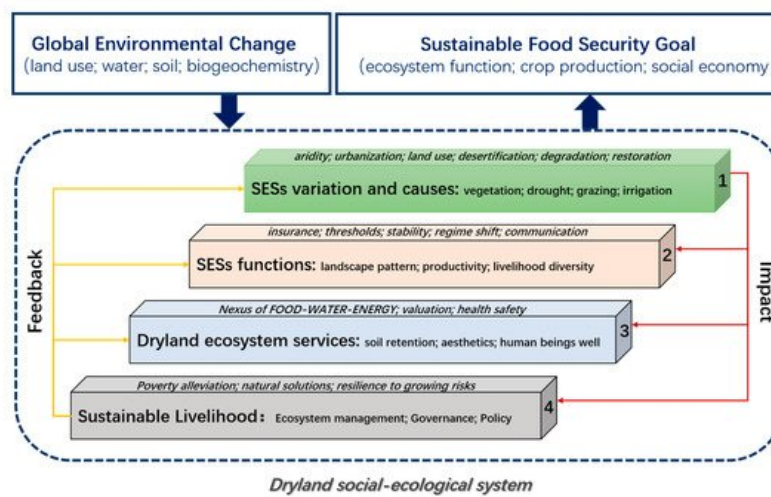


Figure 1. The synthetic conceptual framework of the G-DEP. Goals (Source: Modified by [28].)

4. Future Roadmap

There are emerging signs of the negative impact of COVID-19 on the agricultural food system, compounding ongoing problems of locust/fall armyworm infestations [29]. There is no single prescriptive adaptation solution to these challenges [30], and an integrated approach for rural development is required.

The dryland development paradigm (DDP), introduced in 2007, presented a highly influential framework for dryland development based on systems research [31]. Thus, the successful climate-resilient management experience from different regions could be adapted in Ethiopian dryland food security practice. The sustainable water management strategies of Mezquital Valley empowered farmers to face upcoming external threats such as climate change [32], which is a good example for Ethiopia, where irrigation conditions are extremely scarce. Multiscale analyses on the ecosystem services of the Loess Plateau, a typical dryland region experiencing decades of ecological restoration, provide first-hand experience for ecological restoration at the inland degraded areas in Eastern Ethiopia [33].

Field observation data can be considered a kind of antenna for capturing food security statuses. The capability of in-depth data mining of long-term monitoring and the network comparisons of cross-site typical ecosystems play a decisive factor in correctly assessing and tracing food security in Ethiopia. In addition to the accumulation of observational data, data screening and mining are equally important. Various indicators for remote sensing monitoring of hunger are often biased and misleading [34], while cross-site typical ecosystems can reduce assessment errors caused by environmental differences [35].

Research pointed out that Ethiopia has a great groundwater potential varying from 2.6 to 13.5 billion m³/year [36]. How to utilize underground water as an alternative source to strengthen irrigation activities and improve productivity is another potential direction against food security threats. Water management is important because climate changes, which are likely to occur during future decades, may have significant negative effects on the main water balance elements and maize yield [37]. Moreover, research also showed that Ethiopian farmers disfavored strategies related to water management, which can seriously waste the water potential of the area [27].

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