

Migration as an adaptive strategy to climate change in Ethiopia: Venturing into unexplored territories

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Abstract

Ethiopia contends with the profound repercussions of climate change, notably prolonged droughts disrupting the lives of millions. Despite concerted mitigation efforts, a dearth of understanding prevails regarding adaptation strategies among affected individuals and communities. This study meticulously examines household adaptation mechanisms to climate change, with a particular focus on migration as an adaptive response. Utilizing Grounded theory method of qualitative methodology, our research rigorously scrutinizes migration's efficacy in bolstering adaptive capacities within Ethiopia's climatically vulnerable Kembata Zone.

In the Kembata Zone of Ethiopia, agricultural communities contend with multifaceted climate change impacts—temperature surges, erratic rainfall patterns, prolonged dry seasons, crop diseases, and diminished land productivity. This research accentuates migration not merely as a key but an effective adaptive strategy in this context. Our investigation illuminates that farmer households send members to diverse domestic and international destinations as a strategy of climate change adaptation. Significantly, seasonal, and temporary migrations to local destinations emerge as primary strategies for climate change adaptation. Such migration provides farmer households with access to farmland, which is critical for cash and food crop production, countering potential productivity downturns in the areas of origin attributed to climate change. Notably, some households send their members to international destinations, where remittances have been found to play a pivotal role in addressing escalating climate change challenges by financing climate-resilient agricultural activities and livelihoods.

Keywords: Climate Change; Adaptation; Seasonal Migration; Drought; Kembata Zone

1. Introduction

The earlier migration climate change nexus was dominated by the outlook of migration as a consequence of climate change. More specially, migration as an adaptation response to climate change has garnered significant attention in academic research. Scholars such as McLeman and Smit (2006) have extensively studied the role of migration in facilitating adaptation to climate change. However, in light of recent studies, the effectiveness of migration as an adaptive strategy in specific contexts has become a subject of ongoing debate. This research therefore aimed to contribute to this recent debate over the effectiveness of migration as a climate change adaptation mechanism by undertaking in-depth qualitative analysis of the lived experiences of farmer households in the face of climate change.

Furthermore, some institutions and scholars warn that climate change would result in the migration of millions of people within and across the borders, posing security conditions to host communities in some areas (Brown, 2008). These concerns have led to extensive research and projections on the potential scale of climate-induced migration. For

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instance, in the mid-1990s, it was widely reported that up to 25 million people had been forced from their homes and land by a range of severe environmental pressures, including pollution, land degradation, droughts, and natural disasters. The size of migration was estimated to reach 1 billion by 2050 (Brown, 2008). The World Bank's projections also highlight the potential magnitude of climate change migration. According to its findings, three regions - Latin America, sub-Saharan Africa, and Southeast Asia - are expected to produce 143 million more climate migrants by 2050. Furthermore, a report from the same institution reveals that climate change has already displaced 68.5 million people, more than double the number of climate-induced migrants in the mid-1990s (Podesta, 2019).

In response to the perceived security threats posed by climate-related migration, some states designate it as a significant concern for their communities. The impact of climate change on migration in the United States, for example, suggests that climate change-driven migration may lead migrants to seek refuge in stable democracies adhering to international asylum conventions and having strong economies. The report argues that such migration could cause greater instability among United States allies and partners, potentially strengthening adversary states. Moreover, adversaries could exploit or support irregular migration to destabilize United States allies and partners (The White House, 2021). However, some authors have criticized the securitization of climate-related migration and the perception of mass migration as a threat. Instead, they argue that migration can be viewed as a means of adapting to climate change and reducing its negative effects (Tacoli, 2009). Migration is considered a form of climate change adaptation in which individuals, households, and communities seek to reduce the risks associated with climate change (Sobczak-Szelc & Fekih, 2020). It has become part of a wider process of socio-economic transformation, as people migrate to cope with or adapt to environmental changes and optimize their livelihoods (Sobczak-Szelc & Fekih, 2020).

The decision to migrate in response to climate change is often constrained by socioeconomic factors and lack of resources, making certain groups more vulnerable to its impacts (Farbotko, 2020; Warner et al., 2013; McLeman, 2013). Vulnerable populations such as the poor, marginalized communities, and indigenous peoples are disproportionately affected by climate change and often have limited options for adaptation (IPCC, 2014). Their lack of resources, limited access to services, and dependence on climate-sensitive livelihoods can make migration the only viable option for survival (Warner et al., 2013). Furthermore, the adaptive capacity of individuals and households in the face of climate change depends on various factors, including demographic characteristics, resources and infrastructure, and institutional support (Farbotko, 2020; McLeman, 2013). Demographic characteristics such as age and gender can influence an individual's ability to adapt. For instance, women may face specific challenges due to social norms and gender inequalities, which can limit their access to resources and decision-making power regarding migration (McLeman, 2013). Additionally, the availability of resources and infrastructure, such as access to water, healthcare, and transportation, plays a crucial role in determining the adaptive capacity of communities (IPCC, 2014).

The decision to migrate in response to climate change can range from involuntary immobility to voluntary temporary or long-term mobility, depending on factors such as resource availability and the desire to sustain cultural heritage (Farbotko, 2020; McLeman, 2013). In some cases, individuals may be forced to stay in areas prone to climate-related hazards due to factors like lack of financial resources or legal restrictions on mobility (McLeman, 2013). On the other hand, individuals and communities may choose to relocate temporarily or permanently as a proactive adaptation strategy to safeguard their livelihoods and cultural identity (Farbotko, 2020).

Evidence suggests that households and individuals employ migration as a strategy to overcome the severe consequences of climate change. For example, a study conducted in a village in North-Western Burkina Faso found that households employ seasonal migration to neighboring countries in response to irregular rainfall that threatens their livelihoods (Vinke et al., 2022). This strategy allows migrants and their families to diversify their income sources, empowering them to mitigate the effects of climate change. By seeking opportunities in other regions, they can access alternative livelihoods and reduce their dependence on rainfed agriculture, which is vulnerable to climate variability.

Similarly, research conducted in rural communities in Bangladesh reveals that migration serves as an adaptive response to increased frequency and intensity of natural disasters, such as cyclones and floods (Brouwer et al., 2017). The study highlights that households facing the brunt of climatic events often resort to migration as a coping mechanism to protect their lives, secure their livelihoods, and seek safer environments. Through migration, individuals can relocate to less hazard-prone areas or engage in temporary work in urban centers, diversifying their income sources and reducing their vulnerability to climate-related risks.

In rural communities in Nepal, Ghimire et al. (2019) conducted a study that underscores the critical role of migration in helping households cope with climate change impacts, particularly in areas vulnerable to natural hazards like landslides and glacial lake outburst floods. Their research emphasizes that migration enables households to access alternative livelihood opportunities, reduce exposure to climate risks, and enhance overall well-being. In a similar vein, Think et al.

(2016) conducted research in the Mekong Delta region of Vietnam, examining the intricate relationship between climate change, agricultural productivity, and migration patterns. Their findings indicate that households experiencing declining agricultural productivity due to changing climatic conditions are more inclined to engage in temporary migration to urban areas or neighboring regions. This form of migration allows households to diversify their income sources and adapt to the adverse effects of climate change on agriculture.

In the context of small island states, where the impacts of climate change are particularly pronounced, research conducted in the Pacific Island nations for instance in Kiribati, demonstrates the role of migration in climate adaptation (McNamara et al., 2018). Rising sea levels and increased frequency of extreme weather events pose significant challenges to these low-lying atoll nations. The study reveals that migration is utilized as an adaptive strategy by Kiribati communities, with households sending family members to urban centers or overseas to secure employment opportunities and remit funds back home. This form of migration helps build resilience by diversifying income streams, reducing pressure on limited resources, and enhancing the adaptive capacity of both migrants and those who remain in the homeland. Moreover, the case of Tuvalu, a low-lying island nation in the Pacific, offers additional insights into the interplay between climate change and migration. McNamara et al. (2019) investigated the influence of climate-induced environmental changes, such as sea-level rise and saltwater intrusion, on migration patterns and decision-making processes in Tuvalu. Their study reveals that migration serves as a viable adaptation strategy for households facing the challenges of climate change, providing opportunities for improved education, employment, and healthcare in other countries.

Studies show that individuals and households employ diversified form of migration as a climate change adaptation. For instance, seasonal migration as a response to irregular rainfall and other climate-related factors has been observed in various contexts. In the Sahel region of Africa, for instance, migration patterns have been shaped by environmental challenges, including water scarcity and land degradation (Gray, 2010). Short-distance, circular migration has emerged as a prevalent adaptation strategy, enabling individuals and households to diversify their income and enhance their resilience to climate change impacts. Notably, migration not only increases resilience but also enables individuals and households to accumulate assets. By engaging in migration, individuals can access new opportunities for employment, education, and social networks, leading to improved economic well-being and increased social capital (Foresight, 2011). Remittances sent back by migrants can contribute to local development and serve as a financial buffer during periods of environmental stress (Gray, 2010).

Contrary to these perspectives, research conducted by Huq et al. (2019) in rural communities in Bangladesh posits that migration may not always be a viable or preferred option for households affected by climate change. Their study suggests that the decision to migrate is contingent upon various factors, including socioeconomic conditions, cultural norms, and the availability of alternative livelihood options. It emphasizes the need for nuanced approaches to comprehend the complexities of migration as an adaptation strategy and underscores the importance of context-specific analysis. In the Sahel region of Africa, Black et al. (2020) conducted research that challenges the prevailing assumption that migration is predominantly driven by climate change impacts. Their study asserts that political instability, conflict, and economic opportunities play a more substantial role in shaping migration patterns in the region. The authors caution against oversimplifying the complex interactions between environmental, social, and economic factors by solely attributing migration to climate change, emphasizing the necessity for comprehensive studies that consider multiple drivers of migration.

While these studies provide valuable insights into the relationship between climate change and migration, it is important to note that further research is needed to address the existing research gap in regions like Horn of Africa specifically, countries like Ethiopia where climate change affects significant portions its people. This region experiences high climate change effects, particularly in the form of drought and seasonal changes. This research aims to contribute to addressing this gap, providing valuable insights into the dynamics of migration as an adaptation strategy in Ethiopia with the aim to deepen our understanding of the complex relationship between climate change and migration in the context of the Horn of Africa region.

The Horn of Africa stands as one of the regions of African continent, which is severely impacted by climate change, with its vulnerability exacerbated by the occurrence of severe droughts leading to complex and multi-directional migration flows (Abdiker, 2011). The region's heavy reliance on rain-fed agriculture and pastoralism renders livelihoods and food security highly susceptible to long-term and sudden environmental changes and natural hazards (IGAD, 2017). Nelson and Khan (2021) highlight that extreme weather conditions further compound the intricate factors driving migration in the Horn of Africa, and these challenges are anticipated to intensify in the future.

Ethiopia, being the largest country in the region both in terms of geography and population, offers a prominent example of a developing nation grappling with the impacts of slow-onset climatic shocks, particularly recurring droughts that inflict severe socio-economic consequences on drought-prone areas (Kiros, 1991). The adverse consequences of frequent and extreme weather events, such as droughts, in Ethiopia have profoundly affected access to food, livestock production, water availability, land productivity, and have caused widespread displacement (C.M. Godde et al., 2021). Recent drought events, including those in 2016/17 (Nguyen, 2019) and 2021/2022 (UNICEF, 2022; Ken & Mabaso, 2022), have further exacerbated food insecurity, livestock loss, water scarcity, malnutrition, and displacement (Ken & Mabaso, 2022). Such recurrent droughts have particularly impacted households that reliant on livestock rearing in arid and semi-arid regions, leading to a severe disruption of their livelihoods (FAO, 2022).

Existing studies on migration and climate change in Ethiopia primarily attribute migration to climate change as a causal factor (Gray & Mueller, 2012). For instance, a study conducted in northern Ethiopia by Hermans and Garbe (2019) suggests that climatic factors, specifically drought, stimulate mobility through short-term migrations to nearby destinations in response to immediate needs, such as food shortages. However, this study fails to address whether these migrations are undertaken as adaptive strategies or as consequences of failed adaptation to climate change factors.

Notably, historical evidence points to state-sponsored migration as a response to drought-induced crises in Ethiopia. Mengistu's socialist regime (1974-1991) initiated large-scale relocations of people from drought-affected regions in Central and North Ethiopia to agriculturally productive areas in the southwest (Rahmato, 1989, as cited in Ezra & Kiros, 2001). Although such actions aimed to alleviate livelihood pressures in origin areas and improve conditions for most migrants, they have been subject to criticism due to their severe consequences and inadequate coping mechanisms at destination sites. Post-socialist Ethiopia in the 1990s and 2000s also witnessed state-sponsored local migrations driven by population pressure and declining land productivity. However, the extent to which these migrations serve as individual or household-level adaptive strategies to climate change effects remains inadequately studied. To address these research gaps, this study endeavors to explore how migration is utilized as an adaptation strategy to climate change in the Kembata zone of southern Ethiopia. The region is known for its high vulnerability to climate change factors such as drought and erratic rainfall (Tadesse, 2017).

Grounded theory methods were employed in this study, providing a flexible approach for qualitative research and theory development (Charmaz, 2009). Grounded theory method allows researchers to explore farmers' lived experiences of climate change and their adaptive strategies (BIRKS & MILLS, 2015). Through purposive sampling, in-depth and open-ended interviews were conducted with farmer households who have long-standing residency in the study area (Adugna, 2019). This approach facilitates an in-depth understanding of the agricultural practices and climate change adaptation strategies employed by farmers (Tadesse, 2017). Concurrent data collection and analysis were conducted by employing various techniques such as coding, constant comparative analysis, theoretical sampling, and memoing to ensure a rigorous analysis process (Charmaz, 2009). The use of coding helps researchers in organizing and categorizing the data, while constant comparative analysis allows for the identification of patterns and themes across interviews (BIRKS & MILLS, 2015). Theoretical sampling allows for the selection of participants and data sources that contribute to the emerging theory, while memoing aids in capturing the researcher's reflections on the analysis process (Charmaz, 2009).

The study centered on fifty smallholder farmer households residing in two districts, namely, Kedida Gamela and Kachabira district in the kembata administrative zone. These households actively participated in various agricultural activities, such as farming and livestock rearing, with their farms spanning less than one hectare. Notably, the study sample consisted primarily of male participants, which aligns with the prevailing gender dynamics observed in agricultural activities within the region. This study is aimed to enhance our comprehension of how migration is employed as an adaptive measure in response to climate change. By examining the experiences and practices of farmers in these two districts, valuable insights are gained regarding the context-specific strategies they employ. These findings will contribute to the existing knowledge base surrounding climate change adaptation, particularly with regards to the role of migration in agricultural communities.

2. Results and Discussion

Farmers participating in this study have expressed the diverse ways in which they have been affected by climate change. They have identified rising temperatures, erratic rainfall patterns, and both periodic and prolonged droughts as significant climatic factors that resulted in a drastic impact on their livelihoods. Additionally, they have observed land degradation, soil erosion, declining agricultural productivity, and crop diseases as further climate change-related threats to their livelihoods. According to the respondents, these climatic events have become increasingly frequent over the past two decades, presenting unprecedented challenges to their way of life.

Farmers have reported observing climate change through the noticeable decline in rainfall patterns and the occurrence of droughts in recent years. They emphasize the impact of an extreme climatic event experienced in the 2021/2022 in the form of delay in rainfall, which resulted in a shift in crop season. In the main agricultural regions in Ethiopia there are two rainy seasons, the Meher and the Belg. Meher is the main and prominent crop season. It encompasses crops harvested between Meskerem (September) and Yeaktit (February). Crops harvested between Megabit (March) and Nehase (August) are considered part of the Belg crop season (Taffesse, Dorosh, & Asrat, 2011). Research participants indicate that they experienced a significant crop production loss that led to food shortages for both their families and livestock due to the erratic rainfall during 2021-2022. For instance, delayed rainfall during this period forced farmers to abandon cropping the spring ('Belg') season—the season that contributes nearly half of the annual crop production in the study area. The pressure exerted by climate change compels local communities to forgo the 'Belg' cropping season, leaving them with insufficient time to prepare their land for the 'Meher', the main cropping season, which typically commences in early July in the Kembata zone. The 'Meher' season is regarded as the primary crop season at both the community and national levels. Consequently, any delay in rainfall during the 'Belg' season directly impacts the 'Meher' season, necessitating farmers to harvest prior to the onset of the main crop season to optimize the utilization of the land cultivated during the 'Belg' season.

According to the research participants, the absence of rainfall during the 'Belg' season in 2021 and 2022 has led to food and water shortages for both families and livestock. They have been confronted with escalated prices, particularly for food items, resulting in additional expenditures to acquire food and forage at inflated costs. Some farmers have had to venture farther from their villages in search of water sources for their livestock. The study participants have also noted the emergence of atypical crop diseases during the main crop season, heavy rainfall capable of washing away pollen and fertile topsoil, and concerns regarding diminished crop yields due to climatic challenges. Several farmers express apprehension about the continuation of rain during the harvest season, as there are no signs of the rain season abating by the end of October, which deviates from their usual climatic patterns. Others perceive climate change as contributing to land degradation and declining agricultural productivity, emphasizing that land fertility has progressively diminished over time, necessitating the use of soil fertilizers for crop production, whereas previously, fertile land yielded substantial crops even without such interventions.

This study reveals that farmers employ a range of adaptation mechanisms to mitigate the adverse impacts of changing climatic conditions on their livelihoods. The primary means of climate change adaptation reported by the research participants include income diversification through off-farm activities and enhancing agricultural productivity. Among the adaptive strategies utilized by farmers in the study area, the substitution of drought-sensitive vegetables and crops with drought-resilient and versatile vegetation, such as '*Enset*' (*Enset's* scientific name is *Ensete ventricosum*). *Enset* is the most hailed drought resilient and multipurpose vegetation in the study area. This vegetation is a well-known staple food source for the community under this study and in entire southern Ethiopian communities (Sahle, Yeshitela, & Saito, 2018). '*Enset*', according to farmers, has various medicinal values for humans as well as for domestic animals. Most of the farmers were worried about the diseases that have been depleting '*Enset*' vegetation in recent years, which they believed is caused by climate change. And they feared the depletion of *Enset* vegetation worsening their livelihood as it is the main source of food for people and cattle. Replacing climate sensitive crops like coffee, sweet potatoes, and grains such as wheat, sorghum, etc., with cash crops like Khat, bananas and coffee, as well as fruit trees like avocado and mango, emerges as the prominent on-site climate change adaptation strategy. Farmers in the study area emphasize that they have increasingly cultivated cash crops to supplement their income, which has been adversely affected by climate change. Cash crops according to them, compensate the income previously derived from cash vegetables like onions, garlic, and potatoes, which are now abandoned by many of them due to severe climate change impacts.

Furthermore, farmers employ diversified farming techniques to mitigate the effects of climate change and optimize crop production. Adaptive strategies such as contour farming, terracing, fallowing, mixed cropping, livestock rearing, and rainwater harvesting are practiced by farmers in the study area. Mixed cropping and livestock husbandry are widely adopted mechanisms of climate change adaptation to sustain livelihoods. These strategies enable farmers to mitigate the risks associated with climate change and enhance their resilience.

Livestock production, including cattle, poultry, goats, sheep, donkeys, horses, and beekeeping, also contributes to the income and food security of the communities in the study area. Farmers diversify their livelihood activities by engaging in livestock rearing, which serves as a backup in cases of crop failure due to adverse weather conditions. In addition to providing food and income, livestock also supports farming activities. For instance, livestock manure is used as a natural fertilizer, equines (donkeys and horses) are employed for transportation and crop threshing during harvest seasons, and oxen are used for plowing farmlands. However, livestock is not immune to the impacts of climate change. The scarcity of forage and water emerges as a significant challenge resulting from inadequate rainfall and recurring droughts. To address these challenges, farmers in the study area store crop residues during harvest and collect, and

store water during the rainy season for use during prolonged drought periods. Nevertheless, farmers face difficulties in storing water due to prolonged dry seasons and the associated costs of digging wells.

Migration emerges as a pivotal strategy for climate change adaptation in the Kembata zone, representing a widely practiced off-farm adaptation mechanism. Most farmer households involved in this study indicated that they had migration experiences either within domestic or cross border one. These migration stories among farmers highlight that their destinations, both within and outside their region, were chosen in response to climate change challenges, particularly the decline in land productivity, as well as non-climatic factors such as the scarcity of farmland in the study area. Farmers who migrated within the region predominantly engaged in temporary migration, primarily driven by seasonal factors. They reported migrating to domestic destinations outside the study region to supplement the diminishing agricultural output on their farmlands in their origin areas. Prominent local destinations for seasonal migration among farmers include productive lowland areas outside their districts, such as the rural areas in the Alaba zone located approximately forty kilometers away from the study area. The proximity of these areas to the migrants' origin allows for frequent visits to their families while they work as migrants. At the destination, farmer households primarily focus on pepper and corn production to generate income and diversify crop production, which is already threatened by climate change at their origin areas. Unlike their places of origin, where coffee, Khat, and fruit dominate as cash crops, the destination areas are characterized by pepper cultivation as the main cash crop. This enables migrants to earn cash income, supplementing the decline in agricultural production in their places of origin. Consequently, migrant households diversify their agricultural production, leading to enhanced income and food sources, ultimately improving their climate change adaptation capacity.

Furthermore, migration provides migrants with opportunities to access farmland. As the migrants' places of origin face acute farmland shortages and declining productivity, engaging in migration to neighboring areas facilitates adaptation to the challenges posed by climate change. Farmers who engage in seasonal and temporary migration gain access to farmland at their destination through two main mechanisms. Firstly, crop-sharing agreements: these mechanisms enable migrant farmers to obtain access to plots of land from landlords, with both parties entering into informal agreements to share the crop yield. In this arrangement, the landlord grants the migrant worker the right to use the land, while the migrant worker assumes responsibility for the cost of farming inputs such as seeds and fertilizers, as well as overseeing the crop until harvest. At the end of the cropping season, the crop yield is shared equally between the landlord and the migrant worker. Crop-sharing agreements typically span a season and can be extended based on the crop yield and the willingness of both parties. Migrant workers return to their home villages at the end of the season, utilizing the crop yield for domestic consumption or partially or wholly selling it to generate cash and sustain their family's livelihood.

Secondly, migrants gain access to farmland at their destination through informal land lease arrangements. In land lease mechanisms landlords lease their land to migrant farmers for a specified period. Under this arrangement, migrant farmers have the right to cultivate crops of their choice on the leased land. Similar to crop-sharing, land lease agreements are typically made for one season, with the possibility of extension depending on the parties involved. Informal land lease arrangements allow migrant workers to cultivate the desired crops during the agreed period. The costs of the lease can be paid in advance or negotiated seasonally, depending on the agreements reached by the parties involved. Moreover, the access to farmland through crop-sharing and informal land lease arrangements further strengthens the claims of migration as a climate change adaptation strategy. These arrangements allow migrants to engage in agricultural activities in destination areas, overcoming the challenges imposed by climate change in their places of origin. By entering into agreements with landlords, migrants gain access to land and actively participate in crop production, ensuring the continuation of their agricultural livelihoods. The flexibility and adaptability of these arrangements, including the potential for extension, showcase the resourcefulness and resilience of migrants in navigating the challenges posed by climate change.

The findings of this study highlight the pivotal role of long-distance migration as a climate change adaptation strategy among farmers in the study area. The evidence suggests that long-distance internal migration has emerged as a viable response to the decline in land productivity and the recurring occurrences of drought. This migration pattern has deep historical roots, originating from the state-sponsored initiatives during the imperial and socialist regimes in Ethiopia and persisting under subsequent post-social governments in the study area. The decision to engage in long-distance internal migration stems from the limitations posed by seasonal and temporary migration in effectively addressing the escalating impacts of climate change and the diminishing productivity of farmland.

Findings of our study show that undertaking long-distance migration is alternative means of adapting adverse effects of climate change in Kembata zone. For instance, Jalamo, a farmer participated in the study, undertook several forms of migration to various domestic destinations. First, he migrated to place called Libdu(short distance some 50 km away

from his origin). Then, to place out of his region to Shashemene(long distance over 110 km away from his origin), mainly in search for better agricultural opportunities. Jalamo's initial migration to Libdu for pepper cropping exemplifies the strategic choice made by farmers to undertake temporary migration as a means to supplement their income. Likewise, his subsequent migration to Shashemene(where he lived over thirty years before his return to his origin place), facilitated by state sponsorship, exemplifies the broader trend of domestic migration as an adaptive response to the impacts of climate change.

In addition to long-distance migration, the study emphasizes the substantial role of remittances in supporting climate change adaptation endeavors. Both international and domestic remittances play a pivotal role in alleviating the potential effects of climate change on households. Emigrants residing abroad, exemplified by individuals like Nanniso in the United States, provide financial contributions to their families, enabling them to cope with food shortages, droughts, and other climate-related challenges. Furthermore, local migrants, encompassing both low-skilled laborers and skilled professionals, contribute to domestic remittances that empower rural households to adapt to climate change through diversified income sources and enhanced agricultural practices.

3. Conclusion

In this study, we find that agricultural communities in the Kembata Zone of Southern Ethiopia experience climate change in several ways, most importantly through a rise in temperature, erratic rainfall patterns, periodic and prolonged dry seasons or drought, crop diseases, and a drop in land and agricultural productivity. The study also finds that farmer households employ several climate change adaptation mechanisms to cope with these challenges. Migration is identified as not only a key strategy but also effective strategy of adaption to climate change in the study region.

Our findings indicate that farmer households send household members to several domestic and international destinations, empowering them to enhance their climate change adaptation capacities by diversifying and increasing their income sources. The study also reveals that farmer households engage in seasonal and temporary migration to local destinations as their main strategy of climate change adaptation. Seasonal migration allows household members to access land for farming activities, particularly for cash and food crop production. Such migration aids in expanding agricultural activities to compensate for potential declines or losses in production due to climate change in the origin areas.

To further diversify their adaptive strategies, farmer households also send their members to long-distance domestic destinations where excess land is available, enabling them to mitigate the growing climate change challenges in their origin in a sustainable way. Additionally, some households are able to send their members abroad, such as to South Africa and the United States, with remittances sent by family members assisting in coping with the increasing climate change challenges.

Domestic and international remittances from migrant households play a salient role in diversifying and increasing households' income sources. These remittances are spent on expanding agricultural activities, including planting climate change resilient vegetation, as well as addressing emergency needs such as food shortages, healthcare, and housing that support household climate change adaptation.

Overall, this study provides valuable insights into the climate change experiences of agricultural communities in the Kembata Zone. It emphasizes the significance of migration as a key strategy for climate change adaptation and highlights the role of remittances in supporting households' adaptive capacities. These findings contribute to the existing knowledge on climate change adaptation in agricultural communities. In addition to that, this study sheds light on the ongoing debate on the effectiveness of migration in climate change adaption strategy.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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