Does Climate Change Transfer Poverty from Rural to Urban Areas? Implications for Regional Sub-Saharan Research Agenda

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Received 23 July 2024 / Accepted 20 August 2024 / Published 06 September 2024
DOI: 10.14426/ahmr.v10i2.2305

Abstract

There is growing recognition that climate change is a worldwide phenomenon with far-reaching effects and that it is linked to an increase in the frequency of extreme weather occurrences. In rural areas of most of the sub-Saharan countries and other developing countries in the world, the frequent occurrences of extreme weather events such as flooding, heat waves, and drought have significantly destroyed livelihood activities of poor communities. Unfavorable geographic characteristics, a lack of resources, and a higher reliance on climate-sensitive sources of income among many community members in poor nations all contribute to the impact. These include livelihood activities associated with land use and agricultural practices. Sadly, the population's capacity and incentive to stay in rural areas have been altered because of climate change and its detrimental impacts on agricultural output, income, and subsistence living; as a result, many rural dwellers are migrating to urban areas. Rural populations migrate to urban areas in search of economic opportunities to earn a living. It is evident that the expected opportunities in urban areas are not always available; thus, most of the rural migrants are stuck in informal settlements, shanty towns, and slums without access to services. Consequently, it is evident that climate change is somehow transferring poverty from rural to urban areas. This study adopted the push/pull theory as a theoretical framework to guide the discussion and analysis. Based on an extensive review of the existing literature using qualitative document analysis, the purpose of this article is to examine the role of climate change on rural–urban migration, which ultimately contributes to the increase in urban poverty. The article concludes by reviewing the current (limited) research on climate change and poverty and argues for a research agenda in the context of sub-Saharan Africa toward sustainable ways to respond to the challenges of climate-induced migration, urbanization, and poverty.

Keywords: climate change, rural–urban migration, urbanization, poverty, sub-Saharan Africa

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INTRODUCTION

Sub-Saharan Africa, the region located below the Sahara Desert, comprises 90% of the African nations. Despite its diverse cultural, historical, and socio-political contexts, the region commonly confronts formidable challenges and complexities, such as pervasive poverty and malnutrition, rapid and uncontrolled urbanization (related to rural-urban migration), political volatility, and environmental degradation (Szirmai, 2015). The region, much like other developing nations worldwide, is also characterized by fast urbanization (Blekking et al., 2022), and it is expected to be predominantly urban; by 2043, half of sub-Saharan Africa's population will live in urban areas (Jobarteh, 2024). Rural–urban migration is particularly significant in large developing countries undergoing urbanization, such as those in sub-Saharan Africa and South Asia, where rural populations remain disproportionately large (Brueckner and Lall, 2015; Selod and Shilpi, 2021). The rapid increase in the urban population size is attributable to the natural population growth of existing urban settlements, the reclassification of rural settlements to urban settlements, and rural–urban migration (Jobarteh, 2024). The primary drivers include higher urban incomes, better amenities, climate change, conflicts, and the need for insurance against risks (Selod and Shilpi, 2021). This migration pattern is also significantly influenced by economic factors, population size, housing availability, and environmental conditions (Chaplitskaya et al., 2024).

The impacts of climate change, therefore, are pivotal in exacerbating conditions that drive rural–urban migration. This is particularly evident in how climate change adversely affects rural livelihoods, which are predominantly dependent on agricultural practices. Kumar (2018) notes that this region, particularly the drought-prone areas, suffers from one of the lowest levels of agricultural productivity, primarily as a result of water stress during crop growth. The author further indicates that the region is plagued by conflicts, political instability, poor governance, corruption, politics of exclusion, high rural poverty, and weak human resource capacities (Kumar, 2018). Unlike other regions, the main drivers of rural–urban migration in sub-Saharan Africa include dissatisfaction with public services in rural areas, changing weather patterns, land pressures, natural disasters, and conflict (Jobarteh, 2024). Thus, this pattern of migration poses an imminent burden on urban governance (Bawakyillenuo et al., 2018). The most pressing issue is the readiness of urban governance to address the ever-escalating urban poverty associated with climate-induced rural–urban migration.

Sub-Saharan Africa has encountered frequent climate crises, including extreme weather events and natural disasters. Ayanlade et al. (2022) argue that the impacts of climate change are growing more intense and frequent, with the observed effects of climate extremes on sub-Saharan Africa on the rise. Climate change shocks are increasingly common in sub-Saharan Africa (Blekking et al., 2022), for example, the Southern African drought (2015–2016), the East African drought (2016–2017), the Cape Town water crisis (2017–2018), the Ethiopian drought (2019), and the ongoing drought in the Sahel region. To effectively address the climate crisis, sub-Saharan

African nations need to act responsibly, sensibly, and sustainably, despite the absence of specific climate change legislation in most of these countries. These nations continue to combat climate change by deploying and using various measures aimed at mitigating and adapting to its effects. They are also advancing the United Nations Sustainable Development Goals (SDGs) for 2030. There are several studies investigating the relationship between climate change, migration, and urbanization, particularly how extreme weather and climatic changes promote urbanization (Barrios et al., 2006; Henderson et al., 2017; Dia and Beaudelaire, 2021). However, there are limited studies regarding how climate change exacerbates urbanization and poverty (Henderson et al., 2017). Thus, drawing upon an extensive review of the existing literature, this article aims to examine whether climate-induced rural–urban migration exacerbates the already severe poverty conditions in urban areas of sub-Saharan Africa. This region, already grappling with extreme poverty, provides a critical context for examining the intersection of climate change, urbanization, and poverty.

THEORETICAL BACKGROUND

Migration, in general, is a complex phenomenon influenced by a variety of driving factors. The motivations behind migration are often context-dependent, including a range of socio-economic, environmental, and political drivers. To explain this complex process of migration, different theoretical perspectives have been applied to explore the rationale behind individuals' or groups' decisions to migrate from one geographic area to another, particularly to urban centers. For example, the dual sector theory (Lewis model) on urban–rural migration argues that labor migrates from the rural areas considered underemployed, traditional, agricultural, and subsistence sectors to the urban areas perceived as high-productivity, modern industrial sectors (Knight, 2021). Another example is the Harris–Todaro model, which assumes that expected differences between rural income and urban income or a higher urban wage lead to rural–urban migration (Busso et al., 2021; Bhattacharya, 2024). However, these theories of migration focus mainly on economic dimensions of human migration and development.

This study adopted the push/pull theory, which suggests that people migrate as a result of several push/pull drivers (Al-Khudairy, 2024). Different researchers adopted the push/pull theory to investigate migration, particularly rural–urban migration (Eshetu and Beshir, 2017; Mlambo, 2018; Hoffmann et al., 2019; Nguyen, 2019; Khalid and Urbański, 2021). Applied from a socio-economic perspective, this theory emphasizes that people migrate because of push factors (e.g., unemployment, lack of service, and poverty) in rural areas and pull factors (e.g., better employment opportunities, services, and relatively good living conditions) in urban areas. On the other hand, from an environmental change perspective, the push/pull theory stresses that people migrate because of climate change-related push factors from rural areas to urban areas where they perceive better living and economic conditions. In the context of sub-Saharan Africa, many people migrate from rural underdeveloped areas to urban

areas for various reasons, including climate change impacts. This study, therefore, employed the push/pull theory, as it is relevant for exploring how climate-induced migration can transfer poverty, as migrants may not find sufficient opportunities in urban areas as expected, leading to increased urban poverty challenges.

METHODOLOGY

This study employed a qualitative research approach, which is acclaimed for its significance in providing deep insights into complex issues and fostering the generation of novel research ideas (Maree, 2020). The study used a document review method that involved the systematic analysis of existing documents. This technique is vital in this research to capture rich contextual data in a cost-effective manner (Lim, 2024). It relied on secondary data collection to examine the dynamics of climate change and its impact on transferring poverty from rural to urban areas. According to Maree (2020), secondary sources are materials that synthesize previously published works, which are integral to conducting a thorough literature review. In line with this, the secondary data was drawn from a wide range of existing literature, including peer-reviewed journals, books, and other reputable sources, ensuring a comprehensive analysis of climate change, rural-urban migration, and urban poverty (Lim, 2024). Data collection involved using databases such as Google Scholar and Science Direct, focusing on recent and relevant publications. The study followed qualitative research and document review to explore the complex relationship between climate change and poverty transfer from rural to urban areas. The study provides a comprehensive analysis that contributes to a broader understanding of the impact of climate change on migration by using secondary data from a wide array of credible sources. Thus, the application of the approach underscores the importance of secondary qualitative methods in unraveling the climate-induced rural-urban migration factors that influence urbanization and urban poverty challenges.

IMPACT OF CLIMATE CHANGE ON RURAL AREAS

Global abnormal natural disasters have significantly increased in recent decades. Ali and Erenstein (2017) explain that between 1980 and 2008 erratic natural hazards moved from an average of 125 per year to more than 500 events. The most common disastrous hazards of global magnitude that impact large numbers of populations, include flooding, drought, heat waves, sea-level rising, and desertification (Araos et al., 2016; Dumenu and Obeng, 2016; Alam et al., 2017; Ali and Erenstein, 2017; Sekkat, 2017; Lucci et al., 2018; Delazeri et al., 2022). Unfortunately, episodes of unprecedented hazards are not slowing down and are impacting different spheres of life, including how communities secure food and other sustenance. In other words, climate-related disasters are continuing to be disruptive to poor households in rural areas whose livelihoods are determined by environmental factors. Activities such as subsistence and small-scale farming are mostly affected. The observable effects of

climate change are becoming more pronounced in terms of variations in temperature, precipitation, and wind. Ali and Erenstein (2017: 184) note that "approximately 2.5 billion people who derive their livelihood in part or in full from agricultural production systems" are impacted by climate change-related stressors. Ironically, the most affected communities, who are in developing countries, contribute less than 10% of the world's yearly emissions of carbon dioxide, which is blamed for the fast-paced manifestation of climate change (Ali and Erenstein, 2017). Even though these people contribute an insignificant portion of the emissions, their over-reliance on the climate and environmentally inclined activities expose them to the risks associated with climate change. Maskrey et al. (2007) anticipate that the poor who reside in agricultural communities in developing nations will be the most impacted by these climate changes. In fact, because of their unfavorable geographic location, scarcity of resources, and increased reliance on climate-sensitive sources of income, most impoverished rural and agricultural populations suffer the most from climate change (World Bank, 2009). Because of the large number of impoverished people and the large populations that continue to rely mostly on rural economies based on agriculture, most African and South Asian countries are especially affected.

Agriculture is a climate-sensitive sector; thus, rural livelihoods dependent on this sector are more susceptible to the damages of climate change-related hazards (Dube and Phiri, 2013; Husain, 2015; Nawrotzki et al., 2015; Tacoli et al., 2015; Araos et al., 2016; Dumenu and Obeng, 2016). For example, in the sub-Saharan region, temperatures are increasing, precipitation has dropped on average, and rainfall patterns have become less predictable, making rural livelihoods in nations like South Africa, Malawi, Zimbabwe, and Zambia more susceptible. In the tropical countries, such as those in South America and the Caribbean, livelihoods have been exposed to hazards associated with increases in sea levels, storm activity, and flooding. The issue of infrastructure is the other underlying component contributing to the effects of climate change. Because of inadequate infrastructure, such as sea walls, and a lack of funding for the development of technological protection, poor and less-developed nations are disproportionately affected by climate change (Tacoli et al., 2015; Araos et al., 2016; Dumenu and Obeng, 2016; Alam et al., 2017). For instance, Pakistan has experienced significant financial losses resulting from infrastructure and property damage, decreased agricultural productivity, and the high cost of restoring and reconstructing areas devastated by natural disasters (Husain, 2015).

There is evidence that the detrimental consequences of climate change are threatening to undo the development gains made with transformation since sub-Saharan Africa's independence in other regions of the continent. Frequent unpredictable weather events, such as floods, droughts, cyclonic storm surges, riverbank erosion, saline intrusion, and water logging, have a negative impact on food, water, health, and energy security, as well as many people's lives and livelihoods, especially the impoverished (Alam et al., 2017). According to Ali and Erenstein (2017), recent extreme weather occurrences in the region – such as flash floods –

are thought to be directly related to climate change and are trapping impoverished communities in nations like Pakistan and India. The disappearance of the flora and wildlife, which the majority of the impoverished rely on for the development and sustainability of their livelihoods, threatens their access to food. Although many adaptation tactics are used by rural communities, such as crop diversification, taking on non-farm secondary occupations, and expanding farm sizes, not everyone can afford these options because they need significant financial resources. The only way out of rural poverty caused by these difficulties has been to migrate from rural to urban areas.

The movement of poor people from rural to urban areas has always been there and is influenced by many factors. However, the most common cause has been the lack of income-earning opportunities in rural areas. Dumenu and Obeng (2016) argue that the absence of employment prospects for economically active family members is the main reason why most rural households encourage their young energetic members to migrate to urban areas in search of employment to support the households. With agriculture being the most relied on form of employment and livelihoods in rural areas, it makes sense that the volume of those migrating to urban areas has increased (Nawrotzki et al., 2015; Tacoli et al., 2015). In many developing countries, rural small-scale farming and agricultural livelihoods have been struggling because of climate change. As a result, what remains in agricultural production systems is increasingly centered around large-scale and mechanized farming. These large-scale activities can cope with and adapt to climate change, as they have financial support. The ability of small-scale farmers to respond to climate variability and droughts is hampered by their limited access to technology and credit. In the end, this forces people living in rural areas to migrate to cities in pursuit of employment. With so many people living in urban areas worldwide, it is critical to analyze how climate variability and change will affect urban migration trends. This is a critical area of policy concern. The relationship between climate change, rural–urban migration and the transfer of poverty is at the center of the complex manifestation of climate change and perpetuation of poverty in many developing countries.

THE LINK BETWEEN CLIMATE CHANGE, RURAL-URBAN MIGRATION, AND POVERTY TRANSFER

In the last ten years or so, the scientific community has been increasingly interested in the connection between population mobility and climate change. The interest has also extended to how these movements manifest into poverty transfer from rural to urban areas. This is undoubtedly not an easy process to understand. Delazeri et al. (2022: 2159) state that the "interactions between climate-induced environmental changes and migration are complex and highly context-specific, mediated not only by the type and severity of climate drivers but also by the heterogeneity and vulnerability of affected societies." Currently, poverty and urban concentration are two of the main issues facing many emerging nations. How much climate change contributes to this

process, is the question that needs to be asked. According to estimates by the United Nations Human Settlements Programme (UN-Habitat), 881 million people, or 30% of the urban population in developing nations, reside in slums (Lucci et al., 2018). This urban concentration, which is constantly expanding in many emerging nations, poses significant hurdles to the process of development. Bearing in mind that climate change-related hazards are not slowing down, more people will continue to leave rural areas to search for survival opportunities in urban areas. As a result, although most people in the developing world currently reside in rural areas, the percentage of those in urban areas will soon climb and surpass that of people living in rural areas. Delazeri et al. (2022) highlight that the reason the numbers of migrants from rural to urban areas are drastically increasing, is that whereas climate change is a contributor, it is adding to other more common pull and push factors.

Migration is significantly influenced by several variables, including social, financial, and human capital. These include amenities such as better services. However, in countries like Sudan and Guinea, "socio-economic factors such as high illiteracy level, heavy dependence on climate-sensitive livelihoods, less diversification of income sources and limited access to climate change information contributed to the high vulnerability of the rural population," fueling their desire to move to urban areas (Dumenu and Obeng, 2016: 208). Households therefore use migration as a tactic to diversify their sources of income and to insure themselves against the risks associated with climate catastrophes. Unfortunately, there have been many challenges associated with the movement of people from rural to urban areas. For instance, high levels of urban concentration have received unwelcome attitudes by officials and other well-off urban residents (Dube and Phiri, 2013; Husain, 2015; Nawrotzki et al., 2015; Tacoli et al., 2015; Araos et al., 2016). Different groups "point to claimed negative externalities of geographically concentrated poverty and irreversibility resulting from the costs of migration, which can mean that migrants to urban areas cannot easily return to their former standard of living in rural areas" (Ravallion et al., 2007: 667). Sekkat (2017) also notes that the concentration in cities leads to traffic jams and environmental deterioration, which lower productivity and raise poverty. Although not all immigrants live in poverty, they are frequently held responsible for the rise in urban poverty. Other challenges include the inability of the migrants, particularly the poor ones, to find adequate housing and to access services. Because most low-income and informal settlements lack basic infrastructure, most of these individuals who live in informal settlements work long hours in low-paying, unstable, and dangerous employment, and are exposed to a variety of environmental risks. Lucci et al. (2018: 297) highlight that "whereas urban poverty may be underestimated, it has implications for targeting interventions and allocating resources in the 2030 Agenda for Sustainable Development." The other dilemma is that poor urban populations, such as those living in informal settlements, are often undercounted, and the indicators used to measure basic deprivations do not provide policymakers with the information they need to formulate and implement policies

to tackle urban scarcities (Lucci and Bhatkal, 2014). To develop suitable policies to address the actual problems encountered by the impoverished urban population, it is crucial to increase awareness and comprehension of deprivation in urban situations.

MITIGATION AND ADAPTATION STRATEGIES

While it is known globally that rural vulnerabilities and poverty are more severe than urban ones, there is evidence of growing levels of helplessness and despair in urban areas. Put differently, the notion that most of the extreme poverty in the developing countries occurs in rural areas is an assumption of development policymaking, although this has significantly changed in the last several years (Ravallion et al., 2007). In fact, some experts think that urban poverty is becoming a bigger issue than rural poverty. With climate change as one of the reinforcers of these changes, emphasizing the need for assessing the susceptibility of local communities to climate change and highlighting the necessity of area-specific measures and policies to mitigate vulnerability and improve adaptation in both urban and rural regions are crucial (Alam et al., 2017; Ali and Erenstein, 2017; Sekkat, 2017; Lucci et al., 2018; Delazeri et al., 2022). However, what is more important for the climate response strategies to work is to ensure that those affected are involved from the beginning of any intervention. The effectiveness of climate change plans hinges on comprehending the perspectives of all stakeholders, including those in rural and urban areas. These include the policymakers, community members, farmers, and nongovernmental civil society organizations, to mention a few. Since climate change adaptation tactics vary over time, from place to place, and even within cultures, a variety of players must be included for any program to be successful (Tacoli et al., 2015; Araos et al., 2016; Dumenu and Obeng, 2016; Alam et al., 2017). It is not surprising that any development-related interventions, including those targeting the impact of climate change, are likely to be met with challenges. High levels of vulnerability to factors beyond climate change make it difficult to have a specific climate-related response without first addressing other social ills. For instance, in urban areas it is difficult to address climate change without considering urban poverty, particularly in slums or informal settlements, where the majority of the poorest people are found in cities of the developing world.

When we conceptualize the poor as being vulnerable, we imply that they are either unable to adapt to the negative impacts of poverty, inequality, and other social problems such as extremes and variability in the climate, or that they are susceptible to them. Thus, the intervention to assist such people requires a thorough consideration of "the complex combinations of socio-economic, political and environmental factors that act and interact to influence vulnerability to climate change, the magnitude of the resultant impact and the set of coping or adaptation strategies that are developed in response to the impacts" (Dumenu and Obeng, 2016: 209). It is evident that these vulnerable populations do not have the necessary adaptive capacity to deal with the effects of climate change (Tacoli et al., 2015). However, what is important is to assist

them to sufficiently respond to the challenges they are facing. Some of the main issues that need urgent attention to succeed, include the approaches to addressing social vulnerability. Equivalent to the system's capacity, social vulnerability is primarily influenced by socio-economic variables such as income distribution, asset ownership, gender, ethnicity, poverty, and source of income. Overcoming the challenges associated with social vulnerability is crucial in alleviating the added pressure from climate-related stressors to both urban and rural poor communities. Initiatives and programs that acknowledge the many needs of diverse households and individuals, including migrants, and that are inclusive of all low-income groups have a greater chance of successfully eliminating poverty in both urban and rural areas, when considering various locations and circumstances.

In urban areas, "policies to address issues related to climate-induced migration must focus on both facilitating migration and assisting vulnerable segments of the population who remain in place, as the less-educated rural population whose livelihoods depend on the agricultural activity" (Delazeri et al., 2022: 2159). Access to information to facilitate a participatory approach toward these initiatives should be encouraged. Strategic communication and an aggressive dissemination effort aimed at addressing both urban and rural populations should be employed to improve access to climate change knowledge. Such data should be packaged and disseminated using context-specific methods and technologies. For example, targeted radio broadcasts, local-language pamphlets, and door-to-door awareness visits could be used to maximum effect in rural areas. In urban areas, targeted television broadcasts, social media, and billboards could be used. The creation of information hubs and the use of mobile communications services could potentially enable communities in both urban and rural areas to better meet their needs to access climate change information. This indicates that more financial resources need to be invested in educating communities about climate change and how it affects both rural and urban livelihoods.

All these efforts play a major part in enhancing urban and rural climate change adaptation. In contrast to mitigation, which allows for the measurement of greenhouse gas emissions to assess the efficacy of policy measures, adaptation lacks comparable "off-the-shelf" measurements (Araos et al., 2016). It is challenging to determine the impact of these efforts when the targeted communities continue to experience unaddressed poverty. Also, the fast-paced impact of climate change on small-scale agriculture and food production that ultimately leads to food insecurity, makes it even more difficult to measure the success of adaptation. Whereas commercial and more-established farmers are adapting to climate change, their small-scale counterparts are facing lower food production security levels, resulting in higher levels of poverty. The small-scale farmers have low adaptive capacity compared to the commercial and large-scale farmers. The latter can promote local adaptation efforts and so increase the resilience of farming practices by having access to financing and information about suitable strategies. According to Alam et al. (2017), for small-scale farmers to

succeed, it is critical that they have local-level knowledge of adaptation to strengthen the resilience of vulnerable households against risks and to deal with climate change and variability. The Intergovernmental Panel on Climate Change (IPCC, 2007) has centered discussions on developing adaptation solutions based on local knowledge about adaptation. This underscores the importance of developing and integrating adaptation strategies alongside local knowledge and systems that communities have been using for years.

GOVERNMENT POLICY RESPONSES TO THE IMPACT OF CLIMATE CHANGE

The nexus between climate change and rural–urban migration features a broader socio-economic dimension of climate impacts. For example, in sub-Saharan Africa, climate change poses a severe threat to rainfed agricultural systems, which are essential for the livelihoods of a significant portion of the rural population (Serdeczny et al., 2017). The disruption caused by climate variability is not only jeopardizing food security but also triggering a notable increase in rural–urban migration. This migration exacerbates urbanization pressures and contributes to rising poverty levels in cities (2017). According to the World Bank (2015), in 2015 the sub-Saharan African region had the highest proportion of people living below the poverty line in relation to all world regions. This means that as climate-induced pressures drive people from rural areas to urban spaces, cities face increased demands on infrastructure and services.

In recognition of the impacts of climate change, governments are adopting a range of climate laws aimed at reducing emissions, promoting renewable energy, and enhancing adaptation measures (Akpuokwe et al., 2024). Within Africa, regions such as North and Southern Africa, including countries like Morocco, Cape Verde, and Ghana, have demonstrated commendable performance in climate policy implementation (Epule et al., 2021). The authors argue that these regions' showcasing of effective integration of climate change considerations suggests that the potential for success is great when strong policy frameworks and governance structures are in place. The post-Paris Agreement era has also seen a wave of legislative reforms across African nations aimed at enhancing climate governance. In this regard, Kenya's Climate Change Act of 2016 and the new South African Climate Change Act 22 of 2024 exemplify efforts to integrate both mitigation and adaptation strategies into national frameworks (Rumble, 2019). These legislative measures are designed to establish comprehensive mechanisms for addressing climate impacts, from greenhouse gas reduction to resilience building. Effective governance structures and coordinated climate actions are pivotal in translating these legislative efforts into tangible outcomes.

Regionally, efforts in East Africa to develop gender-responsive climate policies illustrate a commitment to inclusive and equitable climate action. However, these policies face significant implementation hurdles, primarily because of inadequate resource allocation and insufficient attention to the root causes of climate challenges. For instance, Uganda's focus on clean energy and Kenya's Climate Change Act, which

promote renewable energy, reflect positive steps (Namanya, 2016). Nonetheless, without robust support and effective execution, these initiatives may fall short of achieving their intended impact. This underscores a critical need for enhancing resource mobilization and addressing systemic issues in policy implementation. Likewise, most West African countries have also developed climate policies that comprehensively address various sectors, including agriculture, energy, water resource management, and health (Sorgho et al., 2020). These authors further argued that given agriculture's high vulnerability to climate change, it receives particular emphasis. This sectoral approach reflects a broader recognition of the need for diverse and targeted strategies to mitigate climate impacts and enhance resilience across different facets of society. The integration of climate considerations into multiple sectors is crucial for building a robust and adaptive response to climate challenges.

CLIMATE CHANGE RESEARCH AGENDA

The climate change condition is paradoxical in Africa because the continent contributes minimally to global anthropogenic emissions but faces severe and multifaceted impacts from climate change, including changes in hydroclimate, biodiversity, and wildfire dynamics that are already prevalent across Africa (Al-zu'bi et al., 2022; Overland et al., 2022). This discrepancy highlights a significant injustice in the global climate narrative and the impacts are exacerbated by the continent's limited capacity to respond effectively because of economic constraints and underdeveloped infrastructure (Ogega et al., 2022).

One of the primary challenges in Africa is the limited capacity for climate change research, with less than 0.5% of the mean gross domestic product (GDP) invested in research and development (Ogega et al., 2022). Strengthening this capacity is crucial, especially in sub-Saharan Africa, which is particularly vulnerable to climate impacts. Adequate resourcing and investment in research infrastructure are essential to build a robust knowledge base and develop effective adaptation and mitigation strategies. Other challenges include insufficient use of modern technologies, models, climate change scenarios, and earth observation products (Kapuka et al., 2022). Funding trends show that there was no significant increase in climate-related research funding for Africa from developed countries after 2015, which is concerning, given the growing need for mitigation research to support a low-carbon, climate-resilient future (Overland et al., 2022). However, as Africa's population, economy, and energy consumption grow, there is an urgent need for research that focuses on mitigation strategies alongside adaptation, particularly to investigate the nexus between climate crisis, migration, and urbanization in the context of sub-Saharan Africa. Nonetheless, the lack of funding undermines the continent's ability to contribute to and benefit from global climate solutions.

A wide range of climate change research has been conducted in different parts of Africa in key thematic areas, including equitable urban transitions, the resilience of smallholder farmers, and the management of hydroclimate extremes (Al-Zu'bi et

al., 2022). There is also a focus on just energy transitions, the intersection of climate with diversity and ecosystem services, and health impacts of aerosol mitigation (Overland et al., 2022). This diversity in research topics reflects the multifaceted nature of climate impacts in Africa, necessitating an inclusive approach to climate research that encompasses environmental, social, and economic dimensions. Further research is needed in terms of the extent to which climate change policies and strategies integrate gender issues, including promoting gender mainstreaming and budgeting in the context of rural–urban migration (Ampaire et al., 2020). Namanya (2016) also points out that detailed analysis is needed to provide deeper insight on the relevance and effectiveness of climate change policy and legal frameworks in energy, agriculture, infrastructure, and water resource management. Furthermore, Sorgho et al. (2020) stress that evaluating the implementation of climate change action in individual countries is paramount.

CONCLUSION

This article demonstrates that climate impacts livelihoods in rural areas, prompting rural–urban migration. Climate change hurts agricultural outputs, rural jobs and income, and subsistence living, compelling people to move to towns and cities. The primary drivers and patterns of migration from rural to urban areas because of climate change are diverse, and contextual. Broadly, the main reasons why people move from rural areas include: lack of income-earning opportunities; less diversification of income and livelihoods; resource scarcity; higher urban incomes; and access to basic services in urban areas. However, the influx of rural migrants as a result of climate change affects poverty levels and socio-economic conditions in urban areas. The expected opportunities are not always available in urban areas, and such migration contributes to rapid urbanization, causing challenges and pressure on housing, service delivery, and the mushrooming of informal illegal settlements. To address the problem of climate change, governments are adopting different climate change adaptation and mitigation strategies, including laws and fiscal measures, to reduce emissions. Furthermore, in view of supporting government responses, research in climate change mitigation should be enhanced in sub-Saharan Africa through strengthening capacity and resource allocations.

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