

Artículo de Investigación

Climate change and migration dynamics in the Horn of Africa: a comprehensive review and future research directions

Cambio climático y dinámicas migratorias en el Cuerno de África: una revisión exhaustiva de la literatura y direcciones futuras de investigación

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Abstract:

Introduction: In this study, relevant references are analysed to establish what factors determine migratory movements in the Horn of Africa and what role climate change plays. **Methodology:** A systematic literature review in five phases is conducted, selecting 221 relevant references based on inclusion and exclusion criteria. These references are used to analyze migration movements and the factors influencing them. **Results:** A notable increase in publications is highlighted since 2011, coinciding with a devastating drought in the region. Findings indicate that while climate change is an important factor, other elements such as poverty, insecurity, and conflicts play an even more significant role in regional migration. **Discussion:** Challenges, such as the lack of reliable data and the need for a multidisciplinary approach to address these complex issues, are identified. The region faces a critical situation with high levels of food insecurity, conflicts, and climate vulnerability, suggesting that climate change is an added factor to an already complicated situation. **Conclusions:** The study concludes that integrating climate change, migration, and conflicts in future research is crucial to develop effective and sustainable responses.

Keywords: migration; climate change; Horn of Africa; conflicts; food insecurity; displacements; exploratory systematic review; research challenges.

Resumen:

Introducción: En este estudio, se analizan referencias relevantes para establecer qué factores determinan los movimientos migratorios en el Cuerno de África y qué papel juega el cambio climático. **Metodología:** Con una revisión sistemática de la literatura en cinco fases se seleccionan, siguiendo unos criterios de inclusión y exclusión, 221 referencias relevantes. Con ellas se analizan movimientos migratorios y qué factores influyen en ellos. **Resultados:** Destaca un aumento de las publicaciones desde el año 2011, coincidiendo con una devastadora sequía en la región. Los hallazgos indican que, aunque el cambio climático es un factor importante, otros elementos como la pobreza, la inseguridad y los conflictos tienen un papel aún más significativo en la migración de la región. **Discusión:** se identifican desafíos como la falta de datos fiables y la necesidad de un enfoque multidisciplinario para abordar estos problemas complejos. La región enfrenta una situación crítica con altos niveles de inseguridad alimentaria, conflictos y vulnerabilidad climática, lo que sugiere que el cambio climático es un factor añadido a una situación ya complicada. **Conclusiones:** El estudio concluye que es crucial integrar el cambio climático, la migración y los conflictos en investigaciones futuras para desarrollar respuestas efectivas y sostenibles.

Palabras clave: migración; cambio climático; Cuerno de África; conflictos; inseguridad alimentaria; desplazamientos; revisión sistemática de la literatura; desafíos de investigación.

1. Introduction

The Horn of Africa (HoA) is a dynamic and strategic region on the African continent, consisting of Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan, South Sudan, and Uganda. The region covers about 4.3 million square kilometres and has a population of about 190 million people. From 2020 to 2030, the total population of the HoA is expected to grow at an average rate of 2,6%. The region has an extraordinarily young population; in Djibouti, half of the population is younger than 25 years of age; the median ages of the population of Eritrea, Ethiopia, Sudan, and South Sudan is 19 years old and 16 years old in Somalia (World Bank, 2023). In addition to population data, the region faces a convergence of complex challenges that have shaped its socio-economic and environmental landscape, profoundly affecting the lives of its inhabitants. In the middle of these challenges, climate change emerges as an

exacerbating factor that intensifies the vulnerability of local communities and amplifies pressures on natural resources (Freeman, 2017).

The impact of climate change in the HoA manifests in various ways, from increased frequency and intensity of extreme weather events such as prolonged droughts and sudden floods, to variability in rainfall patterns affecting water availability and agricultural productivity (Lindvall et al., 2020). These phenomena, combined with other factors like environmental degradation, scarcity of natural resources, ethnic and political conflicts, terrorism, violence, and widespread poverty, have contributed to a complex landscape of both internal and external migration in the region (Horwood, 2015).

Migrations in the HoA are characterized by their diversity and dynamism, encompassing a wide range of both forced and voluntary displacements. Internal displacements are common, with rural communities migrating to urban areas in search of alternative livelihoods due to the loss of arable land and water resources because of climate change and environmental degradation (Seife, 2021). These internal movements often lead to the proliferation of informal settlements and increase pressure on basic services in cities (Marchand et al., 2017).

Cross-border migrations represent a notable aspect of the region, driven by conflicts, political instability, economic challenges, and the pursuit of economic opportunities and security (Freeman, 2017). These movements across borders occur within the Horn of Africa and extend into neighboring regions, adding complexity to migration dynamics, and presenting additional obstacles for the protection and support of displaced populations (Op. Cit., 2017).

In this complex context, it is essential to comprehend the interconnections among climate change, environmental degradation, and migration in the HoA. It is equally important to develop holistic and enduring strategies that cater to the needs of affected communities and foster resilience over the long term. Regional and international cooperation, investment in resilient infrastructure, sustainable management of natural resources, and enhancing the adaptive capabilities of local communities are fundamental components in tackling these challenges and forging a safer, more sustainable future. It is imperative to involve affected communities in the formulation and implementation of these measures to ensure their effectiveness and relevance (Thriollet, 2009).

The main objective of this research, given the multitude of factors and the complex context we are dealing with, is to synthesize the current scientific evidence available on the subject at hand. This is intended to provide a detailed and comprehensive analysis, as well as to establish clear guidelines for future research that can be addressed soon.

The main objective will be divided in some specific objectives:

- 1) synthesize the current scientific evidence available on the subject at hand. This is intended to provide a detailed and comprehensive analysis, as well as to establish clear guidelines for future research that can be addressed soon.
- 2) Analyze, based on existing literature, the existing migration patterns in the region and their connection to other factors like climate change, conflicts, violence, and terrorism.
- 3) Synthesize key findings from the reviewed literature to provide a coherent and understandable insight into the current state of knowledge on the subject.
- 4) Identify gaps and underexplored areas of research in the existing scientific literature, highlighting emerging topics that could be the focus of future investigations.

The hypothesis of this research is that climate change, combined with other risk factors such as conflict, terrorism, and insecurity, is causing complex migration dynamics in the region. The timeliness and significance of this issue are driving increased research efforts aimed at understanding and analyzing this complex relationship. Therefore, it is expected that a systematic analysis of the literature will clarify the intricate connection between climate change, migration, and conflicts, and will also help identify key areas for future studies.

The current state of knowledge about climate change and migrations in the Horn of Africa is dynamic and continually evolving, with growing attention from both the scientific community and policy and development circles.

Climate change effects in the region include precipitation variability, more frequent and intense droughts, floods, and rising temperatures (Nicholson, 2017). These changes directly impact water availability, affecting livestock farming and agriculture, which are the primary livelihoods of local communities (Muller, 2014). In the Horn of Africa, decreased and variable precipitation has increased prolonged droughts (Gebremeskel et al., 2019). These droughts have reduced water and food availability, raising food insecurity and malnutrition. Additionally, less precipitation has led to desertification and land degradation, reducing agricultural productivity and threatening subsistence agriculture (Meier et al., 2019).

Another significant impact of climate change in the Horn of Africa is the increased frequency and intensity of flash floods and extreme weather events, which can result in loss of life, destruction of infrastructure, and displacement of entire communities (Nicholson, 2014). These extreme events can have devastating effects on food security, public health, and socio-economic stability in the region, especially in densely populated urban areas and vulnerable coastal zones (Calow et al., 2010). In addition to the direct impacts on natural resources and communities, climate change in the HoA also has significant implications for regional security, forced migration, and conflicts (Afifi, 2012). Competition for scarce resources such as water and land can increase inter-community tensions and local conflicts, thereby heightening the vulnerability of marginalized and disadvantaged populations (Buhaug, 2010).

The HoA is a region characterized by complex migration dynamics, driven by a variety of factors that incentive movements both within the region and outward (IDMC, 2023). As mentioned, these factors can be socio-economic, political, environmental, and demographic, and their interaction contributes to the diversity of migratory movements observed in the region. Among the factors influencing migration dynamics in the area, armed conflicts and political instability stand out (Marchand et al., 2017). In countries like Somalia, South Sudan, and Eritrea, these have been significant drivers of migration in the Horn of Africa. Violence, persecution, and lack of security force many individuals to leave their homes in search of protection and safety elsewhere, either within the region or beyond its borders. Additionally, ethnic conflicts and inter-community tensions are additional factors that can contribute to migrations; clashes between groups, competition for scarce resources, and discrimination can force people to leave their homes in pursuit of security (Hendrix, 2012). Furthermore, the pursuit of economic opportunities and employment stands out as another important factor driving migration in the Horn of Africa. Many individuals move to urban areas or neighboring countries in search of work in sectors such as construction, agriculture, informal trade, and domestic services, with the hope of improving their economic conditions and sending remittances to their families (IDMC, 2023). Food insecurity, severe environmental changes, and land degradation are key migration drivers in the HoA (Op. Cit., 2019). Understanding this complex scenario requires investigating multiple factors together to develop a unified understanding of the region's situation.

This research is crucial for examining the HoA, a region severely impacted by climate change.

Understanding its effects is vital for addressing threats to food security, livelihoods, and natural resources. The study links climate change to migration, showing how conflict, poverty, and governance influence climate-induced displacements. It contributes to the literature by providing a critical review of migration dynamics in the HoA and highlighting the connections between climate change, conflicts, and socioeconomic factors. By identifying challenges and proposing future directions, it enriches academic knowledge and provides a foundation for developing effective policies and interventions.

2. Methodology

The methodology used in this research is an exploratory systematic literature review. This approach aims to comprehensively synthesize, evaluate, and recognize the main empirical studies on the influence of climate change on migrations in the Horn of Africa, as well as other factors that contribute to migration. The most used systematic literature review method is the one proposed by Arksey and O'Malley in *Scoping studies: towards a methodological framework*, which consists of five phases (Arksey, & O'Malley, 2005).

- Phase 1 involves formulating the research question based on the objectives and detailing the body of literature to be summarized. The research question should be clearly structured to establish an effective systematic search strategy (Fernández et al., 2020).
- Phase 2, Establishment of Inclusion and Exclusion Criteria and Systematic Search: Establishing inclusion criteria (e.g., years, languages ...) selecting keywords, search terms, and databases of scientific articles to be used.
- Phase 3, Review and Selection of Studies: Identifying and removing duplicate studies; reviewing titles and abstracts; conducting full-text reading of articles that were not excluded and compiling a list of potentially relevant references that were not captured in the initial database search.
- Phase 4, Data Extraction: Data extraction is performed according to the needs of each systematic literature review (Op. Cit., 2020).
- Phase 5, Analysis and Reporting of Results: Quantitative study results will be analyzed numerically, while qualitative study findings will be analyzed using thematic analysis phases (Arksey, & O'Malley, 2005).

Following the Comprehensive Systematic Literature Review proposed by Arksey and O'Malley (2005), the research question (phase 1) we seek to answer is "What impact does climate change have on migration patterns in the HoA?" To address this inquiry, we can pose additional crucial questions: "Which other factors drive migration in HoA?", "Are these factors interconnected with climate change?", "What prevalent themes and patterns characterize current research on this subject?", "What are the key research gaps in the climate change-migration link in the HoA, and which new areas should future studies focus on?"

Once we have formulated the research questions, the importance of conducting a comprehensive review of the existing literature on this topic becomes evident. This process is crucial for assessing the robustness of available evidence and for drawing coherent conclusions that can contribute to advancing knowledge in the field. To carry out this review, the bibliographic database employed was Scopus. The reason for selecting Scopus lies in its extensive collection of abstracts and citations of peer-reviewed scientific papers, making it the most comprehensive database in this regard. Additionally, it stands out for its analytical and visualization tools that facilitate the study and understanding of scientific production, as well as its ability to locate relevant sources and detect emerging research trends. In Scopus, the established word combinations for article searches were as follows: on one hand, "migration,

Africa" to obtain a general overview of migratory movements on the continent. On the other hand, the other search combinations were "migration, climate change, Horn of Africa," "conflicts, climate change, Horn of Africa," "conflicts, migration, Horn of Africa," "migration, climate change, East Africa," and "displacements, climate change, Horn of Africa." These searches yielded 7.732 references. Due to the volume of references obtained from the search, inclusion and exclusion criteria were established (phase 2 of the systematic review) to reduce the number of references to be addressed in the research. The established criteria were as follows:

- a) geographical relevance, for example, studies focused on the Horn of Africa or East Africa, as this is the study area under investigation;
- b) year of publication, only articles published between 2004 and 2024 would be selected, due to the current and changing reality of the phenomenon, including articles prior to this date could result in outdated data;
- c) keywords included in the article, the selected articles should include the following keywords to eliminate those that do not address the topic of interest: migration, climate change, East Africa, conflicts, or violence. After applying these criteria, the number of references was reduced to 1.520.

In phase 3, duplicates will be eliminated, titles and abstracts reviewed, and the final selection of references read. Additionally, data extraction will be performed in phase 4. For data extraction, a bibliometric analysis was conducted to visualize the knowledge structure, relationships between authors, institutions, topics, and publications, and to identify emerging trends and research growth areas.

3. Results: revision of selected articles (phase 3) and data extraction (phase 4)

Phase 3 started with 1.520 articles following the inclusion/exclusion criteria (see Table 1). Then, duplicate articles were eliminated and, from here, the revision of titles, abstracts and theoretical frameworks began. Finally, a total of 221 articles were for the literature review.

Table 1.

Selection of articles for the study

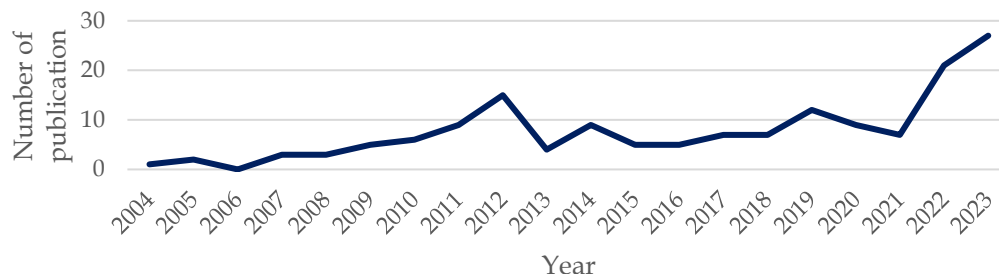
Total references Scopus	7.732
Review of articles following inclusion / exclusion criteria	
Publication date (2.171 references removed)	
Geographical relevance (3.048 references removed)	
Key words (993 references removed)	
References after inclusion / exclusion criteria	1.520
References after elimination of duplicates	1.328
Review of titles, abstracts, and theoretical frameworks (1.107 references removed)	
Articles included in the literature review	221

Source: Own elaboration (2024).

After the selection of the references for the review, data extraction would be started (Phase 4). Figure 1 shows the distribution of publications on migrations in the HoA over the past 20 years, highlighting academic interest in the topic.

Figure 1.

Distribution of articles by year



Source: Own elaboration (2024).

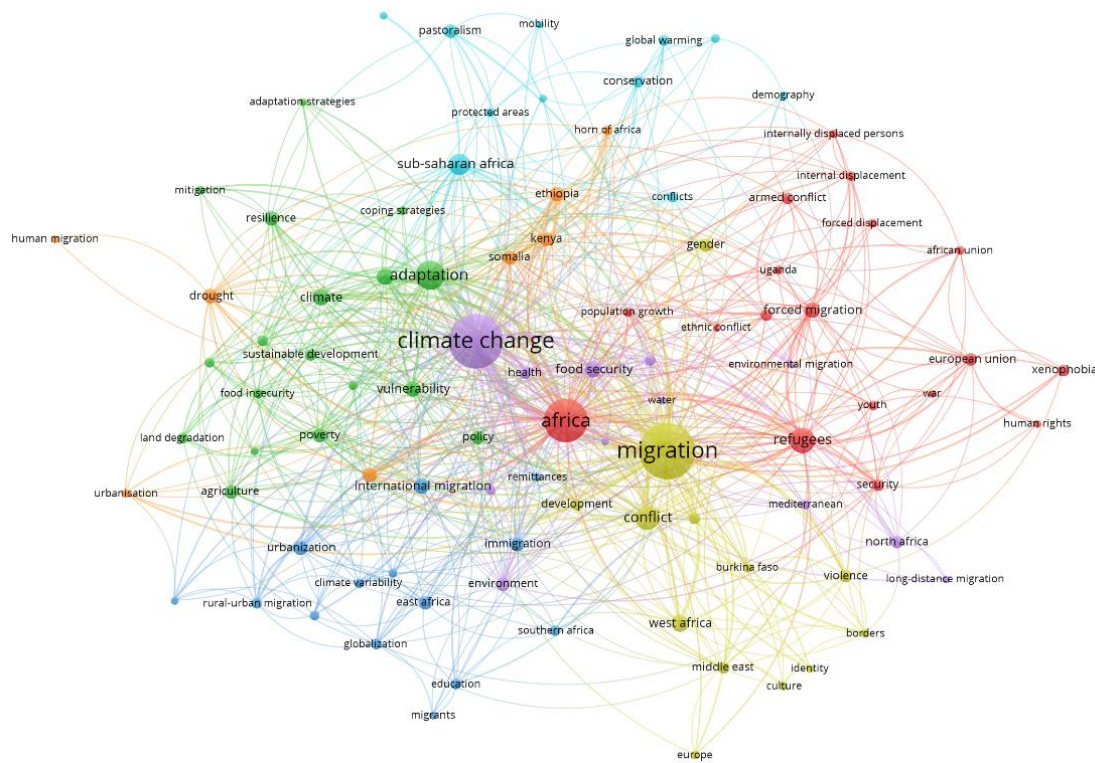
The graphical representation highlights two key points. First, there was a notable increase in publications from 2011 to 2013, coinciding with a severe drought in the Horn of Africa that caused a major humanitarian crisis (IGAD, 2023). Second, there has been sustained growth in publications over the past four years, indicating rising interest and the need for ongoing research due to the availability of climate and migration data.

In total, 94 keywords were identified from at least four different articles in the literature review. Figure 2 shows the main keywords from the articles in the bibliographic selection. The clusters are divided by proximity, meaning that words that typically appear together are in clusters of the same color.

The visible connections in this graphical network represent the interconceptual relationships among the key terms, providing a dynamic visualization of how these concepts are interconnected within the context of the reviewed studies. The significant connections and interrelationships in the study topic make it challenging to establish a clear distinction between the different clusters.

Figure 2.

Bibliometric keyword map.



Source: Own elaboration using VosViewer.

Three main clusters and three secondary clusters stand out. The main ones are: the purple cluster, the yellow cluster, and the red cluster.

In the purple cluster, the main concept is "climate change," and within its cluster (i.e., words that frequently appear together in research) are: food security, environment, health, water, environmental migration, and humanitarian security.

The yellow cluster has "migration" as its main concept, and within its cluster are: conflict, governance, violence, and development, among others. This means that when research addresses migration, it usually discusses it in the context of conflict and violence.

The red cluster is the last of the main clusters. Its most prominent concept is "Africa," which appears along with refugees, security, armed conflict, forced migration, internal displacement, internally displaced persons, and ethnic conflict.

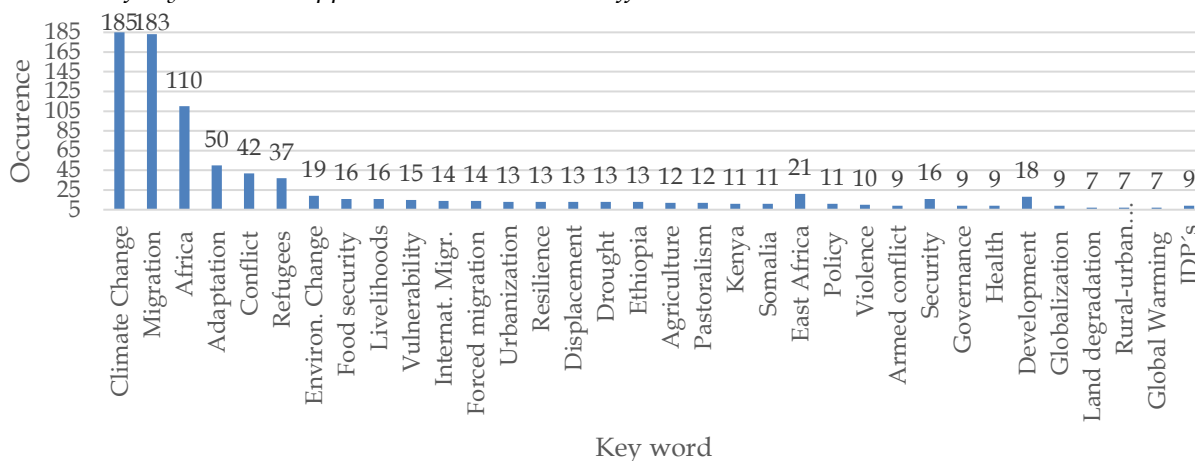
Regarding the three secondary clusters, the green, orange, and blue clusters are found. The green cluster has "adaptation" as its main concept. The importance of this word helps us understand that research dedicated to climate migration in Africa is starting to place considerable emphasis on adaptation, which also appears with: resilience, mitigation, agriculture, desertification, food security, land degradation, vulnerability, and adaptation strategies.

The orange cluster includes words related to the study area, such as: Horn of Africa, Somalia, Kenya, and Ethiopia, along with drought, displacement, urbanization, and conflicts. The use of these keywords together also indicates the problems that the area faces according to research, helping us understand the situation and the future direction of studies. Finally, in the blue cluster, words such as international migration, globalization, remittances, climate variability, and rural-urban migration are found.

Keywords help us understand the main topics and concepts of the research, allowing us to grasp quickly and clearly, what is being addressed in the studies. In this case, analyzing the most repeated keywords helps us focus on understanding which topics are being explored and which concepts are being discussed together (Figure 3). Following this occurrence of keywords and their relationships, it can be affirmed that most research on climate change and migration in Africa also discusses adaptation and conflict.

Figure 3.

Occurrence of keyword that appears at least in seven different articles.

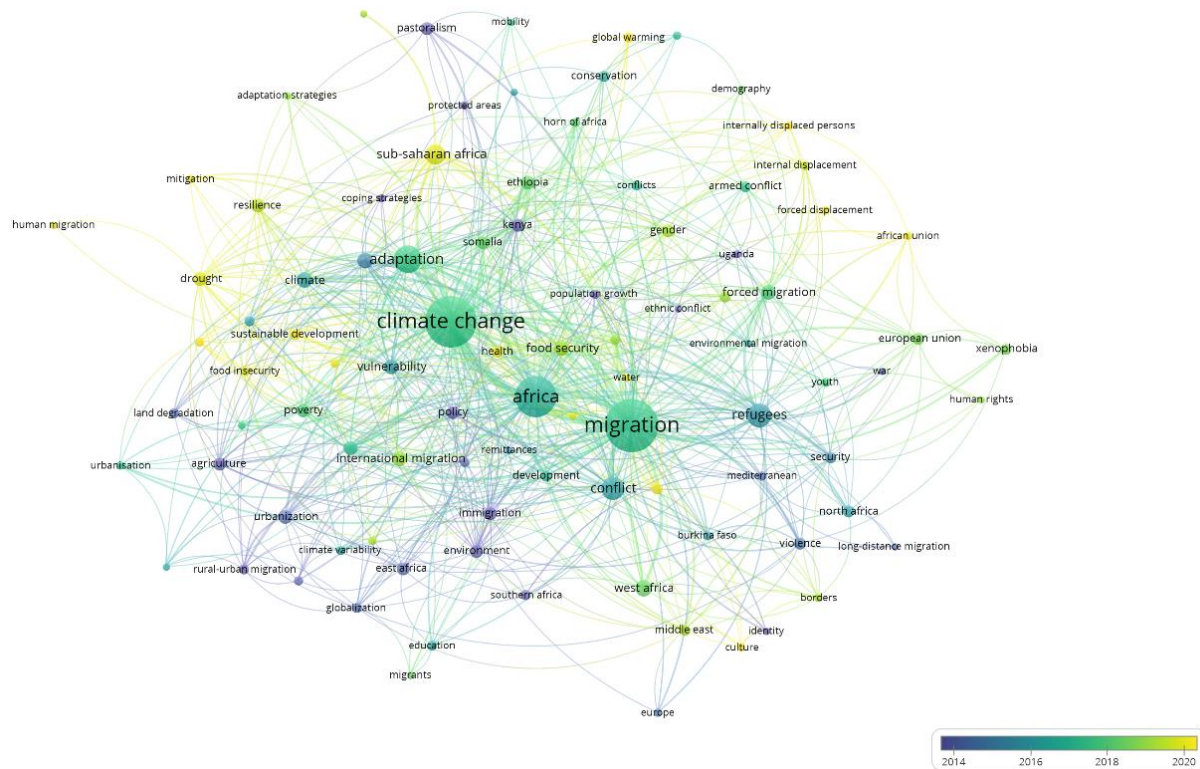


Source: Own elaboration (2024).

To understand the evolution and trends of the field of study over time, Figure 4 illustrates the distribution of keywords across the years (from darker colours representing words used around 2004 to lighter shades, such as yellow, representing concepts used in recent publications).

Figure 4.

Bibliometric map of keyword distributed by years.



Source: Own elaboration using Vosviewer (2024).

This approach allows us to identify emerging patterns, shifts in emphasis, and areas of increasing or decreasing interest in academic literature as the year's progress. With Figure 4, it can be observed that concepts such as drought, resilience, sustainability, mitigation, food insecurity, adaptation strategies, governance, forced displacements, internal displacements, internally displaced persons, and water security have gained prominence from 2020 to the present.

The growing relevance of these concepts in current research can be attributed to several interconnected reasons. Firstly, the African continent is particularly vulnerable to the effects of climate change, including more severe droughts, rising temperatures, desertification, and changes in precipitation patterns. These phenomena have a direct impact on food security, exacerbating the scarcity of basic resources and threatening the livelihoods of many communities. Secondly, food insecurity and lack of access to basic resources due to climate change escalate social and political tensions, thereby contributing to increased conflict and terrorism in certain regions (Maystadt, & Ecker, 2014). These issues force people to migrate in search of safer and more sustainable living conditions, leading to forced displacement and large-scale migrations.

Moreover, the vulnerability of communities to climate change and the risks associated with food insecurity and conflict are determining factors in migration decision-making. Migration becomes an adaptation strategy in response to adverse environmental and socioeconomic conditions (Black et al., 2021). Therefore, the emergence of these concepts indicates that future research will continue to delve into the interrelationships between these factors. It is anticipated that research will focus on better understanding how global warming and food

insecurity influence migration patterns and how these, in turn, affect social, economic, and political dynamics in both origin and destination areas.

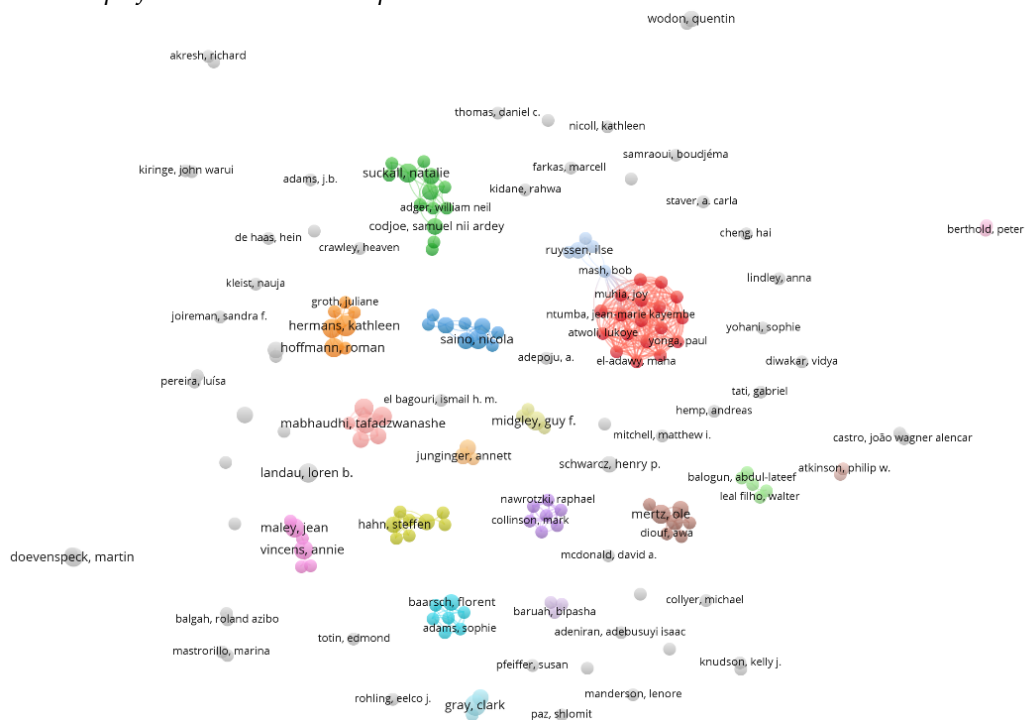
The absence of certain concepts highlights gaps in studies and spaces for new research. Future research could address resilience, understanding risk factors, or food security, concepts that have been less explored in existing research. Exploring possibilities to tackle this challenge from a multidisciplinary perspective, combining climate science, sociology, economics, and politics, will be necessary. This collaborative approach can develop comprehensive initiatives to address the challenges posed by climate change and help us understand the complex links between climate change, food insecurity, vulnerability, and migration, with the aim of developing effective and sustainable responses to these interconnected challenges.

In Figure 5, a bibliometric map of citation relationships is depicted, showing authors citing each other, allowing us to identify researchers working on related issues.

Additionally, the size of each circle indicates the number of citations each author receives, also enabling us to identify the most influential authors. Furthermore, each cluster shows authors working together. If we visualize it in the temporal space, we can see which authors are publishing more recently and know who the emerging authors are, as well as the topics they are addressing.

Figure 5.

Bibliometric map of citation relationships



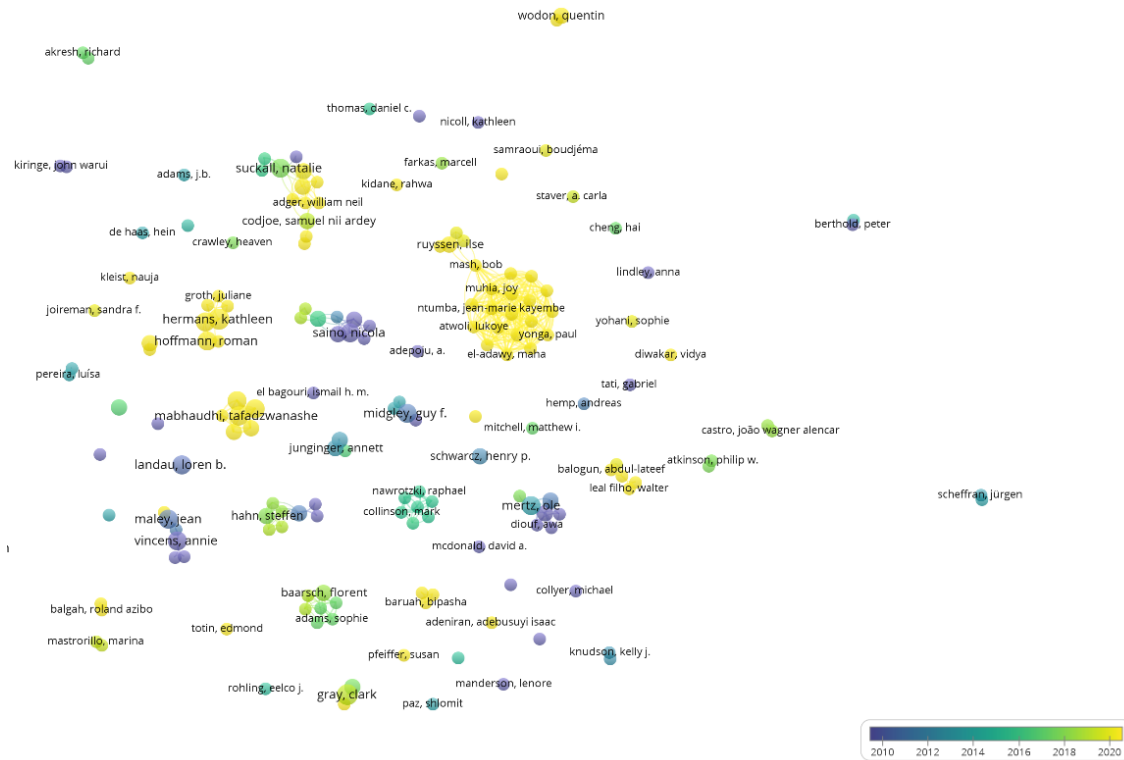
Source: Own elaboration using Vosviewer (2024).

In this case, Figure 6, with clusters in yellow and lighter green, shows the groups of researchers who are currently publishing. The publications of these authors indicate that the most emergent and currently addressed topics are related to rural migration due to land degradation, internal displacement due to climate-related issues, migration due to conflicts caused by resource scarcity, the interconnections and relationships of various factors and

perspectives in migration, and the relationship between climate change, conflicts, and migration.

Figure 6.

Bibliometric map of citation relationships distributed by years.



Source: Own elaboration using Vosviewer (2024).

4. Discussion: analysis and report (phase 5)

The relationship between climate change, migration, conflict, and security has been under study for many years, as demonstrated by the selection of articles in the literature review. The International Organization for Migration (IOM) has aimed to prioritize environmental migration at international, regional, and national levels in cooperation with its Member States, observers, and partners (IOM, 2018). Since 2015, IOM established the Migration, Environment, and Climate Change (MECC) division to focus on preventing forced migration due to environmental factors, providing aid and protection to affected populations, facilitating migration as a climate change adaptation strategy, and enhancing the resilience of affected communities (Black et al., 2011). While the relationship between climate change and migration is increasingly evident, the connection between climate change and violent conflict is more complex. Climate change-related security issues have multiple dimensions, affecting the security of individuals, societies, and states. For instance, the potential impact of climate change on water or food security can influence social and political contexts, potentially leading to more violent conflicts over resource availability (Marquina, 2010).

The situation in the Horn of Africa is particularly unique. Despite recent research focusing on climate-related migrations, the region's conflict, presence of terrorist groups, extreme poverty, and insecurity are the primary drivers of migration, with climate change serving as just one additional factor. Furthermore, the region is a global strategic hub between the Red Sea, the

Gulf of Aden, and the Indian Ocean, positioning it as a center of world geopolitics, which explains, among other things, the presence of terrorist groups like Al-Shabaab (an Al-Qaeda affiliate) seeking to gain power and control over the area (Kamau, 2021).

According to most studies reviewed, the Horn of Africa emerges as one of the global epicentres most impacted by climate change, facing significant climate transformations expected to intensify in the coming years (IGAD, 2018). The region is immersed in a reality marked by climate change, making it particularly susceptible to climate impacts. This vulnerability is due to its heavy reliance on livelihoods highly sensitive to these variations, coupled with its limited capacity to adapt to these climate effects (Abdul-Razak, 2017). According to the Intergovernmental Panel on Climate Change (IPCC), low-income communities depend on climate-sensitive resources, yet they have limited adaptive capacity (IPCC, 2023).

Average precipitation has decreased in both the dry season (June to September) and the rainy season (March to June) (Lindvall et al., 2020). Precipitation is vital for rain-fed agriculture, which supports 80% of the Horn of Africa's population (Alemayehu, & Bewket, 2017). Additionally, temperatures have risen progressively over the last five decades, increasing extreme heat events. This not only affects water availability but also challenges agricultural sustainability and community resilience to climate changes (Hermans, & Garbe, 2019).

In 2011, the area experienced a severe drought that had been preceded by periods of serious flooding. The year 2011 was considered the driest in decades and triggered a food crisis and high levels of food insecurity, leading to the declaration of a famine by the United Nations that same year (Achour, & Lacan, 2011). The number of people requiring food assistance rose to 12.4 million in Djibouti, Ethiopia, Kenya, Somalia, and Uganda (Op. Cit., 2011). This crisis resulted in a complex pattern of migratory movements. Migration was already a characteristic of the region before the drought; however, the drought exacerbated displacement and movement triggered by conflict and instability (IOM, 2011). The drought emerged as an additional factor driving migration in a context where migration represented the only form of security for the population (Thiollet, 2009).

Similar to the situation in 2011, over 43 million people required humanitarian assistance in Ethiopia, Kenya, and Somalia in 2023 due to the severe drought between 2020 and 2023 (UNFPA, 2023). The outlook for subsequent years does not appear to be improving. According to the ND-GAIN Country Index developed by the University of Notre Dame, the Horn of Africa region is one of the most vulnerable to climate change effects. This index measures a country's vulnerability to climate change and other global challenges, along with their preparedness and resilience capacity. Countries with higher scores are better prepared and less vulnerable, while those with lower scores indicate the opposite (ND-GAIN, 2023).

The HoA region includes several countries that rank at the lower end of this index, indicating the worst outcomes regarding climate change vulnerability. To assess vulnerability, six factors are considered: health status, food security and dietary patterns, availability and quality of water, infrastructure, habitat, and ecosystems. Readiness level is measured by economic readiness, governance readiness, and social readiness. Following these criteria, the results are shown in Table 2.

Table 2.

Ranking of Horn of Africa countries based on the ND-GAIN Country Index.

Rank	Country	Score
130	Djibouti	43,6
150	Kenya	39,6
163	Ethiopia	37,5
173	Uganda	35,1
178	Somalia	33,8
179	Sudan	32,8
183	Eritrea	30,8

Source: Own elaboration with ND-GAIN Country Index data (2024).

Out of the total number of countries listed in the ND-GAIN Index (185), the country with the highest ranking has a score of 75 points (Norway); however, the countries included in this research are among the lowest ranks on the table. Several countries in the Horn of Africa are among the bottom 20 countries with the worst data, indicating that they are more vulnerable to climate effects and have lower capacity for adaptation and mitigation of these effects.

This climate risk situation is leading to severe food insecurity, resulting in famine conditions in various parts of the territory; by the end of 2021, more than 18 million people were in this situation (Delgado et al., 2023). Moreover, the region contends with violent conflicts involving rebels and government forces, notably in Somalia, South Sudan, Tigray in Ethiopia, and Darfur in Sudan. Maritime piracy persists despite recent declines, alongside the significant presence of terrorist groups like Al Shabaab, particularly in southern Somalia (Hoch et al., 2021).

Therefore, as previously mentioned, all these factors are leading to migratory movements in the region that are defined by specific characteristics:

Firstly, the majority of these individuals are Internally Displaced Persons (IDPs), as defined by the IOM, who are compelled to flee their homes due to armed conflict, violence, human rights violations, or disasters, without crossing an internationally recognized border (IOM, 2011). The reasons for these displacements include the violence from conflicts and disasters. Between 2018 and 2022, conflicts caused 12.8 million IDPs across the eight countries studied, while disasters displaced 2 million people during the same period. In both cases, the number of IDPs has increased over the years (data from the Internal Displacement Monitoring Centre). The number of internally displaced people in the area could be a valuable topic for future research, providing insights into the region's situation and the factors driving migration.

Secondly, migration from rural to urban areas occurs due to the loss of livelihoods in societies primarily dependent on livestock and agriculture. The difficulty in accessing natural resources and the resulting conflicts drive pastoral communities to migrate to urban areas (Black et al., 2008). The phenomenon of rural-urban migration, which has been studied for years, continues to grow in importance. Sometimes these migrations are temporary, with individuals moving between rural areas or to urban areas with the expectation of eventually returning. This is often due to the lack of infrastructure in urban areas, making permanent settlement challenging (Griffith et al., 2023).

Thirdly, cross-border movements mainly occur to neighboring countries, most migrants head to countries adjacent to their own facilitated by porous borders and, in many cases, the lack of border legitimacy. Like the previous case, many movements are circular, intended for temporary agricultural work or livestock-related activities in search of pasture. Another scenario arises when migration is primarily motivated by conflict and insecurity; in such cases, return rarely occurs, and individuals mainly remain as refugees in one of the neighboring countries (Gebrewold, & Bloom, 2016).

Lastly, it is important to consider the issue of trapped populations; given the levels of famine, insecurity, and violence in the area, there could be a significant number of trapped populations, who, furthermore, would be among the most vulnerable groups without even the option to migrate. However, this topic has received little attention in the analyzed literature and should undoubtedly be considered a critical issue.

5. Conclusion and future research directions

The data extracted from the literature review demonstrates that the issue of environmental migration is relatively new and will gain importance in the coming years, considering the variety of existing data on the number of displaced people in the next decades due to climatological issues (Gray, 2016).

In the Horn of Africa, one of the world's regions with the worst economic data and unfavorable climatological conditions (Afifi, 2012), there is ongoing debate about the importance of environmental migration versus migration driven by other factors. The numerous factors influencing migration decisions in this area make it difficult to categorize migrations definitively, as they involve a complex interplay of various elements.

According to Renaud et al. (2007) in their book "*Control, adapt or flee: how to face environmental migration?*" we could distinguish between: migrants of environmental emergency (those who flee from the worst of an environmental impact permanently or temporarily), forced environmental migrants (those who leave to avoid the worst of a slower environmental deterioration), and environmentally motivated migrants (those who leave a place that is deteriorating environmentally progressively to prevent more severe impacts such as loss of livelihoods or lack of natural resources). Based on these definitions and the regional context, it can be concluded that in the HoA, the interplay of social, political, demographic, and economic factors alongside climate change determines the extent to which climatic stress triggers migration and its dynamics.

In conclusion, migration is influenced by a complex set of variables at domestic, local, and macro levels, with climate change adding to existing issues like conflict, violence, and food insecurity. Even during extreme events like floods, fires, or droughts, migration is shaped by governmental responses, available migration avenues, and internal coping mechanisms. Thus, it is not solely driven by environmental factors but is intertwined with multiple other elements.

Concluding a direct relationship between climate change and migration is challenging due to the influence of non-environmental, political, and socio-economic factors such as population growth, unsustainable development, state capacity, weak governance, poor economies, inequalities, cultural clashes, and conflict patterns. In Kenya, while environmental factors are significant in analyzing rural-to-urban migration, they do not fully explain it. In Somalia, Djibouti, or Uganda, environmental stress must be considered alongside economic and social factors, such as soil degradation and poor harvests, which lead to food insecurity and

humanitarian crises. Additionally, in Somalia, Sudan, Eritrea, or Ethiopia, migrations must be viewed in the context of conflict and insecurity, including the presence of terrorist groups like Al Shabaab, which exacerbates instability by controlling significant areas of territory (Hermans et al., 2023).

Furthermore, even with various types of migrations, rural-to-urban migration is prominent. In predominantly agricultural and livestock communities, the loss of livelihoods forces people to move to cities in search of new means of living. Additionally, temporary migration is notable, where part of the family, usually young males, temporarily moves to neighboring countries or nearby areas to cope with drought periods and ensure family survival. Remittances become crucial in this context, as entire families rely on them during the most challenging periods due to lack of resources (Mueller et al., 2020).

This type of migratory movement opens a debate within the literature on whether migration should be viewed as an adaptive or maladaptive strategy. Traditionally, pastoral societies have migrated based on environmental phenomena to ensure their survival (Fulton, & Nickels, 2017). However, some argue that adaptive migration depends on socio-political and economic factors, often constrained by power dynamics. These dynamics result in "trapped" populations, unable to migrate due to resource scarcity, limited alternatives, and geographic constraints, thereby exacerbating vulnerability amidst humanitarian crises without recourse to adaptation through migration (Eriksen et al., 2015).

A third pillar of significant importance in the research is conflicts. There is concern that climate change and its effects may lead to increased violence and conflict in the future. Existing research suggests that conflicts are primarily the result of social, political, or economic tensions among groups, but these may be exacerbated by environmental problems in the coming decades (Das, 2013). Among authors addressing this topic, there is often a consensus that climate change will lead to more common forms of conflict rather than traditional wars. The challenge for future research is to find reliable data on low-level conflicts, such as those caused by water scarcity or cattle theft. Furthermore, climate change in the Horn of Africa requires not only mitigation efforts but also adaptation. As highlighted in the literature on sustainability education, adaptation is crucial in the transition towards a more resilient and sustainable society (Díaz-Cuevas et al., 2021). Adaptive strategies must be implemented at various scales, from adapting educational curricula to public policies that directly address the needs of communities affected by climate change.

In summary, there is a growing consensus that environmental factors in migration and climate conflict are secondary to social, political, and economic conditions. It may be valuable to examine environmental factors in the broader context of migration and conflict, achieving a closer proximity between climate change, migration, and conflict, thus bringing together the three pillars in a single investigation.

The literature review highlights the complex migratory trends in the Horn of Africa, with climate change being a key factor. However, future research should also consider conflict, terrorist groups, climatological disasters, and governance deficiencies as influential elements. There is little discussion about resilience and mitigation, raising the question of their feasibility in an area with high insecurity, unstable governments, and food insecurity. Additionally, it is necessary to explore whether mitigating the effects of climate change could reduce conflict. To address this, the role of governance and strong states in managing the impacts of climate change needs to be investigated. It is necessary to examine the economic and labor factors driving migration, including cross-border labor movements in both origin and destination economies. Introducing the time factor allows for tracking migrants who leave due to

environmental reasons and comparing their situations before and after migration. Future research should also address migratory policies in the Horn of Africa, analyzing how these policies meet migrants' needs and their potential for development.

Finally, future research must address several challenges. First, the serious deficit in population census records makes it difficult to know the true number of people who have left or moved within the country. Second, the lack of border infrastructure hinders data tracking. Third, the informal organization at both state and social levels makes compiling reliable statistics difficult. Fourth, an area with significant internal displacements has little control over these movements, which could provide insights into migration reasons. Lastly, the difficulty in differentiating causes and the absence of statistics blend migrant populations with refugees, complicating the tracking of both groups.

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