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The Great Amplifier? Climate Change, Irregular Migration, and the Missing Links in EU Responses

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Abstract: This article examines the complex relationship between climate change and migration in Africa, with a specific focus on Senegal—a West African nation increasingly vulnerable to climate threats such as drought, rising sea levels, floods, and salinisation. As a significant origin country for irregular migration to the European Union (EU), Senegal presents a compelling case study to explore how extreme climatic conditions interact with other migration drivers. This article does not aim to quantify or measure the extent to which climatic factors and variability contributed to migration decisions. Instead, building on original empirical material, it seeks to map and explore how climate variability interacts with other migration drivers, either by amplifying them or acting in synergy with them, thereby offering a fresh perspective of the complex dynamics at play. Additionally, this article investigates the extent to which the EU addresses and integrates climate considerations into its policy responses to address migratory flows and people's vulnerability in countries of origin. This analysis reveals that the integration of climate factors as an amplifier and a synergist is a 'missing link' in the EU approach in the case of Senegal, with significant implications in terms of the effectiveness and long-term sustainability of EU action.

Keywords: Senegal; climate change; EU; migration

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1. Introduction

In 2023, the number of irregular border crossings into the European Union (EU) surged to its highest level since 2016, with most people arriving from North and Sub-Saharan Africa via the central and western Mediterranean routes.[1] This new surge of irregular migrants to the EU, following the migratory waves of 2011 and 2015, sparks renewed interest in understanding migration causes, including environmental challenges and climate change (Panebianco 2022, p. 146). While economic and political factors are widely recognised as the primary drivers of these movements (Talani 2021; Giménez-Gómez et al. 2019; Attinà 2016; Naudé 2010), questions remain about whether these migratory flows have been exacerbated by climate change and extreme weather events, and what role such conditions play in influencing migration decisions and fostering international migration to Europe.

Although quantitative measurements, data, and statistics on climate-induced migration continue to be a matter of debate (Findlay 2011; Czaika and Münz 2022), there is a growing scholarly consensus that climate change and weather events trigger mobility (Czaika and Münz 2022; Perch-Nielsen et al. 2008). However, while the link between sudden 'shock' events, natural disasters, and migration is widely recognised (Moawad 2024), the effects of slow-onset changes on mobility, as well as their impact on, and interaction with, existing migration drivers remain more contentious. Additionally, although the relationship between extreme weather conditions and internal migration has been widely explored (see, among others, Ofori et al. 2023; Burzyński et al. 2022; Mastrorillo et al. 2016; Abu et al. 2014), debates surrounding the role of climate change in international migration remain unresolved. This underscores the need for advancing conceptual and empirical research to better understand the complex interplay between climate change and other migration drivers.

The goal of this article is twofold. First, it aims to investigate this intricate relationship in Africa, providing a mapping and exploration of how shifting climate conditions, such as drought, rising sea levels, floods, and salinisation, are intricately intertwined with political, economic, cultural, and social drivers of migration. This article argues that climate change and the resulting extreme weather conditions interact with other push factors in a variety of ways, either as a 'great amplifier' or as a 'synergist', complicating existing socio-economic and political challenges and potentially contributing to reshaping migration patterns toward the EU. This analysis focuses on the case study of Senegal as a West African country which has experienced increasing climate vulnerability in recent years, and has also emerged as one of the primary countries of origin for irregular flows to the EU. This article does not attempt to quantify or measure the extent to which climatic factors and variability influence migration decisions. Rather, through the case of Senegal and building on original empirical material, it seeks to map and examine how climate variability interacts with other migration drivers, either by amplifying their effects or working in tandem with them, thus providing a fresh perspective on the complex dynamics involved. In doing so, this article responds to calls for models that do not limit the analysis solely to climatic hazards but embed climatic factors within a multi-causal approach (Faye et al. 2019). It thus contributes to enrich the academic debates on the convoluted linkages and interactions between various manifestations of climatic and environmental change and the broader structural determinants of international and internal mobility (Czaika and Münz 2022, p. 24; Black et al. 2011).

Second, this article delves into the pitfalls and implications of EU migration policies in dealing with climate change as an amplifier and synergist in a convoluted interplay with other migration factors. While the role of climatic factors and their interaction with other drivers in influencing migration decisions is often overlooked in policy documents (Van Praag et al. 2022), understanding these subtle linkages and their development impacts is crucial (Martin et al. 2014). Therefore, this article investigates the extent to which the EU addresses and integrates climate considerations into its policy responses to address migratory flows and people's vulnerability in countries of origin. This analysis reveals that the integration of climate factors as an amplifier and a synergist is a 'missing link' in the EU approach in the case of Senegal, with significant implications in terms of the effectiveness and long-term sustainability of EU action. In this sense, by incorporating the views of various stakeholders on the ground through original data, this article provides novel insights into the practical challenges and gaps in current EU strategies.

This article is organised as follows. The first part reviews the literature on how climate change and extreme weather conditions interact with other migration drivers. It then proposes a dual-role framework that synthesises the roles of climate change as both an amplifier and a synergist. The second part illustrates the methodology while the third section applies the framework to the case study of Senegal. Finally, the last part of this article investigates the pitfalls and implications of EU policy responses in dealing with climatic factors and migration in the country.

2. Climate Change, Extreme Weather Conditions, and the Interaction with Other Migration Drivers

In exploring the role of climate change and extreme weather conditions as causes of migration, this article begins with the understanding that migration is a complex multi-causal process, and that the fundamental drivers of migration do not work in isolation but are rather intertwined, interacting in numerous ways through various interlinkages (Czaika and Münz 2022; Czaika and Reinprecht 2020; Black et al. 2011). Climate change is thus only a factor among several others that trigger and shape migration dynamics, mixing and combining with other social, economic, political, demographic, and cultural causes (Khavarian-Garmsir et al. 2019; Martin et al. 2014; Piguet et al. 2011). In this sense, identifying individuals who migrate only due to environmental drivers is difficult, as migration is

rarely attributable solely to climate factors and is the product of several converging causes (Borderon et al. 2019; Abu et al. 2014, p. 347; Piguet et al. 2011).

An extensive body of literature has attempted to unravel the intricate relationship between climate factors and other migration drivers. Most scholars agree that the role of climate change is through consequences on economic factors, in terms of an 'environmentally induced economic migration' (Afifi 2011). Extreme climatic conditions alter people's economic survival, shrink livelihood opportunities, and create a more volatile income that in turn affects individuals' incentives to migrate (Czaika and Münz 2022; Khavarian-Garmsir et al. 2019; Beine and Parsons 2015). This is particularly evident in rural areas, where environmental risks like drought and rainfall variability adversely impact agricultural productivity, reducing crop yields and livestock numbers while driving down rural wages (Abu et al. 2014; Di Falco et al. 2012; Black et al. 2011). Similarly, disruptions to rivers and seas affecting fishing communities reduce fish stocks and deteriorate livelihood (Afifi 2011). This contributes to a push for rural–urban migration initially, potentially followed by international migration (Coniglio and Pesce 2015; Marchiori et al. 2012). While acknowledging that the relationship between climate change and migration is not deterministic but is influenced by the vulnerability of specific populations, Perch-Nielsen et al. (2008) make the effort to trace the causal links between climate-related conditions and migration. Through a conceptual model, they show how climate change can lead to intense precipitation events that result in flooding, directly damaging crops and livestock. Indirect effects include land loss, reduced food availability, fewer job opportunities, and overall lower income, which increase vulnerability and may prompt migration as an adaptive strategy. The model also highlights the role of climate change in causing sea level rise, which directly results in erosion, inundation, land loss, and saltwater intrusion. These effects indirectly reduce agricultural production, limit water availability for crops, damage infrastructure, and lower incomes, potentially leading to migration. The influence of climate change may also extend beyond economic impacts. For instance, it can affect and deepen governance challenges by creating new sources of tension and violence, particularly where governments lack the capacity to effectively mediate disputes and manage resources (Hsiang et al. 2013; Abel et al. 2019; Brzoska and Fröhlich 2016; Raleigh 2010). As climate factors exacerbate resource scarcity, competition over water, arable land, and fishing rights can escalate leading to conflicts between social groups, producing social unrest and instability, and in turn driving displacement and outmigration (Brottem 2021; Abel et al. 2019; Reuveny 2008).

Moreover, as migration is a multicausal process, climatic factors interact and intersect with other political, social, cultural, and demographic factors (Van Praag et al. 2022; Cattaneo et al. 2019; Black et al. 2011). In this regard, they can be compounded by cultural expectations such as the idealisation of international migration as a pathway to economic success and a better life (Tacoli 2011); or by social factors such as frustration among youth of limited voice and access to family and community resources necessary for an adequate life (Faye et al. 2019); or by family networks and social ties that can influence the decision to move, as well as the inherent migration patterns and destinations (Doevenspeck 2011; Black et al. 2011). The effects of extreme weather conditions can also interact with demographic factors such as high population growth and density, both straining resource access (Warner et al. 2010); or may combine with technical factors such as inadequate farming techniques and outdated agricultural practices that can exacerbate the situation and increase migration pressures (Dreier and Sow 2015; Rademacher-Schulz et al. 2013). Finally, as migration always involves individual agency mediated by social norms, traditions and cultural backgrounds, environmental beliefs, educational levels, and perception of climate threats affect migration decisions (Martin et al. 2014; Van der Land and Hummel 2013).

Disentangling the Interplay: Climate Change as an 'Amplifier' and a 'Synergist'

This brief review of the literature reveals a scholarly consensus that exploring the linkages between climate change and human mobility requires an understanding of the

intricate interactions among migration drivers (Abel et al. 2019, p. 241), as well as the need to examine not only whether climate influences migration but also how it does so (Cattaneo et al. 2019). However, while it is widely acknowledged that climatic events interact with other migration drivers, and some models were developed in this regard (e.g., Black et al. 2011; Parrish et al. 2023), there has been little effort to conceptualise *the type* of these interactions and the specific roles that climate events can assume.

Some scholars address climate change as *affecting* other drivers (Parrish et al. 2023; Hummel 2016; Black et al. 2011); others argue that the relationship between climate change and migration is indirect and *mediated* by other socio-political, economic, or cultural factors (Czaika and Münz 2022; Cattaneo et al. 2019; Brzoska and Fröhlich 2016; Van der Land and Hummel 2013; Piguet et al. 2011); others stress that climate change *adds* to and compounds existing vulnerabilities (Khavarian-Garmsir et al. 2019; Cattaneo et al. 2019; Uddin 2013). Scholars variously describe climate events as an 'accelerant' of existing drivers (Huber et al. 2023); as a 'stressor' (Hummel 2016; Abu et al. 2014; Warner et al. 2010) that brings strains to individuals motivating them to consider migration (Koubi et al. 2016; Banerjee et al. 2013); as a 'threat multiplier' (Goodman and Baudu 2023; Dodson et al. 2020; Nett and Rüttinger 2016; Huntjens and Nachbar 2015); or as something that 'exacerbate' existing push factors (Huntjens and Nachbar 2015; Abu et al. 2014; Warner et al. 2010).

These terms suggest that climate change has an impact on migration, speeding up existing processes ('accelerant'), providing additional pressure ('stressor'), or increasing the severity of existing threats ('multiplier'). However, these terms often overlap and are sometimes used interchangeably, leading to ambiguity in understanding the types of interaction among migration drivers and the distinct roles that climate change can play.

Building upon existing scholarly discussions and in an endeavour to synthetise key findings from the literature, I propose a dual role for climate change in its interaction with other migration drivers: as an 'amplifier' and as a 'synergist'. The terms 'amplifier' and 'synergist' are intended to encompass the range of situations described by the other terms while providing a more integrated understanding of how climate change and other migration drivers interact. By doing so, they offer an original comprehensive framework that helps categorise two main forms of interaction and the multifaceted role of climate change in that regard.

For climate change and related climatic events, this article refers to those extreme weather conditions, including drought, rainfall variability, sea-level rise, salinisation, and flooding, that are induced by climate change.[2] The impact of these conditions varies depending on the context and on how they intertwine with other political, economic, social, cultural, or other types of factors, including people's motivations and agency.

More specifically, as an amplifier, climate change affects and impinges upon other migration drivers in the sense of *amplifying and intensifying their effects*, thereby making people more vulnerable. This is in line with those scholarly insights that highlight how climatic conditions can have consequences on economic factors, exacerbating and worsening economic vulnerabilities, with prolonged drought, salinisation, floods, or higher sea temperatures impacting agriculture productivity and fish stocks and resulting in reduced employment opportunities and volatile income. Similarly, this aligns with the already-mentioned insights that emphasise how climate change can affect resource scarcity and contribute to social and political unrest, impinging upon political factors.

Alongside its role as an amplifier, climate change also interacts with other drivers as a synergist, when climatic events do not impinge upon other drivers but *operate in tandem with them*. In this case, climatic events are an additional burden (Piguet et al. 2011) that adds to and complements other political, demographic, economic factors, and social tensions, thereby working concurrently with them. This aligns with scholarly insights that underline the importance of considering climatic events within the broader social, political, and economic context, recognizing the multiplicity of conditions shaping people's vulnerability and decisions to move (Faye et al. 2019). As already stressed in the previous paragraph, studies highlight how climate change compounds with socio-cultural dynamics such as

family networks, sense of hopelessness, or cultural aspirations to migrate, demographic factors, lack of or inadequate technical means, global inequality structures (Faist and Schade 2013) or political instability, and food prices (Jónsson 2010). The synergistic role of climate change means that it adds an additional layer of complexity and burden to conditions already potentially set to influence migration decisions. Given the multicausal and complex nature of migration, climate conditions are likely to always embody both roles as an amplifier and a synergist. They amplify certain vulnerabilities while simultaneously interacting with and adding to a complex network of other social, economic, political, and technical factors. Together, these interactions contribute to migration through multiple overlapping pathways.

The dual-role framework is illustrated in Figure 1. The framework does not aim to be exhaustive,[3] but it represents an effort to reduce the complexity surrounding the links between climate events and migration drivers. Drawing on insights from existing literature, it aims to simplify our understanding by categorizing the distinct and yet complementary roles climate change can play in influencing migration dynamics.

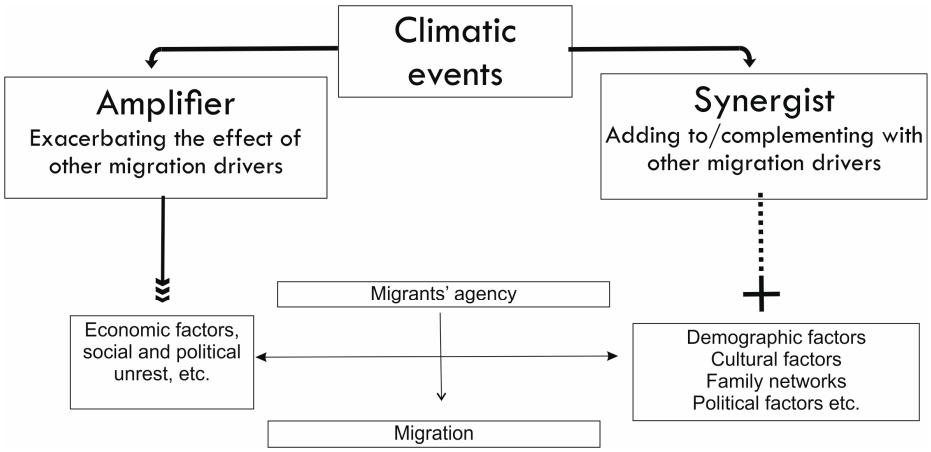

Figure 1. The interaction of climate change and related climate events with other migration drivers. Source: Author's elaboration.

3. Methodology

To investigate the interplay of climate change, migration drivers and motivations, this study utilises original empirical material focusing on the case of Senegal. This West Sub-Saharan country exhibits a significant climate vulnerability, ranking 149 out of 185 on the ND-GAIN Country Index.[4] Moreover, it has emerged as a key country of origin for migratory flows to the EU, recording a significant increase in irregular arrivals after 2022. A year-on-year comparison between January 2023 and January 2024 reveals a dramatic 400% rise in the number of arrivals.[5] While the Atlantic Route to Spain and the Canary Islands has been active for boat migration since 2006 (IOM 2023), in recent years, migrants of Senegalese nationality have also increasingly taken the central Mediterranean route.[6] In 2023, they became the third largest nationality among the top 10 nationalities of arrivals to Europe, with over 23,430 arrivals.[7] The country is thus an intriguing case for engaging in a reflection on the drivers and push factors of migration, and exploring how these may intertwine with climate change as an amplifier or synergist.

The methodology employed combines desk research, including documentary analysis, with in-depth interviews and direct observation to gather primary data for qualitative analysis. Overall, 63 semi-structured interviews and 1 focus group (14 interviews) were conducted with a variety of actors, including return migrants, local communities, governmental institutions, representatives from international organisations assisting migrants, non-governmental organisations on the ground, and experts and academics with relevant expertise in the field. This approach provided a diverse range of perspectives from various actors across different parts of the country, enabling a more comprehensive and objective

understanding of the phenomenon being studied (Pires 1997, p. 65). The interviews served two main purposes. First, they enabled a more profound comprehension of migration push factors and the role of climate change, capturing the dynamics of shifting climate conditions and their potential impacts on human mobility in conjunction with other drivers. Additionally, they explored development challenges associated with addressing the root causes of migration, identifying obstacles related to the implementation of projects designed to mitigate migration drivers and reduce people's vulnerability, as well as issues concerning the effectiveness and sustainability of these initiatives.

The interviews were conducted using a semi-structured topic guide tailored to the specific type of actor being interviewed. For local communities, including potential and return migrants, the interviews began by identifying the socio-economic background, followed by an open discussion on local challenges affecting living conditions, including climate change. To mitigate methodological challenges and biases,[8] climate change was approached by breaking it down into different climatic conditions (drought, coastal erosion, rainfall variability, etc.), and participants were asked to identify the impact of each condition, if any, on their livelihoods. The second part of the structured interview focused on migration, asking about the key factors shaping migration in their communities and whether extreme weather conditions and their impact on livelihoods were a cause of migration. The interviews also delved into personal migration stories, intentions, and actions being implemented by international donors. For NGOs, the questions aimed to explore the local challenges to livelihoods in the areas where each specific NGO was working. They also investigated whether different climatic conditions were among these challenges and how they affected local livelihoods. Additionally, the interviews sought to identify the factors contributing to migration patterns in the area of intervention, the role of extreme weather conditions in shaping these patterns, and the inherent adaptation strategies. Further inquiries focused on the pitfalls and difficulties of implementing projects addressing root causes, people's vulnerability, and migrants' reintegration on the ground, as well as whether extreme weather conditions ever posed challenges for the implementation and sustainability of these projects. For institutional actors, the approach was similar but covered a broader level of governance, addressing the entire country and including discussions on climate adaptation and migration policies. Additional interviews were carried out with experts and academics to complement the qualitative data collection and gather further insights on the mechanisms through which climate change impacts migration and the interaction of climatic factors to other migration drivers. For a detailed list of the actors interviewed, their characteristics, and locations, see Table 1 and Figure 2.

Table 1. List of interviewed actors. Source: Author's elaboration.

	Total Interviewed	Dakar			St. Louis		Matam	Louga	Thiès		Casamance		Fatick	Tambacounda
		Dakar	Yoff	Thiaroye-Sur-mer	St. Louis	Podor	Matam/Mid-Valley	Louga	Thiès	Niayes	Ziguinchor	Sédhiou		
NGOs	24	8		1	2	1	1	3	2	1	3	1	1	
Institutions	8	3		1	1		1	2						
Experts	8	4			1		1			1			1	
Local Communities (potential and returned migrants)	37		14 (focus group)	12										11
Gender (F/M)			5/11	3/9										3/8
Age variation in years			18–45	18–65										18–35

Data were collected as part of the research project titled 'Climate Change and Forced Migratory Flows: an Analysis and Assessment of the Impact of Changes to Ecosystems on Human Mobility', funded by the European Union, the Italian Ministry of University and Research, and the University of Catania. Fieldwork was carried out over a three-month period in Senegal, from February to May 2023. A second round of online interviews were conducted in April–May 2024.

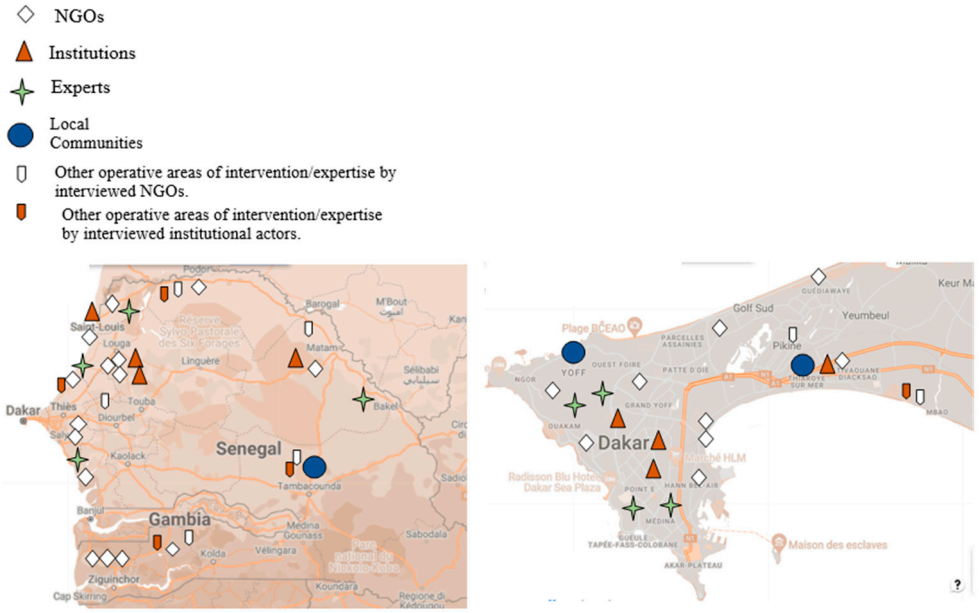

Figure 2. Map of interviewed actors. Source: Author's elaboration.

As already stated in the Introduction, this article does not aim to quantify or measure the degree to which climatic factors and variability contributed to migration decisions, nor does it aspire to provide an exhaustive overview of push factors. Instead, using the collected original empirical material, it seeks to map and explore how climate variability interacts with other migration drivers, either by amplifying them or acting in synergy with them. The next section applies the dual-role framework to the case of Senegal. Building upon the original data collection mentioned above, it illustrates the role of climatic factors as an amplifier and a synergist that complicate and add to other existing factors.

4. Mapping Migration Drivers and Their Interaction with Climate Change: The Case of Senegal

4.1. Climate Factors as an Amplifier of Economic Migration Drivers

All the interviews conducted across a variety of actors and in different parts of the country consistently highlighted that economic factors, particularly the lack of employment opportunities and economic prospects, especially for youth, are among the key drivers of irregular migration from Senegal. This observation is supported by recent data, which reveal that more than 50% of the Senegalese population is composed of young people under 19 years old (ANSD 2023a) and that youth unemployment has increasingly become a major issue.[9] To some, this is like a 'social bomb' poised to trigger even more migration in the future (Interview 2). However, interestingly, while there is consensus among interviewees on the significant role of economic drivers, 90%[10] also acknowledge the importance of climatic factors as a 'new reality' (Interview 2), an 'additional factor' (Interview 5), and a 'relevant dynamic' (Interview 16) that is increasingly exacerbating economic challenges (Interviews 14–27, 35; 33; 5; 40–49), acting as an 'amplifier' of internal and international mobility (Interviews 14; 40), respectively, from the countryside to the capital Dakar and to Europe (Interviews 23, 26).

Fishermen and farmers are identified as the most vulnerable categories. Regarding fishermen, scholarly analyses through specific case studies in the northern part of the country and the area of St. Louis have shown that while fishing initially became an alternative activity for farmers and herders affected by the drought waves that impacted the country during the 1970s and 1980s, climatic factors are now contributing to crippling the economy of artisanal fishing (Abdoulaye Alassane and Abdoulaye 2022; Zickgraf 2018). Interviews across the country confirmed these findings, indicating, however, that this is a widespread phenomenon affecting the entire coastal area from north to south and not limited to specific

zones. Respondents stressed three major dynamics related to shifting climate conditions at sea: a dramatic rarity of fish, a loss of diversity with species changing their routes away from Senegalese coasts, and increasingly smaller fish.[11] In-depth interviews with the local community in the small fishing village of Thiaroy-sur-Mer, on the periphery of Dakar, suggested that fishing has become significantly more difficult over the last 20 years. As one fisherman noted, 'in 2004–2005, it was enough to go just 5 km away from the coast, you would catch a lot of fish and go back. Now, you can even go 50 km away and spend the entire night at sea, coming back with nothing in your hand' (Interview 7). Village officials suggested higher sea water salinisation and temperature among key factors (Interviews 5A; 5B). This observation is supported by recent studies indicating that rising surface water temperatures and ocean acidification alter species' reproduction and migration, thereby affecting biodiversity (USAID 2023; Ndoye et al. 2018; Sylla et al. 2019).[12]

In this context, 'climatic anomalies at sea have aggravated an already worrying situation' (Interview 19). Climatic factors have amplified economic vulnerability not only through reduced economic opportunities and livelihoods for fishermen, making fishing no longer sufficiently remunerative, but also by contributing to the phenomenon of 'chômage technique' or technical unemployment among fishing operators. As suggested by local institutions in Thiaroy-sur-Mer,

> 'A fisherman can go to sea today and not earn enough even to pay for fuel or the fishing license. He may wait one or two days before going back to sea, and if he doesn't have the fuel, he is stuck on land, only bearing costs. This is what we call the technical unemployment of our fishermen.'. (Interview 5A)

A significant consequence is that young men are increasingly induced to seek better opportunities elsewhere by taking the pirogues to migrate irregularly or to transport other migrants (Interviews 2, 40, 5, 19, 1, 13, 14, 47), leveraging their expertise in navigating a pirogue and knowing the routes: 'They know when to leave, when the sea is dangerous, and when it is not. They master all these aspects. Therefore, they are more inclined to attempt irregular migration' (Interview 28). Testimonies by returned migrants[13] in Thiaory further underscore the severe impact of declining fish stocks on their livelihoods, compelling many to consider new migration attempts as their only viable option: 'I decided to leave as I was paying for the [fishing] license in vain, without catching anything' (Interview 10); 'I left and tried to migrate twice, due to the dramatic fishing crisis I cannot take care of my family. I am now planning try [to migrate] again' (Interview 4).

The role of climatic factors in amplifying economic vulnerability is not exclusive to Thiaroy-sur-Mer but a pervasive issue affecting the entire coastline of Senegal, with respondents from the north to the south of the country emphasizing the widespread nature of this phenomenon. In the northern region of Saint Louis, a representative of the Regional Development Agency (RDA) identified fishing problems as a 'significant root cause' of out-migration from the region: 'according to a study on returned migrants that we conducted last year in our region, 74% of those in the area of St. Louis are fishermen. The rarity of fish is pushing more and more people toward migration (Interview 30). Similarly, respondents operating in the areas of Thiès and Fatick stressed the same phenomenon (Interviews 34, 40, 37), that of involving young men 'as one of most vulnerable categories' (Interview 23) or the 'first candidates' (Interview 44) to irregular migration. In the area of Dakar, according to the data provided by the local representative of the RDA, 'most return migrants are fishermen' (Interview 28). Finally, in the southern areas of Zighuinchor, they were also identified by NGOs operating in the region as a 'prominent target' (Interview 31) and a 'key actor' of irregular migration' (Interview 33), with 'a big number of departures witnessed every month' (Interview 48). The data collected by the International Organization for Migration (IOM) on the main regions of departure for pirogues during the summer months of 2023 further suggest the widespread nature of the phenomenon (Figure 3).

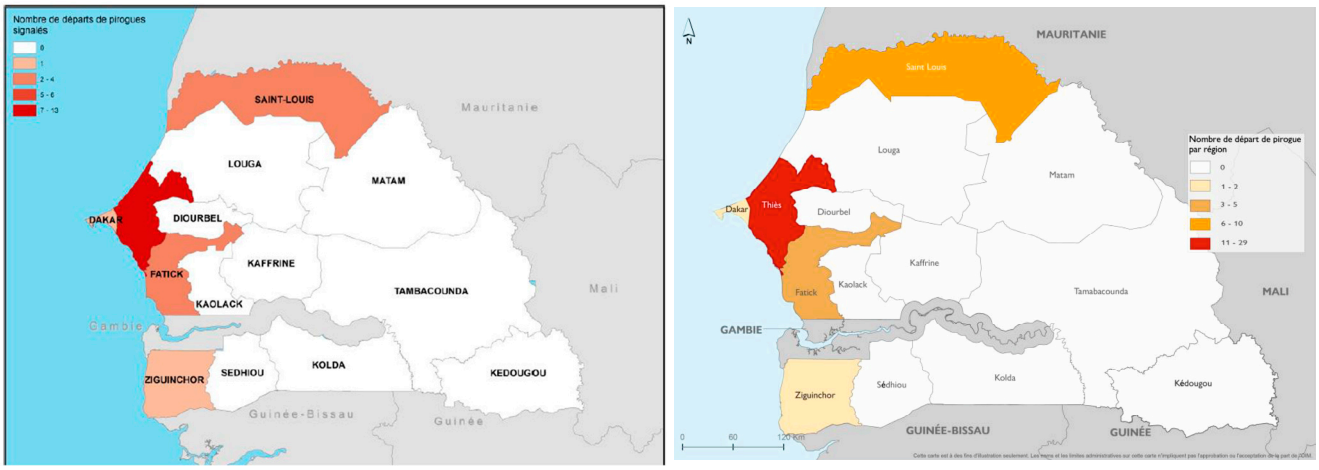

Figure 3. 'Regions of Departure for pirogues from Senegal', May–June 2023 (**left**), 2213 migrants and 21 pirogues detected; and July–August 2023 (**right**), 4121 and 45 pirogues detected. Source: IOM (2023).

Finally, alongside changes at sea, interviewees highlighted the impact of coastal erosion and floods as other climatic factors potentially amplifying economic drivers for migration among fishermen. Some respondents stressed that due to coastal erosion, many fishermen are losing their homes, which severely impacts their livelihoods (Interviews 3–11; 30; 34): 'It's [the sea] taking away everything you see [houses on the beach], disappearing, and that's why more people are migrating' (Interview 9). Moreover, according to an institutional representative from the Saint Louis area, and in line with Abdoulaye Abdoulaye Alassane and Abdoulaye (2022), this issue further affects employment opportunities and contributes to technical unemployment: 'due to coastal erosion, fishermen living close to the coast have to move further inland, losing direct access to the sea and incurring significant costs for commuting back and forth every day' (Interview 30).

Farmers are considered another category vulnerable to the effects of climate change. According to recent studies, Senegal is particularly susceptible to irregular and unstable rainfall patterns, which have become more frequent in the latest years (Faye et al. 2021; Faty et al. 2017; Funk et al. 2012) and has experienced rising average monthly temperatures over the past decades (USAID 2017). These climate factors are considered to have affected agricultural productivity, which is mostly rain dependent (ANSD 2023b).

As the agricultural sector employs 60% of the active population,[14] climatic anomalies potentially exacerbate economic drivers of migration, with recent studies demonstrating that rainfall deficits act as a significant factor reducing crop production and shaping mobility across the country and to Europe (Cissé and Seck 2023; Diallo 2023). Respondents confirmed these trends, stressing that in recent years, drought and rain variability have increasingly affected farmers and agricultural activities, leading to a reduction in income, challenges to food security, and the inability to support family needs (Interview 15, 19, 22, 23, 25, 28, 32, 37, 42, 46). Economic vulnerability affects not only farmers but the entire value chain, with an 'impact on women and young people involved in the processing and commercialisation of crops' (Interview 2). Coastal erosion and the inherent salinisation of water sources and lands were identified as another factor affecting soil fertility and productivity, with many soils 'no longer usable' (Interview 40) and a 'high rate of well abandonment' (Interview 44) due to salinity, in several of the country's regions (Interviews 23, 32, 36, 27, 40).

These conditions contributed to a 'diffusion of the migration behaviour' in rural areas (Interview 36), with more people leaving the countryside to move to major cities, including Dakar, and eventually taking the pirogues to Europe (Interviews 14, 16, 23, 32, 33, 37, 39, 44). This is confirmed by an IOM official: 'When we have interviews with returned migrants, it is [climatic conditions] one of the main reasons [to leave] for people working in agriculture' (Interview 24).

For instance, in the remote southern interior region of Tambacounda, interviewees from the local community all emphasised that agriculture is the primary income-generating activity for their families and stressed that the lack of rain and increased drought have severely affected the sustainability of this livelihood. As reported by a respondent, 'Without agriculture, we cannot live. But here you can cultivate only two–three months, and the remaining part of the year young people are just there, doing nothing. Most people here are in the agricultural domain, but the great majority is quitting as water is too rare and farming has become more and more difficult' (Interview 52). They all expressed a strong willingness to migrate for economic reasons and search of better opportunities (Interviews 52–61), thereby suggesting the role of climatic factors exacerbating economic drivers.

4.2. Not Only an Amplifier: The Synergy with Other Migration Drivers

As a multicausal process, irregular migration from Senegal is not merely the result of economic push factors amplified by climatic events; rather, climatic factors in their amplifying role also interact in synergy with other drivers, adding to and complementing other political, demographic, economic, and social tensions, in a complex entangling of drivers.

In the case of fishermen, the problem is not only determined by the impact of climate on fish availability but also by a range of other dynamics that concurrently influence migration patterns. The first dynamic is related to political governance, specifically the high number of fishing licenses granted to Chinese vessels (APRAPAM 2020), and the fishing agreements that the Senegalese government has concluded with Russia (APRAPAM 2016) and the EU[15], respectively, in 2011 and 2014. As stated by an interviewee, 'the politics [of the Senegalese state] of granting fishing licences to foreigners, and its incapability to prevent irregular fishing are further complicating the effect of climatic anomalies at sea' (Interview 27). Interviewees highlighted that foreign multinational companies, equipped with much larger ships and more advanced technology than the small Senegalese pirogues, 'deplete fish stocks' (Interview 1), catching the majority of fish without respecting biological rest periods and preventing the fish population from reproducing (Interviews 1, 34, 13, 47, 14, 46, 2, 3–12). According to a representative of the village of Thiaroye-sur-mer, the limits of territorial water and rules on quantity and types of species are not respected—'they are taking everything that is left and small fish is not able grow and reproduce' (Interview 12). In this sense, 'bad sea governance [*la mal gouvernance*] and lack of control' (Interview 15) were identified as further factors contributing to fishermen's difficulties.

Moreover, the lack of technical resources is also adding to these factors. Respondents stressed that Senegalese fishermen not only lack the means to compete with the large foreign vessels, but they also face significant challenges such as the lack of ice-making machines to preserve their catch. This makes their situation even more challenging because, without ice, 'they cannot venture far or stay at sea for extended periods to ensure the quality of the fish' (Interview 5A). In this regard, while climatic factors reduce the variety of species near the coast, overfishing depleting fish stocks, lack of regulatory control to prevent IUU fishing practices (Greenpeace 2015), and concurrence with international companies restricting the ability to fish further offshore concurrently contribute to a complex set of dynamics that 'discourage young men to go fishing' (Interview 22), and rather 'push them to take the sea to migrate' (Interview 1). Similarly, as stressed by a returned migrant in Thiaroye, 'The fishing problems have created an economic immobility that is turning into irregular migration, I tried once and I was refouled from Spanish border guards, but as soon as I get a new pirogue I will try again' (Interview 11).

The issue is not confined to Thiaroye-sur-Mer. Respondents from across the country, have highlighted the extensive and pervasive nature of this phenomenon alongside the entire coastline of Senegal, which is affecting fishermen from the northern coasts of Saint Louis (Interview 30) and Thiès (Interviews 34; 22; 23) to the southern region of Casamance—where the situation is further complicated by the unclear boundaries of international waters between Senegal and Guinea-Bissau (Interviews 39, 48) and lack of control (Okafor-Yarwood 2019).

The rural sector also experiences a similar convoluted interplay of factors that may contribute to shape migration decisions. While drought and salinisation are major issues that reduce crop productivity and intensify economic pressures, these climatic challenges are compounded by other factors such as the lack of technical and economic resources (Interviews 47, 33, 49); high electricity costs (Interviews 27, 44, 46, 42), and limited access to water (Interviews 15, 27, 14, 42).

The issue of water access is particularly critical and closely linked with climatic conditions. If rainfall variability affects irrigation capacity, the lack of financial and structural resources hinders the development of alternative water sources necessary for year-round farming. The high costs associated with drilling wells and installing irrigation systems exacerbate this problem (Interviews 47, 33, 27), especially considered that success is not granted: 'We dug twice without finding water, we had only costs so far and no results' (Interview 33). This is further complicated by competition from large multinational companies that, unlike small farming holders, can afford extensive irrigation infrastructure (Interviews 2, 46): 'Small farmers are trapped between the need to work the land and the lack of modern and appropriate tools' (Interview 47); at the same time, 'agriculture has become a competition with the Chinese, Indians, Turks. When they engage in agribusiness, they take over the land, including even the old lands' (Interview 27). Additionally, increasing demographic pressures (Lalou and Delaunay 2015) have led to a reduction in cultivable land, particularly around major cities where new settlements are being established (Interviews 32, 24). This, combined with land degradation due to overexploitation, adds another layer of complexity to the challenges faced by local farmers (Interview 29; Niang et al. 2017).

This combination of climatic and other factors, including the lack of adequate policies to deal with these challenges, and the state's withdrawal from the agricultural sector (Cissé and Seck 2023), pushes more people to leave rural areas and move internally to the capital city of Dakar. This shift is 'transforming traditional seasonal mobility between the countryside and the city, into a more permanent one-way migration' (Interview 25). Indeed, interviews in the periphery of the city revealed that many who moved into the suburbs came from rural areas: 'There is too much [land] competition in Nnaye [Thiès Region], and due to rain variability seeding was not easy' (Interview 1a, area of Guedeway Dakar periphery); 'Soil is no longer good there [Fatick Region], before it was good but now soil is no longer giving crops' (Interview 1b, area of Yoff, Dakar periphery); 'The tools that my family has there [Louga Region] are old, it is not easy to cultivate the land, and the seeds are not good (Interview 1c, area of Guedeway, Dakar periphery). While many might remain in Dakar, the city is considered as an 'intermediate step' (Interview 36) before planning international migration (Interviews 13, 14, 34, 1, 2, 19).

Finally, climatic events as an amplifier and working in synergy with other political, economic, and social issues also compound various crosscutting issues well known by the relevant literature and confirmed by respondents across the country. Interviews identified key drivers such as family ties and social pressures to move abroad to support family needs. At the same time, in line with Abdoulaye Abdoulaye Alassane and Abdoulaye (2022), social pressure can also drive migration as a means of 'emancipation and escaping hierarchical family structures' (Interview 44) that stifle individual autonomy. The idealisation of the myth of Europe, encapsulated in the belief that 'when you go to Europe, you suddenly earn a living' (Interview 31), is also a crucial factor. This myth, along with the need to escape daily precariousness (Faye et al. 2019) and the desire to travel as a 'challenge' (Interview 21) and a stage of personal growth (Interviews 15; 42), as well as the aspiration to have or build a house for the family (Interviews 34, 36, 37, 10, 39, 44, 45, 46), influence migration decisions. The lack of legal channels of mobility and the 'draconian' conditions (Interview 19) for obtaining a visa to Europe further exacerbate the situation. Figures 4 and 5 illustrate an example of the application of the dual framework to the cases of fishermen and farmers.

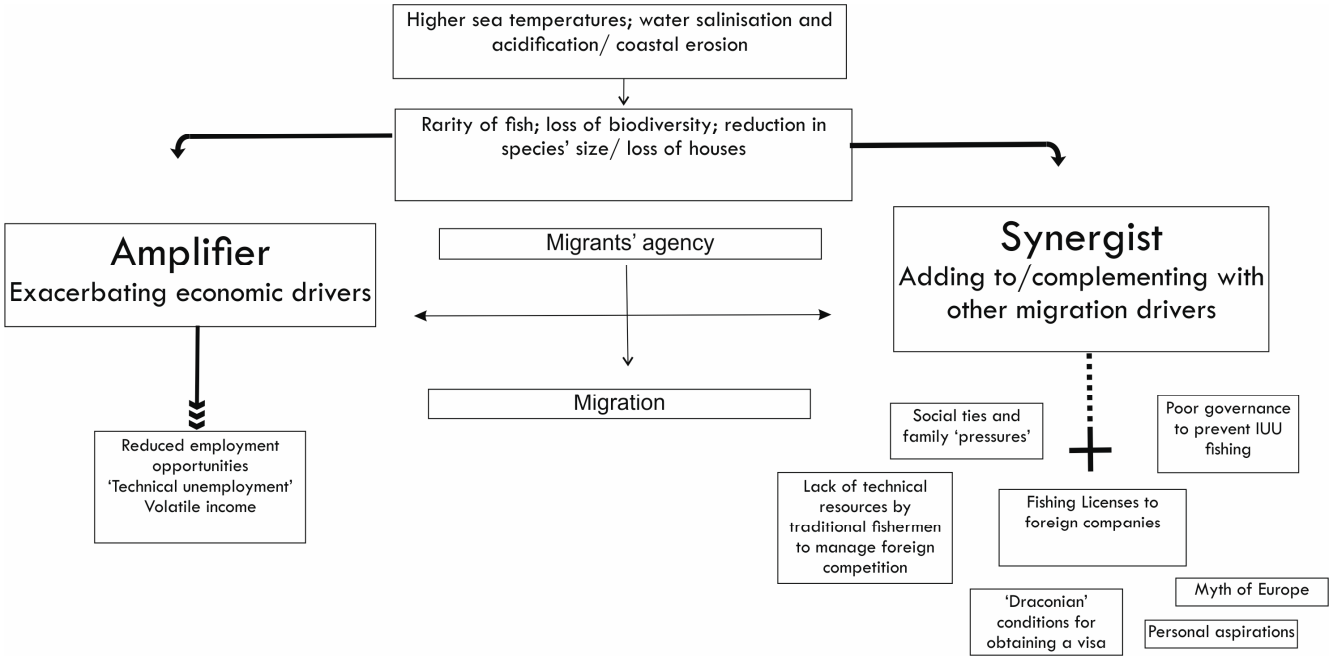

Figure 4. Application of the framework: climatic factors as an amplifier and a synergist. The case of fishermen in Senegal. Source: Author's own elaboration.

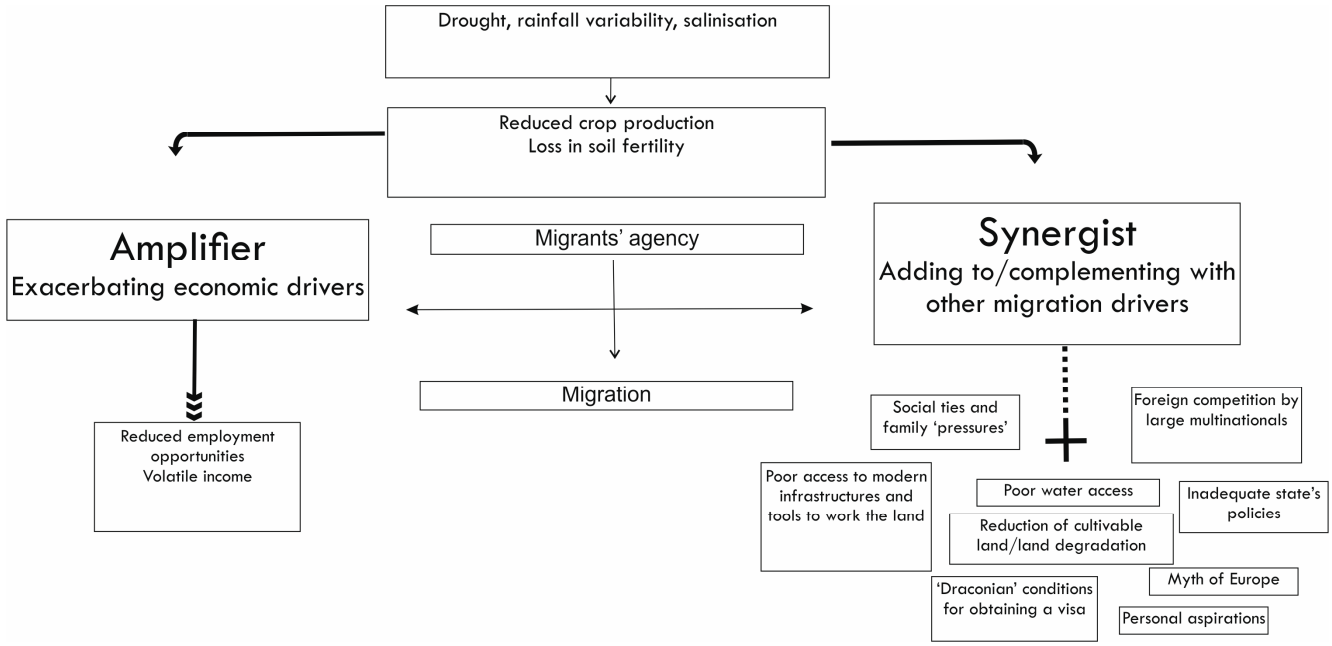

Figure 5. Application of the framework: climatic factors as an amplifier and a synergist. The case of farmers in Senegal. Source: Author's own elaboration.

5. Dealing with Climate Change and Irregular Migration: A 'Missing-Link' in EU's Responses to Deal with People's Vulnerability

As climatic factors become entangled in a variety of ways with migration drivers, potentially shaping irregular migration to the EU, questions arise about how thoroughly the EU incorporates environmental and climate considerations into its policy responses to address migratory flows and people's vulnerability in countries of origin, as well as the potential pitfalls and implications for the effectiveness and sustainability of EU action.

As of early 2011, the Council Conclusions on EU Climate Diplomacy have acknowledged that climate change is a development challenge with implications in terms of 'mi-

gratory pressures' (EU Council 2011). In its 2013 Staff Working Document on 'Climate Change, Environmental degradation and Migration', the European Commission recognised the 'inter-linkages between migration, environmental degradation and climate change', noting that 'vulnerability to climate change may significantly impact migration drivers' (European Commission 2013). Similarly, in the EU Agenda for Migration (European Commission 2015) and in the New Pact on Migration and Asylum (European Commission 2020), climatic factors are mentioned among the 'root causes of migration' and identified as one of the threats to be prevented and mitigated along with civil war, persecution, and poverty. More recently, in a new Staff Working Document of July 2022, the European Commission recognises the role of both natural disasters and slow-onset events as a potential cause of forced displacement and migration (European Commission 2022).

EU migration policy is characterised by three dimensions: a 'control-instrument' approach, a preventive 'root causes' strategy, and a focus on mobility and legal patterns (Boswell 2003; Trauner and Deimel 2013; Longo and Fontana 2022). The 'root causes' strategy is based on development assistance in order to address and reduce the factors of vulnerability that may influence people's decisions to move. This also includes support for the reintegration of return migrants, with development programs aimed at mitigating the economic and social vulnerabilities that prompted migration initially to ensure they can successfully reintegrate into their local economies and societies.

Addressing climatic factors as a root cause of migration would therefore necessitate integrating climate considerations and their interactions with other drivers into development assistance. However, although the documents reviewed above indicate that the EU acknowledges climatic factors as one of many root causes of migration, these factors are not yet fully integrated into EU policy responses and development projects aimed at managing migration and people's vulnerability in countries of origin. The case of Senegal is illustrative of these dynamics.

The EU is engaged in Senegal with reintegration projects for returning migrants[16] and a variety of other projects under the EU Trust Fund for Africa.[17] However, interviews with NGOs and key stakeholders in the field have highlighted several 'missing links' in the EU strategy related to role of climatic factors, with various implications in terms of the sustainability and effectiveness of EU action.

The first missing link is the impact of climatic factors on the sustainability of projects. Respondents stressed that most projects addressing the root causes of migration or the reintegration of return migrants focus on supporting economic activities in agriculture or fisheries. However, given the vulnerability of these sectors to a complex interplay of factors, including climate as an amplifier, stakeholders on the ground have raised concerns about the sustainability of these projects, pointing out the risk of 'vicious cycles' (Interview 40):

> 'Many [fishermen and farmers] are induced to migrate due to a combination of factors that includes climate change, as something that affected their income and capacity to support the needs of the families. Therefore, if we promote projects in the very same sectors from which they escaped, what kind of impact can we really expect?'. (Interview 36)

Additionally, other interviewees emphasised that climatic factors can indeed compromise the sustainability of reintegration projects: 'We supported many return migrants to start activities in farming and agriculture, but in many areas, water is scarce or too saline. Consequently, many have abandoned their wells' (Interview 39). Similarly, some respondents noted cases where return migrants had initiated a project or activity supported by the assistance program, either in agriculture or breeding sectors, which then failed due to issues related to water access and drought (Interviews 17, 31). Moreover, many of these projects do not consider the synergy with other key factors such as personal aspirations. The majority of interviewees stressed that most projects to support potential or return migrants provide support in many sectors but not in housing. Yet, as emphasised by many, this approach ignores that a key driver of migration is the search for a house or the willingness to build one. As one respondent stated, 'We give support to projects in all

sectors, many of which are vulnerable to climatic factors, but not housing as it is considered a sector unable to produce economic benefits' (Interview 36). However, as someone else noted, 'Building houses might not be economically productive, but it is socially productive' (Interview 34) because 'if people are provided with houses for themselves and their families, most will be induced to remain, as having their own house develops a sense of belonging' (Interview 45).

Secondly, respondents have expressed concern over the lack of studies assessing the impact of climatic factors on the implementation of reintegration projects or those addressing root causes, and that this remains an underexplored dimension. Indeed, many projects' action fiches fail to consider climate change among the implementation risks. Moreover, when they address 'transversal questions'[18], the focus is typically on the impact of the project on climate, rather than the reverse, in terms of how climate change might impact the project's implementation[19] (Interviews 41, 39, 48, 42). This also relates to a further missing link: poor long-term monitoring. Respondents stressed how most of the monitoring is carried out during the project but not after, with reintegration projects still too much focused on an 'emergency approach' (Interview 38) that does not allow for the consolidation of results. As stated by two interviewees, 'One year after the conclusion of the project, we do not know anything about the 80 young people we assisted. We do not know whether they are continuing the activity, if they are still autonomous or if they abandoned the area' (Interview 39). Similarly, another one wondered, 'what happened three years later [i.e., after the implementation of the project]?' (Interview 23).

Third, stakeholders have pointed out a lack of 'emergency insurance' (Interviews 28, 34) to support projects aiding professional activities in sectors vulnerable to climate shocks: 'Such insurance would help sustain the activities of potential or returning migrants even in the face of adverse impacts, thereby supporting the sustainability of the process' (Interview 28). Moreover, many of these projects do not consider the synergy with other key factors such as social or cultural aspects (Interviews 39, 41). Too many projects focus on the dimension of the 'single' individual, not involving families and the community, which is essential for the effectiveness and sustainability of the projects. This approach not only would help 'buffer' (Interview 44) the amplifying effects of climate change —with the head of the village or the family acting as 'cushioning mechanisms' in case of major crises, whether due to climate anomalies or other reasons (Interview 42)—but also ensures the long-term sustainability of interventions, enhancing the overall impact and resilience of these initiatives. This major pitfall is also highlighted by other scholarly analyses that point to the inefficiency and inappropriateness of centralised migration projects that are unable to address local needs and aspirations without the involvement of local actors (Faye et al. 2019). In this context, EU programs and projects that focus on addressing economic drivers but fail to adequately integrate climate considerations and recognise their amplifying role in synergy with other factors are particularly ineffective and unable to truly address people's vulnerabilities.

6. Conclusions

Climate change's effect on mobility cannot be isolated to a singular outcome; it affects population's vulnerability and resilience capacities in complex manners (Zickgraf 2018) and through a convoluted entangling of drivers and conditions (Faye et al. 2019). This article contributed to academic debates on the complex interplay between climate change and migration, providing a fresh perspective on how climate variability interacts with other migration drivers, through a comprehensive framework that categorises the roles of climate change as an amplifier and a synergist. Through the case study of Senegal, and by building upon and expanding the existing literature with original material, this article highlighted how climate change amplifies economic vulnerabilities, particularly in the agricultural and fishing sectors. Climatic events intensify economic hardships, leading to reduced employment opportunities and increased income volatility, thereby pushing more individuals toward migration. Additionally, climatic events operate in synergy with other

factors, such as governance issues, social pressures, and inadequate infrastructure, adding a layer of complexity that further drives migration.

Senegal's experience highlights the urgency for migration policies to integrate more robust climate considerations. While EU documents acknowledge climate change as a root cause of migration, this analysis reveals significant missing links in EU policies, particularly in integrating climate considerations and failing to fully address the nuanced interplay of climatic and other migration drivers. Projects focused on sectors vulnerable to climate change, like agriculture and fisheries, or ignoring the synergy with other factors, often fail to address the root causes of migration effectively, thereby perpetuating cycles of vulnerability and displacement. Incorporating views from various stakeholders and offering novel insights from the ground, this article highlighted the practical challenges and gaps in current EU strategies, underscoring the importance of aligning policy responses with the realities faced by local communities.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the University of Catania, in charge also of the ethical guidelines and overview of the project. Approval Code/date: 21/10/2021.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to privacy reasons.

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Notes

1 https://www.frontex.europa.eu/media-centre/news/news-release/irregular-border-crossings-into-eu-so-far-this-year-highest-since-2016-hZ9xWZ, accssed on 15 May 2024.

2 Intended as the result of both natural and anthropogenic factors.

3 While not the focus of this article, migration may not be the only potential outcome or behavioural strategy of people exposed to a combination of climate variability and other drivers. Regardless of the type of role played by climate change, (im)mobility could also be a response. For a further discussion on the point, see Czaika and Münz (2022) and Thornton et al. (2023). For a discussion on the migration-mobility nexus see Piccoli et al. (2024) and Salazar (2019).

4 https://gain-new.crc.nd.edu/ranking/vulnerability, accssed on 28 May 2024.

5 Own's calculations from FRONTEX data on irregular border crossings.

6 https://data.unhcr.org/en/situations/mediterranean/location/5205, accssed on 22 March 2024; Similarly, according to FRONTEX data, between 2015 and 2019, over 22,000 Senegalese migrants took the route from Libya to Italy, https://www.frontex.europa.eu/what-we-do/monitoring-and-risk-analysis/migratory-map/, accssed on 1 June 2024.

7 https://dtm.iom.int/europe/arrivals, accssed on 26 March 2024.

8 As the concept of climate change may not have the same understanding for everyone and may not be easily comprehensible, we took specific steps to break down the broader concept into more tangible and relatable elements (drought, rainfall variability, coastal erosion etc.). This approach aimed to reduce the risk of biases and facilitated a clearer and more consistent understanding among respondents, regardless of their background or level of familiarity with the term "climate change."

9 https://senegal.un.org/fr/168265-renforcer-les-comp%C3%A9tences-et-cr%C3%A9er-des-opportunit%C3%A9s-pour-promouvoir-lemploi-des-jeunes, accssed on 24 March 2024.

10 Only two interviewees did not recognize the role of climatic factors, stressing that the search for a better future is the only relevant reason explaining irregular migration from the country.

[11] The 'rareté de poissons', or the rarity of fish, is a common theme stressed consistently by almost all interviewees at all levels (institutions, NGOs, local communities, return migrants, etc.).

[12] According to experts, one of the key species of zooplankton in Senegalese waters is sensitive to temperatures above approximately 23 °C. A decline in zooplankton off the West African coast due to rising surface water temperatures is expected to impact the diet of some fish, pushing them to migrate elsewhere. See https://cdkn.org/story/feature-ocean-temperature-increase-along-senegalese-coast-could-reduce-sardine-fisheries, accssed on 22 May 2024.

[13] All interviewed return migrants in Thiaory-sur-Mer were either forcibly returned or pushed back from Spain or Morocco.

[14] https://www.economie.gouv.sn/fr/investir-au-senegal/secteurs-porteurs, accssed on 24 May 2024.

[15] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2014:304:FULL, accssed on 3 June 2024.

[16] https://rodakar.iom.int/news/senegal-migrant-protection-return-and-reintegration-programme-sub-saharan-africa-steering-committee-holds-its-first-meeting, accssed on 3 June 2024.

[17] https://trust-fund-for-africa.europa.eu/where-we-work/regions-countries/sahel-lake-chad/senegal_en, accssed on 3 June 2024.

[18] In development projects, 'transversal questions' are generally those crosscutting issues upon which the project could have an impact: gender, environment etc.

[19] For instance, https://trust-fund-for-africa.europa.eu/document/download/cf43efbb-5833-401f-b3cc-903683bfa3eb_en?filename=t05-eutf-sah-sn-05.pdf, accssed on 3 June 2024.

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