A Qualitative Study on How Perceptions of Environmental Changes are Linked to Migration in Morocco, Senegal, and DR Congo

Lore Van Praag[1] · Samuel Lietaer[2] · Caroline Michellier[3]

Abstract

Environmental migration is a growing concern of academics and policymakers, who foresee a rise in the number of such migrants. However, most prevailing academic and policy discourses ignore the variety of perceptions of environmental changes among people living in highly affected areas across the world. We examine the perceptions of environmental changes and how these are seen to be relevant to migration in Senegal, DR Congo, and Morocco. In total, we conducted 410 interviews with people living in two regions in each of these countries. Results indicate differences in the perception of environmental changes across regions, gender, education, and livelihoods. The economic activities of individuals determine exposure and sensitivity to environmental changes, while educational levels increase familiarity with prevailing environmental discourses and policies. Despite country-specific and regional differences across research sites, few people perceived environmental factors as directly related to their own or family members' migration projects.

Keywords Environmental change · Migration · Perceptions · Democratic Republic of Congo · Senegal · Morocco

Introduction

Awareness of environmental migration has exponentially increased over the last two decades, placing it high on the agenda of both policymakers and academics (McLeman & Gemenne, 2018). As a result, theories on how migration and environmental changes are related have developed rapidly (Nielsen & D'haen, 2014). While migrants declare financial constraints and professional goals as the most common reasons for migration, empirical studies show that environmental

✉ Lore Van Praag
Lore.VanPraag@UAntwerpen.be

Samuel Lietaer
samuel.lietaer@ulb.be

Caroline Michellier
caroline.michellier@africamuseum.be

1   Centre for Migration and Intercultural Studies, University of Antwerp, Lange Nieuwstraat 55, 2000 Antwerpen, Belgium

2   ULB, Faculté Des Sciences Centre d'Etudes du Développement Durable CEDD, Avenue F.D. Roosevelt, 50 1050 Bruxelles, Belgium

3   Natural Hazards Service, Royal Museum for Central Africa, Leuvensesteenweg 13, 3080 Tervuren, Belgium

changes and limitations play a role in migration processes (de Longueville et al., 2020), notably in Africa, where environmental changes are severely affecting livelihoods and livelihood strategies, including migration. Migration can thus function as an adaptation strategy (Afifi et al., 2016). Since the end of the 2000s, global consortia of academics commissioned by governments and international organizations have been eager to develop models to connect migration and environmental changes on the one hand, and migration and adaptation to climate change on the other (Foresight, 2011). Nevertheless, these consortia frequently overlook the fact that people do not link their own migration aspirations and trajectories with ongoing environmental changes (de Longueville et al., 2020; Few et al., 2017; Howe et al., 2014, authors). Social, political, and economic changes interact with environmental changes and therefore mask their importance. This relationship is even more difficult to perceive in regions confronted with slow-onset environmental changes, such as drought, that coincide with societal changes (De Longueville et al., 2020; McLeman & Gemenne, 2018; Van Praag & Timmerman, 2019), again notably in Africa, one of the continents most affected by climate change, where data availability and reliability are poorest, technological change is slowest, and domestic economies largely rely on climate-sensitive livelihood activities (WMO, 2020). In this

study, we use a qualitative approach to further our understanding of how inhabitants living in two regions in three countries—Morocco, Senegal, and the Democratic Republic of Congo—perceive and explain environmental changes and how they connect these changes to migration. Although the perceptions of people involved may also be biased and do not necessarily match the observed data (De Longueville *et al*., 2020; Rebetez, 1996), they matter when deciding on adaptation strategies (Nguyen & Wodon, 2014).

## The Relationship Between Perceived Environmental Changes and Migration

Considerations of how perceived environmental changes relate to migration aspirations and trajectories are often overlooked in policies and academic research (de Longueville *et al*., 2020). Ongoing research and policy debates too frequently connect environmental changes to actual migration without questioning (1) whether the people involved perceive and interpret these environmental changes and (2) whether these perceived changes are linked to migration aspirations and trajectories. Rather, migration and environmental changes are often associated in a causal way without including the views of the actors involved. More particularly, in policy and scientific documents migration is often depicted as a last resort strategy whereby people respond to a specific short- or long-term event (e.g., Perruchoud & Redpath-Cross, 2011). This is for instance visible in references to 'climate refugees' (Hartmann, 2010). The automatically assumed relationship between environmental changes and migration is problematic, as views on environmental changes vary considerably depending on contextual and individual factors (Wodon *et al*., 2014; Jenkins *et al*., 2018; Van Praag *et al*., 2021, 2021a; Van Praag *et al*., 2021b). Furthermore, these policy discourses too frequently assume that migration is only seen to address environmental changes in the end stage of the response to environmental degradation or as a measure of last resort, ignoring all other kinds of adaptation strategies. These discourses also mainly focus on actual migration outcomes—especially transnational migration— and neglect (im)mobilities and migration aspirations (Van Praag, 2021b; Zickgraf, 2019). Instead, migration as a response to environmental changes could be seen as part of a wider process of transformation in which households and migrants, in particular, try to ensure a secure livelihood (Jónsson, 2010) and should be studied together with ongoing societal changes.

Here we do not focus solely on groups that have already migrated (transnationally) but also examine groups still living in regions heavily affected by increased environmental changes in recent decades through exploration of the linkages people make between migration and environmental changes. This helps to understand what other adaptation strategies they have considered, whether they are seen as viable together with migration, and whether individuals identify and categorize themselves as (potential) 'environmental migrants.' These issues are overlooked in many policy documents, yet enhance understanding of how environmental factors contribute to individual and household migration decision-making or the extent to which local and diaspora communities help to address environmental stressors and changes in their home environment or region of origin (Authors). This is relevant since the groups that may be struggling most to secure their livelihoods are not necessarily those that are able to migrate. Yet, (im)mobilities are highly diverse and uneven in terms of people's abilities and aspirations to move, "when, how, and under what circumstances" this takes place (Sheller, 2018: 51), and how it is experienced. These asymmetries reflect and reinforce factors such as unequal resources in individuals' networks and within larger communities, as well as different levels of external control, shaping migration opportunities and capacities (Rogaly, 2015).

By examining people's perceptions of environmental changes, we aim to better understand how environmental changes inspire people to migrate and how they relate these migration aspirations and trajectories to such changes. Previous research indicates that it is difficult to observe and capture such environmental changes (Nielsen & D'haen, 2014; Wodon *et al*., 2014). Environmental – especially climatic – changes often span a period of approximately 30 years of weather characteristics such as wind, temperature, humidity, rainfall, and sunshine (IPCC, 2014). Without systematically tracking these parameters, it is very difficult for individuals – especially younger generations – to assess these climate (or broader environmental) changes without familiarity with climate change discourses or noting gradual differences over time or generations (Nielsen & D'haen, 2014). People mostly refer to temperature and rainfall when discussing their natural environment (Bele *et al*., 2014). However, some changes are more easily noticed (e.g., precipitation patterns or extreme events) than others (e.g., temperature changes) (De Longueville *et al*., 2020; Few *et al*., 2017; Howe *et al*., 2014). People are more aware of these environmental changes when they affect livelihood activities, such as agriculture, water availability, or vegetation changes (e.g., Bele *et al*., 2014; Howe *et al*., 2014; Wodon *et al*., 2014; De Longueville *et al*., 2020; Van Praag *et al*., 2021a; Van Praag *et al*., 2021b; Van Praag *et al*., 2021). Perceptions of environmental changes vary depending on how people learn about these changes (Weber, 2010), their livelihoods (Bollig & Schulte, 1999; Mbow *et al*., 2008; Mertz *et al*., 2010), their understanding of traditional knowledge and local discourses (Berkes, 2009;
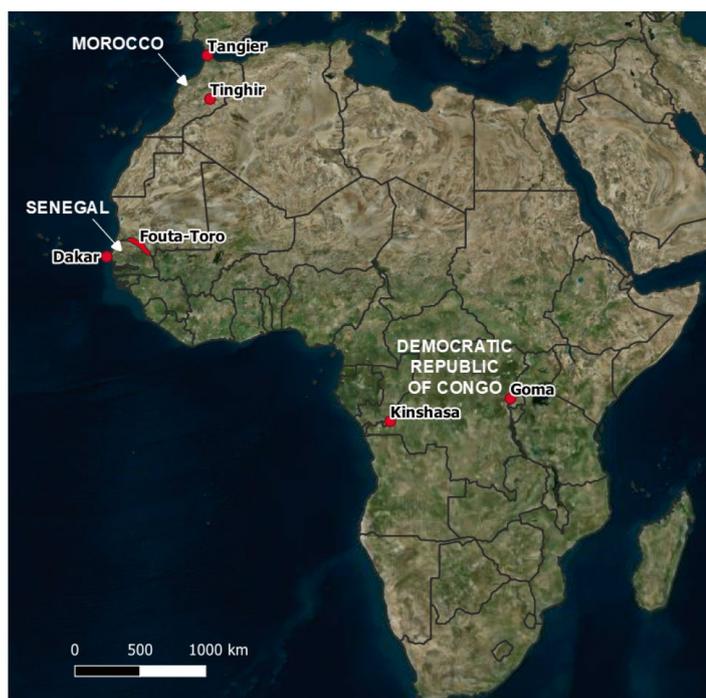
In each of these countries, study areas correspond to the red patches locating 5 cities (Tangier, Tinghir, Dakar, Kinshasa and Goma) and a rural area (Fouta Toro).

Bollig & Schulte, 1999), individual and demographic variables (e.g., household size and migration of labor force: Mertz *et al*., 2010) and media discourses (Marin & Berkes, 2013).

Moreover, these perceptions vary across research settings, for various reasons. Previous research indicates that country-specific factors matter due to differences in the overall economy (Afifi, 2011), demographic characteristics (Plane, 1993), current political stability and ongoing conflicts (Black *et al*., 2011), previously developed policies dealing with environmental changes (e.g., Plan Maroc Vert in Morocco: Balaghi, 2014), and the emphasis on climate change in prevailing discourses (e.g., climate change conferences, etc.) (Marin & Berkes, 2013; Mertz *et al*., 2009). Regional factors also matter, due to rural–urban differences (e.g., Howe *et al*., 2014), contrasted vulnerability and exposure to environmental changes (e.g., mountain areas, coastal proximity, etc.: De Longueville *et al*., 2020; Howe *et al*., 2014), and cultures of migration and migrant networks (Van Praag *et al*., 2021, 2021a; Van Praag *et al*., 2021b). Cultural and religious factors also play a role in perceiving, explaining, and coping with environmental changes, as there are shared cultural notions of risk and vulnerability (Vedwan, 2006; Leclerc *et al*., 2013; Mertz *et al*., 2010; Jenkins *et al*., 2018). Most previous studies focus on one country or region (Nielsen & D'haen, 2014), e.g., West Africa (Mertz *et al*., 2010, 2012; Afifi, 2011; De Longueville *et al*., 2020), the MENA region (Wodon *et al*., 2014; Van Praag *et al*., 2021, 2021a; Van Praag *et al*., 2021b; Van Praag, 2021a, 2021b),

DR Congo (Bele *et al*., 2014; Few *et al*., 2017), India (Howe *et al*., 2014), or Eastern Africa (Leclerc *et al*., 2013).

Methods and Materials

This study is part of a research project entitled "Making Migration Work for Adaptation to Environmental Changes. A Belgian Appraisal" (MIGRADAPT) that examines the role of the environment as a driver for migration from Morocco, Senegal, and the Democratic Republic of the Congo (DR Congo) to Belgium, connecting this to how migrants in Belgium support the adaptation and resilience of their communities of origin (Fig. 1).

Countries were selected based on two factors: (1) large migrant populations living in Belgium; (2) impacted by environmental/climate changes. Within each country, two regions with varying degrees of urbanization and migration patterns were selected (Table 1).

In each research setting, we attempted to recruit a diverse sample in terms of age, gender, occupation/livelihood, social status, and personal migration history. We selected participants with and without migrant networks (in- and outside the country) and with and without personal migratory experiences, to fit the main research question of the MIGRADAPT project. To realize this purposive sample variation, some recruitment strategies were adjusted over the course of the fieldwork. Depending on the local context and support, we used distinct recruitment strategies in each research

Table 1 Selected regions and research strategy

Countries	Morocco		Senegal		DR Congo	
Region	Tangier	Tinghir	Migrants of the Mid-valley of the Senegal river living in Dakar Metropolitan area	Mid-valley of the Senegal river (incl. 12 villages)	Kinshasa	Goma
City type	Industrialised port city, large number of internal migrants	City in mountain area, oases valley	Capital of Senegal, low-lying vulnerable coastal city	Halpulaaren (Fulani) agro-pastoralist villages	Capital city of DR Congo	Regional trading hub, intense traffic, highly insecure area
Migration context	Large number of internal migrants networks in Europe since WWII	Internal migrants from surrounding saller villages and large emigration to in Europe since WWII	Large number of internal migrants networks in Europe since WWII	Internal rural-urban migration and international migration towards Europe	International migrants left Kinshasa mainly for economic reasons	International migrants left Goma mainly for security reasons
Environmental changes	Mediterranean regime, precipitation and temperature changes	High impact of precipitation and temperature changes. Drought, desertification, water scarcity, more extreme weather events	Coastal erosion, flooding in low-lying areas, various types of pollution (air, water, plastics, …)	High impact of precipitation and temperature changes. Drought, desertification, water scarcity, more extreme weather events	Erosion at the origin of large gullies, and flooding	Several environmental issues, from forest overexploitation to volcanic eruption
Inhabitants (year of census)	947952 (RGPH, 2014)	42044 (RGPH, 2014)	2452656 (ANSD, 2014; 2020)	12 villages between 1000 and 7000 inhabitants	13743300 (UNdata, 2020)	974800 (INS-Nord-Kivu, 2017)

setting. In Morocco, participants were selected 1) through their connections to immigrants living in Europe, to include people with transnational migrant networks, and 2) during the fieldwork, through a wide variety of channels, such as social media posts, local conferences, local NGOs, tourist guides, etc. During the study, we made additional efforts to recruit elderly female participants. For Senegal, similar purposive, and snowball sampling methods were used. The key personalities in the villages, especially the hosting village chiefs, located people and representatives from various social groups (socio-professional statutory groups, females, young people) for the interviews and 38 focus group discussions. For DR Congo, half of the interviews conducted in Kinshasa were organized with the help of Congolese immigrants met in Belgium who facilitated contact with a close family member still living in Kinshasa. The rest of the interviewees were selected using a snowball sampling method. In Goma, all interviews were based on the snowball sampling method.

This resulted in some differences in selection criteria and sampling across countries and regions. While in DR Congo we interviewed mainly people living in urban areas, in Senegal and Morocco we also interviewed people living in rural areas. In Senegal, more interviews were conducted over a longer time span with the support of research assistants for interviews and transcripts to allow the researcher to elaborate on other topics as well (not discussed in this paper) (Table 2).

All fieldwork was conducted as part of the MIGRADAPT project; however, different researchers (and research assistants) conducted the fieldwork in each country. Research was conducted in April–May 2018 in Morocco, November 2019 – April 2020 in Senegal, and in Kinshasa (March–May 2019) and Goma (October-December 2019) in DRC.

Taking a qualitative approach, in which we contrast the findings of three countries and six research settings, we aim to highlight constants across all dimensions and to verify similarities and variations across different socio-environmental contexts. We based ourselves on ethnographic observations to conduct semi-structured interviews. All interviews followed a similar topic guide, adjusted to the local context, first asking about socioeconomic background characteristics (e.g., gender, age, profession, place of residence, birthplace), followed by open introductory questions on factors affecting living conditions and livelihoods. Afterwards, more in-depth questions were asked about the migration history of the region and participants' personal migration experiences and aspirations. Subsequently, more tailored questions were asked about specific environmental changes and the impacts on the interviewees' livelihoods. Finally, questions were asked about familial and communal (local and transnational) solidarity, with a particular focus on migration and environmental changes. By starting from a common set of interview questions, we also facilitated systematic and comparative thematic analyses. Although no shared Nvivo file was made (also to safeguard the anonymity of the participants), the codes and comparisons correspond and are in line with the shared interview guidelines. For this paper, we focus only on the commonalities and similar topics addressed during the fieldwork. We analyzed our data per country sample using thematic analyses (Boyatzis, 1998), comparing and framing the analyses within broader transnational migrant networks, migration histories, and colonial past, as well as local and global initiatives to adapt and mitigate environmental changes within these respective countries. Afterwards, we triangulated all data analyses across regions and countries, and considered individual-level characteristics, such as gender, profession, and age. After initial discussions on the significant emerging issues, thematic analyses on the selected topics were conducted and summarized. After discussing these topics and reflecting more critically on the differences and similarities, more in-depth analyses were conducted to triangulate the data and give a better understanding of the data. For the country-specific analyses, data analysis facilitating software Nvivo was used to structure, code, and analyze the data. In all settings, participants were given information about the MIGRADAPT project, were asked for informed consent to participate, and were informed that they would be able to withdraw from the project at all times, and that their names and background information would be made unidentifiable. All interviews were transcribed and translated from the respective language (mainly French) to English.

Table 2 Participants interviewed per country and region

Countries	Morocco		Senega	l	DR Congo	
Region	Tangier	Tinghir	Dakar	Mid-valley region	Kinshasa	Goma
Total interviewed	18	30	94	238	15	15
Female/male	7/11	13/17	41/53	90/148	5/10	6/10
Age variation in years	24-70	20-64	12-78	12-85	27-65	19-67
Fieldwork difficulties	Gender and languages issues, fear for political repercussions		Gender issues		Suspicion of the persons to interview resulting sometimes in very concise answers	

Results

Perceived Environmental Changes in Changing and Fragile Socio-Political Contexts

Across research sites, we found considerable variation in perceptions of environmental changes; these variations seemed to depend on both individual factors, including profession and socioeconomic status, age, and gender, and contextual factors, such as the reliance on agricultural activities in the region, local political activities, and policies. Furthermore, the specific migration history and patterns (e.g., rural–urban migration patterns or transnational migration) of each region mattered in that migrant networks and policies made people aware of changes in their natural environment, potential adaptation strategies, and alternative ways to manage the adverse impacts of environmental changes.

Morocco

In Morocco, where two entirely different research settings (urban and rural) were selected, large differences were noted between Tangier and Tinghir concerning people's perceptions of environmental changes related mainly to participants' daily economic activities and their connection with their surrounding environment (also Nguyen & Wodon, 2014). Due to the mountainous area, subsistence economy, and importance of the oasis valley, people in Tinghir are more aware of environmental changes than those in Tangier. Conversely, in Tangier, climate was often interpreted in terms of sunny weather and living in an overall warmer climate (compared to many European countries). Mainly people with relatives outside Tangier or who themselves migrated to Tangier were aware of deteriorating environmental changes in the countryside and their impact, particularly on water scarcity, drought, desertification, and all associated adaptation strategies (e.g., wells, dams, change of crops, migration, etc.). For example, a 31-year-old male participant living in Tangier, with family from Talafilet, stated that people are used to and adapt to drought. Those who want to migrate do so to "improve their standards of living." By contrast, in Tinghir more people were aware of the deteriorating natural environment making it unattractive for young people to invest in agricultural activities or stay in this region due to the lack of attractive employment opportunities. Lack of investment also led to continued use of traditional methods in agriculture, badly maintained water canals and wells, deserted land plots, and so on. Water management took a central role in informants' accounts, together with changing standards of living, new technologies, and the attraction of larger cities (in terms of health care services, educational and employment opportunities):

"The last 15 years, the palm tree oasis has changed due to the drought. Normally, in March and April, there used to be a lot of snow on the mountain ridges, but this year, there was nothing. Normally, this is the start of a dry period and drought, as every five years, there is a change in climate and the drought starts. Even the palm grove in Tinghir changes. There are many changes due to water. There is no water here, not like before. It's not like 40 years ago, not like 30 years ago, not like 20 years ago, even the last 10 years, it has changed. This year there wasn't any snow, or at least not like other years." (64-year-old male, Tinghir)

The Moroccan data suggest a mismatch between those familiar with discourses on climate change and its dynamics and those who have seen changes over the last decades in their immediate environment. Perceptions of environmental changes differed across educational levels, professional experiences, and access to migrant networks. People with a relatively higher educational level and close migrant networks in Europe seem to know more about specific scientific climate change discourses, connecting CO_2 emissions and pollution to global warming. They interpreted climate changes, such as global warming, more in generic terms, such as the warming of the Arctic and endangered polar bears. As international migrant networks send social and financial remittances, people are not only able to invest in their education but improve their understanding of climate change discourses. This group mainly referred to economic, political, and social changes as reasons why people tend to leave their agricultural activities. Nonetheless, they failed to apply their knowledge on climate change discourses to their immediate natural environment. Most of this group did not refer to increasing drought and desertification in their surroundings and how it has turned agriculture into a lost investment. The group that was not familiar with climate change discourses often had tacit knowledge of environmental changes through personal experiences and networks. They saw changes that affected agricultural activities that aligned with general changing standards of living, and reduced interest to invest in agriculture. Most informants with relatives living in rural areas or who themselves worked in agriculture could specify in more detail changes over the last decades. Many referred to reduced or unexpected rainfall or snowfall, water shortages, and increasing drought. A 62-year-old male living in Tinghir reported: "We used to have rain and there was water. But now, it's quite the opposite, especially in the regions of Tinghir, Ouarzazate, Errachidia, Zagoria." His male friend added that "There is no rain!" This group provided alternative explanations for these gradual changes, referring to the collapse of harmony between mankind and nature, as well as to God and their religious beliefs. We can

state that professional experiences, especially of people in agriculture or nature conservation, and location (Tinghir vs Tangier) are crucial in linking climate change discourses to changing local natural environment.

Senegal

Most participants in the Senegalese fieldwork lived in the Mid-valley in Northern Senegal, where climatic conditions have worsened over the last 50 years (Faye *et al*., 2019; Lietaer *et al*., 2020). A rural exodus has taken place, mainly because of policy reforms combined with major droughts in the 1970s and 1980s (Dia, 2020). Hence, the villagers interviewed, both farmers and non-farmers (practicing agriculture as a secondary activity), seemed to be very concerned not only about the changing climate but also about broader (rapid- and slow-onset) environmental changes impacting their living conditions. Additionally, participants mentioned that, in line with Grolle (2015), the unfavorable timing of rainfall during agricultural seasons is perceived as more serious than the drought itself. Sandstorms and heat waves are also considered to be strongly impacting living conditions of most villagers, especially of vulnerable people (i.e., the sick, children, the elderly) who do not have a pied-à-terre in Dakar "to take refuge there*"* as some elderly people in the village noted. Similar to the findings in Morocco, these analyses indicate the importance of migrant networks. They also show the need for a differentiated approach towards the impact of environmental changes, considering individual vulnerabilities in specific socioeconomic and political conditions.

Participants perceived the artificial flooding caused by unannounced releases of water from the Manantali hydroelectric dam and rainfall variability as the most important factors causing socioeconomic damage. Both were considered unpredictable as no prior information was provided by any public or private service. However, most villagers blamed the government for not managing and communicating these hazards better (Kamara, 2013). The representative of the farmers of the Commune of Ouro Sidi places these developments in their historical context:

> "Since the construction of the dams [of Manantali upstream and Diama, respectively in 1988 and 1986] near the river mouth, farmers who do not have access to irrigated perimeters suffer, especially since they can no longer rely on rainfed cultivation every year. Fishing has also become bad, because the river water is no longer good as it used to be, either for fish reproduction, or for feeding the land [through river alluvium, which acts as a natural fertilizer during floods], or for allowing us to drink for free, as before." (52-year-old male, Matam region).

Droughts partially influence ecosystems, but the links with anthropogenic pressures were not clearly perceived. Many believed extreme climate events and their impacts to be caused by the divine will ('act of God') and did not necessarily link them to climate change discourses. Nonetheless, the direct effects of climate change on living conditions are of great concern: soil degradation, rainfall variability, and droughts (Bleibaum, 2010). Most participants attribute the lack of work and insufficient agricultural yields to insufficient financial and technical means and capacity. In a second narrative-line they refer to various environmental hazards (including birds, insects, plant diseases, etc.), climate events, and the construction of the dams. In addition, fieldwork in Dakar shows that even when rainfall is perceived to have become heavier, many floods are believed to be caused by bad sewer and dredging infrastructure. Many saw it as a political responsibility – currently lacking – to adapt neighborhoods to better absorb rainfall to avoid floods in Dakar's low-lying areas.

DR Congo

Recent decades in DR Congo have seen considerable migration from rural to urban areas; the main drivers for migration have been socioeconomic circumstances, conflicts, and bad governance (Gemenne *et al*., 2013; IOM, 2017). These movements have resulted in increased degradation of natural resources (forests, crop lands). Combined with poorly managed urbanization, overcrowding, and informal settlements, more people have been exposed to risks and the potential negative effects of environmental changes (Makanzu *et al*., 2015; Michellier *et al*., 2020). In both study cities, people recognize that the environment has changed considerably. Although the interviewees emphasize the rural areas, where they identify deforestation, shrinking rivers, erosion, and seasonal rainfall changes, those living in Kinshasa also indicate that the situation of the capital city is worrying. This is striking, as it shows that environmental changes are also perceived in an urban context and seen as independent from agricultural activities (in contrast to Morocco and Senegal). People experience different types of environmental changes and impacts (gullies, floods, landslides), strongly affect their perceptions of environmental changes. The more abrupt/rapid and intrusive nature of environmental changes in Kinshasa seems to make these changes more visible to a wider audience. People in Kinshasa experience these environmental effects as a real hardship and describe their neighborhood and the climate as having undergone major changes, creating a "hostile environment."

> "There are changes that poison our peace of mind at every moment: when it is not unbearably hot, there are

violent winds that raise swirls of dust and make the air unbreathable, followed by torrential rains that hits the ground and roofs." (65-year-old female, Kinshasa)

Participants describe such threats as causing widespread damage, affecting many people. They identify environmental changes as a reality they are confronted with daily. Large gullies affect many districts of the city. Heavy rainfall is expected to increase in the following decades combined with ongoing urban sprawl, which worsens the current situation (Makanzu *et al.*, 2015). Several participants indicated that "everybody is affected by environmental changes, in Congo and everywhere." Although the situation is particularly difficult in Kinshasa, their feeling is that their experience is reflects that of people in other parts of the world.

> "In the Congo, as in many other countries, there are big changes; they concern temperature, rain, and winds, each of these completely natural phenomena is exaggerated and has disastrous consequences. This destabilizes the ordinary activities of many people, especially those who work the land." (46-year-old male, Kinshasa)

Faced with such phenomena, the prevailing feeling of many participants are helplessness and lack of knowledge. Information availability is crucial for people to feel a sense of control over the situation, as well as development of adaptation strategies, and attitudes towards local politics, but information regarding environmental issues is not easily accessible or widespread in DR Congo. People feel unprepared to face an increasingly frequent events such as floods, drought, storms, stating: "Here we are unarmed when it comes to dealing with it." (59-year-old male, Kinshasa). Among those most affected, some consider irresponsible behavior of the population helps to amplify the dramatic consequences of environmental changes. Many blame the authorities for not fulfilling their responsibilities.

> "Don't talk to me about our politicians, they have always sacrificed their people and I am not sure that it is today that this is going to stop. Neither migration (apart from sending their families to live in the West), nor climate change is of interest to them, their only concern has always been to line their pockets." (32-year-old male, Kinshasa)

People living in Goma are in a different context, and therefore do not perceive environmental changes as strongly as in Kinshasa, although they are aware of environmental changes affecting several parts of the country. However, most declare that such phenomena do not affect Goma and the surrounding region. For example, a 21-year-old female in Goma said that: "We hear about environmental changes especially in Kasai and Katanga. Rivers are said to be drying

up. Thank God my community is spared in this respect." A 52-year-old male stated: "I often hear about catastrophic climate change in other provinces of Congo. Here at home, they are minor: sometimes the rain is delayed, but the farmers are adapting quickly." Goma inhabitants think that their community is simply not affected by environmental changes causing floods or droughts, and only farmers are identified as potentially having difficulties. Yet, despite their limited technical and financial capacities (IOM, 2017), it is thought they can adapt quickly. Comparing the findings from Senegal and Morocco with those in DR Congo, one striking similarity is that when people's livelihoods are threatened or impacted by environmental changes, they are more likely to perceive them, particularly when they are not well-managed by the local authorities.

Linking Environmental Changes to Migration

Relating environmental changes to migration requires a better understanding of other adaptation strategies developed to deal with such changes. The focus on migration needs to be interpreted within the local context, depending on whether people perceive environmental changes and the factors behind such changes. As we show, perception of environmental changes depends on individual professions and networks, familiarity with environmental changes and climate change discourses, the nature of the experienced environmental changes (slow-onset or abrupt), and the rural/urban as well as socio-political and socioeconomic local contexts. Such perceptions are a starting point for the development and implementation of adaptation strategies, with migration as an alternative if these strategies are not attractive or possible (McLeman & Gemenne, 2018).

Morocco

The mismatch between those familiar with the discourses on climate change and its dynamics and those who have seen changes over the last decades in their immediate environment also hampered the development of adaptation strategies to mitigate these changes over the long run, or migration projects. In some cases, people are generally more aware of the impact of climate change due to projects addressing its consequences. For instance, one participant (45-year-old female, Tinghir) refers to drought, but immediately connects it to the development of a project aimed at mitigating the effects of drought:

> "There is a lot of drought; we are currently working on a small-scale project with volunteers, because in the region of Anif – a region with a lot of water scarcity – the rain doesn't fall there and there are many people

suffering from drought. They don't have water, there are some people who want to make it rain there."

Knowledge of climate change discourses as well as explanations given of these changes mattered considerably to the development of adaptation strategies, including migration. These strategies are not always consciously developed, as changes occurred slowly over the past decades that make working in agriculture, for instance, not really a viable option for younger generations. They therefore do not really reflect ways to adapt or cope with such changes. Groups with vulnerable livelihoods exposed to natural environmental changes tend to explain these changes according to their religious beliefs. Consequently, acceptance is often mentioned as a strategy to deal with such changes, as people respond to the outcomes of environmental changes, but do not anticipate or seek to prevent future changes, for instance, building wells or seeking alternative income sources. People in Tangier, however, refer to governmental and scientific discourses but were no longer exposed to environmental changes.

Migration was frequently mentioned as a solution to the lack of employment opportunities in rural areas and to find better living conditions. Young people, especially, do not see agricultural activities as an option, due to the deteriorating natural environment, the lack of investment in modern infrastructure and techniques and the fragmentation of agricultural land. All these factors result in low revenues from agriculture.

Senegal

Participants perceived the need for additional means and investment to address environmental hazards and enable commercially viable farming, since agricultural production systems characterized by flood recession cultivation (beans, sweet potatoes, millet, and maize) have been disrupted. Additionally, the "lack of good politics and policies," including "barriers to accessing finance" is seen as a major reason for insufficient rural income. This affects more than agriculture since most households have adopted livelihood diversification strategies. Nonetheless, when addressing impacts of environmental changes, other factors must be considered. First, people distrust public investment incentives and state agencies providing support to farmers. The concerns surrounding environmental issues are heavily intertwined with attitudes to the building of dams and other policy initiatives. As argued by a village chief in the Mid-valley: "You can't see a sign of the government except for a few minor things" (50-year-old male). These political frustrations are heightened by private investments putting more pressure on key resources such as land along the river. Second, changing political structures – especially regarding land and water management – are increasingly impacting

awareness of environmental issues. More specifically, ongoing decentralization processes have imposed administrative boundaries that do not match traditional village boundaries and historical socio-political links between villages. This results in conflicts and frustration, as people belonging to a village have their land belonging to another administrative unit. Such conflicts increase the need for coherent land policy practices and support from elsewhere, notably from and through diverse types of diaspora remittances. And apart from these political shifts, changing living standards in society and family structures hamper the development of adaptation strategies. For instance, an important trend that clearly impacts how people deal with environmental changes is the shift from a non-cash to money-based system (Dia, 2020). Many agro-pastoral households have members who moved to Dakar or to Europe, and so lack labor to guard cattle and raise crops. As a resilient solution, they pay in cash or in kind for the services of extended family members or kin whom they trust.

Overall, these factors have increased the attractiveness of internal and transnational migration, perceived as a powerful resource providing different revenues and (political) networks. Indeed, many villagers believe that it is important to be able to rely on (return) migrants with strong political connections, to attract public resources to improve livelihood conditions (e.g., hydro-agricultural facilities, such as dykes and irrigation systems; agricultural machines). Since the severe and subsequent droughts of the 1970s, international migration has become one way to adopt other coping and adaptation strategies (Tacoli, 2011; Dia, 2020):

> "The short rainy season limits our working hours [in the Mid-valley]. After the 'hivernage' [rainy season], we have nothing else to do so we have to come to Dakar to work. We ask our migrants in Europe to invest in water boreholes and irrigation means to cultivate in the dry season as well. But there are not enough of them left yet and they don't have enough means to help us in agriculture in the village." (28-year-old male, internal migrant from the Mid-valley Commune of Méry, interviewed in Dakar).

Internal and/or international migration of at least one family member, who will then contribute to the family's livelihood by sending remittances (financial, material, and immaterial), was generally perceived as necessary by most participants from the Mid-Valley (Lietaer et al., 2020). These migrant networks have sent material and non-material remittances to most of these villages; this has resulted in greater independence from vulnerable local agro-ecological conditions (see Doevenspeck et al., 2011), triggering more international migration due to environmental hazards. Besides the constraints on their livelihoods, there are also strong social and cultural reasons behind the migration of Senegalese youth. Amongst the Haalpulaar popular culture, migration stems more from

the culturally embedded idea that it is normal to leave the community of origin. [1] The migrant's project is usually also a community project (Tandian, 2018). Most participants considered migrants' contributions—via collective remittances through their hometown organizations – as crucial for their community's resilience. Likewise, individual financial, material (home or water pump solar panels, smartphones, etc.), and immaterial remittances (ideas, skills, 'political' contacts, etc.) are also perceived as enhancing household living conditions in an adverse socio-environmental context.

Importantly in the suburbs of Dakar internal migrants also face new adverse environmental effects as they settled in flood-prone areas during the 1970s droughts, are now confronted with recurrent floods, water, and air pollution, and thus increased expenses. Our participants often relied on international migrant networks to cover some of these expenses. Young people interviewed confirmed that this also triggers aspirations to move abroad to "avoid being a burden," and "become capable of improving their family's living conditions" (also Van der Land, 2018). Fatoumata, a 22-year-old student, who lives with her aunt in a flooded neighborhood of Pikine, Dakar, states:

> "Almost the whole neighborhood is flooded every year because there is no sanitation system, and we experience these problems in our homes every year. The administrative authorities don't do anything, it's the neighborhood volunteers who do everything. Fortunately, when it's too bad, we can ask some help from family in Europe (…) I don't like that, because we want to be independent!"

Besides a perceived lack of opportunities in Senegal to meet their own personal development aspirations, most also wanted "to be part of these successful contributing village and family members", as many village members expressed it, both in Dakar and in the Mid-valley villages. To conclude, fieldwork in Senegal shows clear perceived and experienced concerns about environmental changes and their impacts on daily living conditions. While such changes and hazards may not be perceived as a main direct driver of migration *per se*, their interlinkages with other drivers contribute to migration aspirations.

DR Congo

In both Kinshasa and Goma if people notice environmental changes they seem disinterested. This does not reflect the reality of these urban areas, where many occupied by the poorest populations are endangered by sudden events, such as landslides and heavy rainfall. Nonetheless, we can

attribute such perceptions to the fact that people have other daily concerns, which for many are a question of survival (Michellier *et al*., 2020). However, the viewpoint of people living in Kinshasa differs significantly from those in Goma. In Kinshasa, most participants indicated that they have no resources to address such changes, but in Goma, they do not feel affected by such events, as expressed by a 43-yearold male: "I don't know the people who are undergoing these changes. My community is not affected." From both points of view, the consequence is that there is no real willingness to adapt or to help those negatively impacted. During interviews, participants frequently mentioned their sole aim was to improve their daily life and standard of living.

Consequently, in DR Congo, migration, whether internal or international, appears to be frequently due to a multitude of social, political, or economic factors (Sumata *et al*., 2004; Gemenne *et al*., 2013), themselves driving environmental change and degradation, such as uncontrolled deforestation, urban sprawl, mineral extraction leading to industrial pollution, or overexploitation of agricultural land resulting in soil erosion. Although these may influence the decision to migrate, they alone seem insufficient to determine migratory behavior, as shown in previous studies (Gemenne *et al*., 2013; IOM, 2017). Insecurity (physical and income security) and lack of basic social services (clean water, healthcare, sanitation systems, education) and personal development opportunities systematically dominate the Congolese participants' discourses. These worries and related hardships experienced reflect the typical characteristics of a "failed state" or "fragile state" (Trefon *et al*., 2002). Nevertheless, public services are somehow provided by a wide range of actors (including non-state providers such as NGOs). Our interviewees, however, did not perceive these services as sufficient to preserve them from environmental stress, nor to allow decent living conditions.

Local institutions responsible for environmental protection and disaster risk reduction have limited intervention capacity. These issues are not a priority for the authorities, which are trapped in weak governance and short-termism. Such a system prevents the implementation of effective disaster risk and land degradation reduction actions, such as prevention and awareness-raising programs; teams are untrained, understaffed, and underfunded (Michellier *et al*., 2020; Trefon, 2016). Until more attention is devoted to disaster risk reduction and environmental degradation, the population, continually growing, will continue to suffer. Combined with a lack of family planning and the importance of large families for long-term survival, natural resources will become even scarcer and more precious (Trefon, 2016). While political and economic drivers appear to have several direct effects on the migration aspirations of our Congolese interviewees, environmental changes do not appear to influence them.

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[1] In fact, popular culture is full of proverbs that highlight the importance of migration: 'If you have a son, let him go. One day he will come back, either with money or with knowledge or with both' (Tandian, 2018).

Discussion

Our objective is twofold: to understand firstly how people perceive environmental changes, and secondly, how such perceptions are linked to migration (and other adaptation strategies) in DR Congo, Senegal, and Morocco. We first examined how inhabitants of the selected research settings perceived environmental changes to better understand the reasons for diversity within these perceptions as well as to examine how they fueled specific adaptation strategies (or the lack thereof). This linkage is interesting: adaptation is a somewhat artificial notion, but it is useful to grasp which livelihood strategies are adopted in response to environmental stressors, and how this relates to migration aspirations and/or trajectories—which are often proposed as an adaptation strategy (Barnett & Webber, 2010). 'Adaptation' in contrast to 'coping' describes longer-term, strategic measures taken to counter environmental risks, by creating new resources or by addressing vulnerability factors (Birkmann *et al*., 2013); it is therefore necessary to examine how migration could be an adaptation strategy to also understand its consequences (Authors).

People perceived environmental changes in various and distinct ways, depending on their living environment, the type of environmental changes that affected their livelihoods as well as their individual characteristics. This means that regions, policymakers and environmentalists cannot automatically build on just one set of shared ideas concerning the locally changing natural environment. Moreover, interpretations and explanations given for these changes seemed to rely on people's knowledge of climate change discourses, local environmental policies, social struggles, personal experiences with their home environment, and (religious) beliefs (Authors; De Longueville *et al*., 2020; Jenkins *et al*., 2018). Large rural–urban differences were noted in Morocco relating to whether people perceived the environmental changes in their local environment and the effect on their own lives; yet in Senegal and DR Congo, people living in cities, such as the urban areas of Dakar and Kinshasa, also experienced and perceived adverse effects of environmental changes and hazards. This highlights the importance of the nature of these environmental changes and their recurrence, which in turn impacts how they fuel the development of adaptation strategies, including migration. For example, in DR Congo, respondents, particularly those living in Kinshasa, are often confronted with gullying and sudden environmental disasters (e.g., landslides during the rainy season). However, few or no coping strategies have been developed in the face of their daily struggle for survival (food security, physical security, etc.). As a consequence, they do not necessarily feel able to or responsible for developing adaptation strategies, for instance to face land degradation. Certainly,

structural deficits make it even more difficult to consider longer-term (coping) strategies. By contrast, in Senegal, people from both Dakar and the Mid-valley are confronted with recurrent events, such as annual floods and droughts, that severely impact their livelihoods. Consequently, these events and their effects are more easily recognized expressed and reacted to, notably by mobilizing members of the diaspora. Also, in Morocco, adaptation-specific actions, such as the construction of a dam, and associated political and social conflicts are more common in people's discourses, compared to actions undertaken to stop ongoing drought and desertification.

These findings are in line with the political ecology framework (Taylor, 2015). People's perceptions of environmental changes are in many cases linked to more concrete and visible consequences (e.g., on their own livelihood and/or political conflicts and actions). While food security and health are often perceived as affected by environmental stress (droughts, floods, erosion, etc.), other major domains, such as the weak (or almost absent) healthcare system, income insecurity and fair access to markets, are considered more pressing political issues. Furthermore, not all aspects of such environmental changes are considered problematic. For instance, as shown in the Senegalese case study, unpredictable timing and shorter periods of the rainfalls, potentially disrupting all harvests, were seen as more problematic than increased rainfall (if not too intense), especially by people in agriculture. Nonetheless, in all research settings, political and policy initiatives facilitate a growing awareness of environmental issues and how human-made factors intervene and thus adapt or aggravate such changes. In regions that are more appealing for local and international investors and policymakers, more efforts are made to invest in adaptation strategies, such as land and water management, and to invest in agricultural production. This also makes all inhabitants more aware of the ongoing environmental changes and the disruptive effects of policy/company initiatives. Other regions that have suffered environmental degradation for longer are less interesting for investors and are slowly abandoned. People then focus more on household income diversification, migration, and switching professions. This trend is so strong that it already disconnects migration motivations from (perceived) environmental change, and only reconnects them when environmental changes give rise to political and social conflicts.

Across research sites, migration was often not immediately linked to environmental factors and changes by persons living in affected regions. Our case-studies show that most people would not migrate because of environmental adaptation considerations, certainly not when aspiring to international and permanent migration. Other drivers of

migration, such as education and job opportunities, were mentioned—which could act as adaptive capacities in the longer run. Rather, migration was in some cases seen as a path to "success" for unemployed people, particularly young people (e.g., Tandian, 2018), and a path to greater security (especially in the case of DR Congo, Schoumaker & Flahaux, 2016). The only exception is when people face extreme environmental rapid-and-slow-onset events and temporary internal relocation is deemed necessary, for example after damage to buildings caused by heavy rainfall in all three countries, landslides in DR Congo, and tidal waves in the suburbs of Dakar. Nevertheless, both Senegal (Panizzon, 2008; Toma & Kabbanji, 2017) and Morocco (Lacroix *et al*., 2008) have implemented migration policies with international development partners that encourage co-development through hometown organizations' collective remittances, investment, and return of emigrants. Governmental agencies are promoting Diaspora investments in government-run infrastructure projects and utilizing business contacts and professional networks established by emigrants abroad. The effects of these policies in the study zones of these countries were relatively significant, although not in DR Congo. These findings indicate that policymakers could see how remittances can be invested to build other tangible and intangible resources, which could be used for adaptation purposes. However, due to differing perceptions of environmental changes within and across groups, and because environmental changes are rarely linked with migration, the potential of migration as an adaptation strategy is not (yet) fully exploited or strategically coordinated (Michellier *et al*., 2020). The immediate spending of remittances on household consumption, education, land, and other property has long-term economic, social, and generational impacts that affect people's aspirations (especially young people) and their opportunities to realize them. And yet pertinent adaptation measures that allow for long-term adjustment of economic strategies can reduce forced movements (Geddes, 2015).

Finally, both the perceptions of environmental changes and how such changes are related to migration (and other adaptation strategies) should be understood within the changing societal structures and incomplete decentralized policies in these countries. These changes further complicate the development of long-term and sustainable investments to tackle environmental changes, to make agriculture more attractive, and to develop adaptation strategies. The main concern in all these regions is the vulnerability of people exposed to environmental impacts, their loss of human and economic security (Tschakert, 2007) and their limited freedom of choice as to whether to move (Zickgraf, 2019). Environmental changes are an additional stress, undermining the confidence of older and younger people in staying as a reasonable option, and hence bolstering migration aspirations.

Some limitations of this study should be noted that are relevant for future research. When interpreting these results, it is important to be aware of biases in perceived climate changes. These biases tend to categorize and imagine past weather always as 'better' (Mertz *et al*., 2012) and to focus on extreme events and rainfall as environmental changes, rather than slow changes in temperature. More research is needed to fully understand how different cultures and religions perceive environmental changes and which cultural/religious factors contribute to distinct perceptions (De Longueville *et al*., 2020; Howe *et al*., 2014). Future research should include more factors, such as the number of people engaged in agriculture in a region, dependence on agriculture for regional prosperity, networks in rural areas, and the internal migration background of city dwellers.

Conclusion

Through a comparative study regions in Morocco, Senegal, and DR Congo facing distinct environmental changes and migration trajectories, we mapped differences in the perceived linkage between environmental changes and migration. Our findings indicate that awareness of environmental changes and whether this results in the development of migration aspirations is closely linked to the political and social consequences of these changes. This also reflects a bias in people's awareness of sudden or slow-onset environmental changes. Apart from these socio-political factors, an individual's profession and livelihood influence their awareness of environmental changes. In this regard, differences are found across regions/countries, reflecting distinct social structures, gender divisions, and dependence on agricultural activities within these settings. While migration sometimes appeared to be part of an adaptation strategy responding to broader socio-environmental change, the meeting of immediate needs took precedence, as often in developing countries (Conway & Mustelin, 2014): current and future trends in environmental and climate change and other drivers are of lesser concern than immediate consequences of under-development and modernization (e.g., Boissière *et al*., 2013).

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Availability of Data and Material Data is available upon request in a pseudonymised way to safeguard the identity of the participants.

Code Availability Not applicable.

Declarations

Ethics Approval All research was conducted according to the ethical guidelines provided by the host institutions the authors are affiliated with.

Conflicts of Interest/Competing Interests Not applicable.

Consent to Participate All participants have formally agreed to be part of the research and have given informed consent.

Consent for Publication All participants were aware that the interview data would be used for publication and scientific purposes.

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