

Climate Hazards, Aspirations to Stay and Climate Immobility in Mozambique

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Title Page

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Climate Hazards, Aspirations to Stay and Climate Immobility in Mozambique

ABSTRACT

Conventional wisdom and prevailing theories assume that when humans are seriously affected by climate hazards, they will migrate. Based on systematic data from four communities in Beira, a coastal city in central Mozambique that is highly exposed to sudden and slow onset climate hazards, this study found, firstly, that the majority will be unable to move, will plan to leave only in the future, or do not want to leave at all. A high proportion will never leave; will remain even if climate impacts continue to worsen or will be unable to leave. Secondly, when tested against aspiration to stay, climate hazards have little effect on climate mobility. Thirdly, by probing the drivers of aspirations to stay, as a proxy for climate immobility, we found that the *capability to stay* and *needs*, followed by *adaptation*, explain climate mobility widely. But *dignity* and *intersectionality* also play their roles. The study identifies areas for further research and for policymakers to better support immobile populations amid intensifying climate shocks.

Keywords: *climate hazards, climate immobility, aspiration to stay, capability to stay, adaptation, intersectionality*

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INTRODUCTION

Climate migration scholars stress that environmental conditions, combined with other factors, drive people to move (Wyngaarden et al. 2022; Yang et al. 2025; Ivanova et al. 2024; Black et al. 2011; Semenza and Ebi 2019). They tend to focus on a linear relationship between climate change and mobility, suggesting that once severely affected by climate hazards, humans will migrate to other locations. This perspective “produced warnings about the ‘threat’ of climate-induced mass migrations” (Boas et al. 2022), and it has been heavily criticized (Bettini 2013; Foresight 2011; Black et al. 2011), due to its oversimplified models and assumptions (Selby and Daoust 2021; Durand-Delacre et al. 2021). It considers ‘moving away’ as the only effect that climate change may induce in people, ignoring that many might be trapped or decide to stay. In contrast, climate immobility scholars stress that when seriously affected by climate hazards, many people will be unable to move, will choose not to move, or will move and return (Thomas et al. 2025).

Climate immobility studies have been limited but are gaining momentum (Schewel 2021; Vezzoli 2023; Debray, Ruysen, and Schewel 2023; Freihardt 2025; Transiskus and Bazarbash 2024; Blondin 2021). How scholars explain climate immobility depends, in part, on analytical frameworks. One of the well-known frameworks explaining immobility is the aspiration-capability model (Collins and Carling 2019; de Haas 2021; Schewel 2021). But other possible explanations of immobility include adaptation (Bernasconi 2025; Rufat and Kuhlicke 2025; Hidayati and Liang 2026), needs (Bergmann 2024; Doyal and Gough 1991), dignity (Bergmann and Martin 2023; Yamaguchi 2026; Schewel 2021; Tschakert and Neef 2022; Ahmed and Mallick 2026), and intersectionality (Nielsen et al. 2025; Cundill et al. 2021). Conceptually, the aspiration-capability model is framed in relation to three dimensions of immobility: voluntary, involuntary, and acquiescent immobility. Yet it does not consider other dimensions of immobility, particularly for those who have moved and returned.

This study contributes to the literature by considering all these aspects, focusing on the case study of Beira, a coastal city in the central region of Mozambique, highly exposed to both slow-onset and sudden climatic hazards, including cyclones, flooding, and sea level rise. This study is two-fold: Firstly, we test and probe the climate migration scholars’ assumption that environmental conditions lead people to migrate. To avoid bias towards mobility alone, our dependent variable, climate mobility, includes both mobility and immobility. Further, to prevent a spurious relationship, we control the effect of environmental conditions on climate mobility for aspiration to stay. Secondly, we test and investigate the effect of five families of explanations on climate im/mobility, using aspiration to stay as a proxy of immobility. All of these are tested and analysed using a systematic public opinion data with a representative, random, stratified probability sample.

LITERATURE REVIEW

Numerous migration scholars associate environmental conditions with human migration in the sense that once affected by climate shocks, people will migrate (Yang et al. 2025; Ivanova et al. 2024; Black et al. 2011; Semenza and Ebi 2019). Ivanova et al. (2024) found that climate change is driving human migration. Black et al. (2011) argued that climate drives migration through mechanisms characterised as the availability and reliability of ecosystem services and exposure to hazards. Yang et al. (2025) stressed that climate conditions, in complex interrelations with other socioenvironmental, economic, political, and cultural factors, significantly play a key role in shaping population movement. Whilst climate migration

scholars stress that environmental conditions, combined with other factors, drive people to move, climate immobility scholars reveal otherwise. Thomas et al. (2025) stressed that when seriously affected by climate hazards, many people will be unable to move (or will be trapped), choose not to move (voluntarily or involuntarily), or move and return. In this scope, what makes people prefer and/or decide to stay?

Aspiration-capability is one of the earliest and well-known theoretical frameworks explaining climate immobility, developed from three dimensions of immobility: voluntary, involuntary, and acquiescent (Collins and Carling 2019; de Haas 2021; Schewell 2021). The *aspiration to stay* approach is understood as the conscious preference to remain in one's current location rather than migrate. Aspiration to stay can be driven by non-economic factors or place attachment that includes closeness to nature, family, and friends (Vezzoli 2023), social ties, local amenities, trust in community institutions, and life satisfaction (Debray, Ruysen, and Schewel 2023), among other aspects. The *capability to stay* model is assumed as the ability to achieve well-being, flourish, and realize one's values in one's place of origin. As we show in this study, it is indicated mostly by resources and means for well-being.

The aspiration-capability explanation to voluntary immobility assumes that people can voluntarily hold a deep-seated 'aspiration to stay' in their home community, even if they have the means to migrate. With respect to involuntary immobility, it stresses the gap between wanting to migrate and lacking the capability to do so. Regarding acquiescent immobility, it highlights those who both have no desire and the capability to migrate (Schewel 2021). However, the aspiration-capability model ignores other dimensions of immobility, for instance, circular mobility (Skeldon 2016; Thomas et al. 2025), indicated among others by those who have migrated and later returned, because they did not achieve well-being in their destination site, for example. As a result, the literature advances with alternative explanations of immobility, such as adaptation, needs, dignity, and intersectionality.

Adaptation explanation assumes that adaptation in place (or adaptation *in situ*), the process of adjusting a system, community, or ecosystem in its current location to cope with climate conditions, influences people to prefer and decide to stay (Rufat and Kuhlicke 2025; Hidayati and Liang 2026).¹

“The adoption of novel technologies, the utilization and diversification of crops, infrastructure reinforcement, and analogous practices [play] pivotal roles in adapting to evolving climate and environmental conditions without necessitating proactive or reactive migration processes” (Bernasconi 2025:12).

Adaptation in place strategy is viewed as an ‘anticipatory action’, before the relocation of whole communities is considered², “to support the resilience of people and communities” who choose to remain (Thomas et al. 2025:47). Individuals who stay may develop new strategies and skills to make staying viable, transforming aspirations into capabilities and into adaptation. Communities may adapt in place by improving infrastructure, changing livelihoods, and strengthening social networks to build resilience without migrating.

Human *dignity* is associated with climate immobility (Bergmann and Martin 2023; Yamaguchi 2026; Schewel 2021; Tschakert and Neef 2022; Ahmed and Mallick 2026). The dignity approach (or rights-based approach) to climate immobility emphasizes the right of people to stay in their homes and communities with support and resources. In a context of climate shocks,

¹Besides adaptation in place, other adaptation strategies include relocation and migration. These strategies are not reviewed in this study since they are mostly associated with migration, not immobility.

²Climate mobility: from evidence to anticipatory action, <https://10insightsclimate.science/year-2022/climate-mobility-from-evidence-to-anticipatory-action/> accessed on 25/5/2026.

“action is needed to respect” (Bergmann and Martin 2023:3) and safeguard the rights of people who stay (Bernasconi 2025), suggesting the adoption of policies that integrate universal principles of climate justice and human rights in the current location (Thomas et al. 2025; Thornton, Serraglio, and Thornton 2023). A lack of dignity can trap people in place due to poverty and limited resources, while policies and initiatives centered on dignity can provide people with the agency to choose whether to stay or move, ensuring that their fundamental human rights are protected in either case. When people are affected by climate conditions and must be relocated, they should also be given the “right to remain” (Schewel 2021).

Needs, understood as universal basic needs³ “that everyone either does or should try to achieve” (Doyal and Gough 1991:35), shape people’s preferences and decisions to stay. When needs aren’t met, people become more vulnerable, less capable, and more difficult to adapt (Bergmann 2024) and end up trapped. Whilst needs studies exist, few are related to climate immobility, suggesting an area for a research agenda.

With respect to climate immobility, *intersectionality* is about how different aspects of people’s identity interact to create a unique system of discrimination or not that affects their preferences and decisions to stay. It is measured by “interconnected [indicators] such as race, class, gender, (...) as they function within interdependent (...) environmental conditions linked to systems of power, privilege and oppression” (Nielsen et al. 2025:330). It suggests, in quantitative cross-sectional data, a multiplicative intersectionality measure compounded from the intersection of age and gender to form young females’ interconnection, for instance, or of race and social class to construct black destitutes. Studies on the effect of intersectionality on climate immobility are necessary (Cundill et al. 2021), but “clear guidance on quantitative intersectional analysis is still lacking” (Nielsen et al. 2025:334). As a result, scholars end up looking at the individual uncompounded nonmultiplicative effects of gender or race, ethnicity, and class. This has been the case, for instance, of Debray, Ruysen, and Schewel (2023), who explained aspiration to stay by urbanization levels, population groups, gender, education levels, rural/urban residential locations, migration story, religiosity, and perceived thriving alone.

METHODS

This study is focused on Beira, a coastal city located in the central region of Mozambique. Beira is highly vulnerable to climate hazards (sudden and slow-onset events), including tropical depressions and cyclones, floods, drought, heat stress, coastal erosion, sea level rise, and saline intrusion into freshwater systems. For example, Tropical Cyclone Idai in 2019 caused widespread flooding and coastal erosion, with over 90% of the city’s infrastructure damaged or destroyed (IFRC 2019). Recovery is still ongoing in the context of cyclical tropical storm events affecting the region⁴. The city has a young and growing population, and it is characterised by high levels of informal settlements, land conflicts, and a lack of urban planning. It has five administrative posts and 26 wards (communities), of which we randomly selected four, among those that are most vulnerable to environmental hazards: *Praia Nova*

³ The universal basic needs include physical health and cognitive autonomy. Physical health needs “comprise food, water, shelter, non-hazardous work and physical environments, physical security, health care, security in childhood, significant primary relationships, economic security, safe birth control and childbearing, and education. [These needs] create conditions (mental health, thinking skills, and chances for social participation) in which cognitive autonomy can be satisfied” (Bergman 2024:42).

⁴ Since 2020 Mozambique has experienced 15 tropical storm or cyclone events. See here for more information: <https://www.worlddata.info/africa/mozambique/cyclones.php> (accessed 26 June 2026)

within the Chaimite administrative post; *Vaz*, in the Munhava administrative post; *Ndunda*; and *Mungassa*, in the Manga-Loforte administrative post.⁵

Data and research design. This study uses public opinion survey data conducted in February and March 2025 through face-to-face interviews with a representative, random, stratified probability sample of 416 individuals (Shenga, Howe, and Macome 2025). As the data is at the individual level, this study's analysis is primarily at that level. The sample was drawn by taking the smallest geographic units within Census Enumeration Areas (EA/ward), sub-EA known as *Quarteirão*. Thirteen *quarteirões* were then randomly selected from their list with the probability proportionate to their size in the overall population as represented in the 2017 population census. Thirty-two households were then randomly selected within each *Quarteirão*, and a respondent 18 years of age or older was randomly selected from each household. A sex quota of 50-50% ensured that every other interview was with a female. This data reveals a cross-sectional research design, suggesting that "people of many ages, behaviours, and opinions are represented within the study population" (Lewis-Beck, Bryman, and Liao 2004:299-230).

Data Analysis Strategy. In this study, we employ several indicators of climate mobility and its explanatory factors. It uses two types of indicators: *Single items* are used where a concept is indicated with one survey question. *Multiple indices* are employed wherever possible, depending on factor analysis, which measures how an observed item relates to a hypothesised construct, and reliability analysis (Cronbach's Alpha). To test the effects of competing explanations on climate mobility, we use statistical multivariate regression modelling. Where the dependent variables are coded in linearity, we employ the ordinary least squares regression model, and where they are coded in binary form, we use binary logistic regression.

For the first test of the hypothesis, our first dependent variable is climate mobility, indicated by eight measures. The first is the *climate immobility index*. It is an index that combines the constituent concepts of people's predisposition to not wanting to leave their place and still wanting to remain even if climate impacts continue to worsen; their observation that they will never leave their current home; and their visualization that they cannot imagine leaving their place. The index was constructed from a set of questions⁶ coded: strongly agree (1) agree (2), neither (3), disagree (4), and strongly disagree (5) and recoded into 0-1-2, where the high code is associated with those who agree/strongly agree, the low code with disagree/strongly disagree; and the mid code with those who were indifferent (those who said: neither) or did not know.⁷ As we give high code to immobility rather than the mobility side of the questions, we

⁵ *Praia Nova* is an informal settlement exposed directly to the bay of Beira and suffers from frequent flooding and storm surge events, as well as the impacts of sea level rise. It is populated by fishermen, informal traders, and other destitute people, and it constitutes a vibrant informal market of fish, food, and second-hand clothes, among other consumables, that attracts almost the entire city. *Vaz* can be best described as a swamp surrounded by rice fields for households' self-subsistence, and it is prone to floods. Private sector land development in the rice fields is further exacerbating flooding in *Vaz*, as these land developments, adapting to the reality of the frequent flooding in the area, are building their infrastructures at a higher altitude than existing households. *Ndunda* and *Mungassa* are both crossed by the Beira corridor National Road N6, which links Beira port to Zimbabwe, Malawi, and Zambia. Like *Praia Nova*, *Vaz*, *Manga-Mungassa*, and *Ndunda* are mostly informal settlements. They also tend to be surrounded by subsistence rice farming fields, as their low-level geography is prone to harvesting rainwater to cultivate this crop (Shenga, Howe, and Macome 2025).

⁶ Please tell whether you agree or disagree with the following statements: A. I do not want to leave this place. B. I would remain if climate impacts continued to worsen. C. I will never leave my current home. E. I cannot imagine leaving this place. F. I want to move somewhere else, but I am unable to leave.

⁷ A single unrotated factor was extracted with eigenvalue greater than one (2.88) and 72% of the common variance explained. Index reliability (Cronbach's Alpha = .87) is acceptable. Factor loadings: I do not want to leave (.67),

call it the *climate immobility index*. The other two items from this set of questions (that factor, and reliability analyses did not prove to be part of the immobility index) remain as single items. They refer to the situations where people are unable to move (trapped) and have not made plans to leave in the future.

The fourth measure is indicated by the question: *Are you originally from this area?* Those who responded yes are deemed to be immobile. The fifth is indicated by: *Have you moved away and returned?* Respondents who say, ‘yes, moved away and returned’ are immobile compared to those who say, ‘moved away and did not return’. The sixth is measured by: *How long have you been living here?* Respondents who say 6 to 10 years are deemed to be immobile compared to others, although those more than 10 years also are. The seventh measure of climate immobility is indicated by the question: *Do you live anywhere else for short periods during a year?* Those who said no are viewed as being immobile. The eighth is measured by: *Do any of your household members live anywhere else for short periods during a year?* Respondents who express no are treated as immobile.

Climate hazard is the explanatory factor that we test on climate immobility, controlling for *aspiration to stay*. It is measured by: *What environmental or climate hazard have you been affected by in this neighbourhood?* Here, we considered only responses that at least comprised five percent in several categories (flash flooding, cyclone/tropical depression, rising average temperatures, sea level rise, storm surge or coastal flooding) where we created dummy variables of the first three, keeping the fourth as a reference.

Aspiration to stay is measured by a set of questions⁸ coded strongly agree (1) agree (2), neither (3), disagree (4), and strongly disagree (5) and recoded into 0-1-2, where the high code is associated with those who agree/strongly agree, the low code with disagree/strongly disagree; and the mid code with those who were indifferent or did not know. From these questions, we constructed two valid and reliable composite indices (that is, latent variables) of aspiration to stay. The first composite index entailing the following observable variables:

I see my future **here** as happy and satisfying.
 I am committed to the people and institutions **here**.
Here I can practice my religion and culture.
 My family needs me **here**.⁹

And the second:

I am **working towards** a positive future here in this place.
 I do not want to risk losing the community services I get from living here **by leaving**.
 Because **I know this neighbourhood**, I feel safe.

I would remain if climate impacts continued to worsen (.82), I will never leave my current home (.89), and I cannot imagine leaving this place (80).

⁸ Please tell whether you agree or disagree with the following statements: A. I see my future here as happy and satisfied. B. I see my future here economically secure. C. I am committed to the people and institutions here. D. I am working towards a positive future here in this place. E. I do not want to risk losing the community services I get from living here by leaving. F. This area is connected to my cultural heritage and personal identity. G. Because I know this neighbourhood I feel safe. H. I cannot see myself and or my family living in another place. I. I cannot gather the social network and support in any other place except here. J. Here I can practice my religion and culture. K. My family needs me here. L. People who stay here are seen to be kept from negative influences or situations.

⁹ A single unrotated factor was extracted with eigenvalue greater than one. Cronbach's Alpha = .62. Factor loadings: I see my future here as happy and satisfied (.41), I am committed to the people and institutions here (.43), Here I can practice my religion and culture (.48), and My family needs me here (.81)

I cannot see myself or my family living in **another place**.¹⁰

We shall call the first the *internal index of aspiration to stay*, as its observations mostly address the current place where respondents live. The second composite index's observations report the place where respondents are based, but in relation to other aspects, including a positive future, mobility, knowledge of the place in relation to other places, and other places. Therefore, we shall call the second index the *external index of aspiration to stay*. The remaining items from this set of aspiration-to-stay questions are used as single items.

At the first stage, aspiration to stay is strategized as an independent controlling variable in the analysis of the relationship between climate hazards and climate immobility. But as we move, instead of continuing to use climate immobility as a dependent variable, we use aspiration to stay. Although they are different concepts, there is a strong, positive, and significant relationship between the climate immobility index and aspiration to stay indices.¹¹ Aspiration or preference to stay is then a proxy of immobility. With this strategy, as the second round of analysis, we analyse the effect of the five families of possible explanations for aspiration to stay reviewed above: capability to stay, needs, adaptation, dignity, and intersectionality.

Capability to stay is measured by questions¹² coded strongly agree (1) agree (2), neither (3), disagree (4), and strongly disagree (5) and recoded into 0-1-2, where the high code is associated with those who agree/strongly agree, the low code with disagree/strongly disagree; and the mid code with those who were indifferent or did not know. From these, we constructed a reliable and valid *economic capability to stay index* composed of resources and support, money and savings, family financial support, and more privileges than others.¹³ The remaining capabilities item questions are used as single items.

Needs is measured by questions¹⁴ coded strongly agree (1), agree (2), neither (3), disagree (4), and strongly disagree (5) and recoded into 0-1-2, where the high codes are associated with

¹⁰ A single unrotated factor was extracted with eigenvalue greater than one. Cronbach's Alpha = .73. Factor loadings: I am working towards a positive future here in this place (.55), I do not want to risk losing the community services I get from living here by leaving (.66), Because I know this neighbourhood I feel safe (.60, and I cannot see myself and or my family living in another place (.73)

¹¹ Pearson correlation between climate immobility index and internal and external aspiration to stay indices is equal to .61** and .63**, respectively.

¹² Please tell whether you agree or disagree with the following is statements: A. I can decide for myself to stay. B. I have the option to stay. C. I think the future will be better because of the actions I am taking now. D. If I were displaced by a climate related disaster, I feel that I have the resources and support to stay in this area. E. I have enough money and savings to stay here. F. Educational opportunities here help me to stay. G. I am happy with the quality of life here. H. My family and social networks help me when living here. I. I must consider the needs of other people before making any personal decisions. J. I can stay because people in my family leave to work and send money back. K. I am relatively privileged compared to other people in this place and this helps me to stay here.

¹³ A single unrotated factor was extracted with eigenvalue greater than one. Cronbach's Alpha = .62. Factor loadings: If I were displaced by a climate related disaster, I feel that I have the resources and support to stay in this area (.63), I have enough money and savings to stay here (.68), I can stay because people in my family leave to work and send money back (.45), and I am relatively privileged compared to other people in this place and this helps me to stay here (.44).

¹⁴ Please tell whether you agree or disagree with the following is statements: A. I am not discriminated in this place. B. Here I can lead a healthy life. C. Here I have freedom to live my life. D. Here I have access to enough food and water. E. My home is strong enough to withstand. F. Here is easy and safe for me to move around. G. I have access to adequate healthcare services. H. Here is safe for children. I. Staying here I am near my close relations/people important to me. J. I feel safe here. K. Here I can find work to support myself. L. Mothers and children have protection here. M. It is possible to get basic education here. N. Staying here culture/way of life is

those who agree/strongly agree, the low code with disagree/strongly disagree, and the mid code with those who were indifferent or did not know. We construct a composite index associated with a healthy life, freedom, a strong home to withstand, safety, and basic education. We call it the *social needs index*.¹⁵ All other items from this question are treated as separate single items. *Adaptation*¹⁶ and *dignity*¹⁷ are indicated by questions coded similarly to needs. For adaptation, it was possible to construct one *adaptation index*¹⁸ while the rest of its items are used as single items. For *dignity*, its two items are used as single items.

Intersectionality is captured through compounded multiplicative variables constructed from four demographics: gender,¹⁹ generation,²⁰ lived poverty²¹, and residential location²², where two interaction variables were created. The first is the interaction variable resulting from gender and generation, creating *young females*. And the second is from a residential location, and living in poverty, creating *Praia Nova destitutes*.

RESULTS

The patterns of climate mobility

In the six measures of climate mobility, three reveal climate immobility, and three illustrate climate mobility (Figure 1). A majority agree/strongly agree that they are unable to leave (65%), and plan to leave only in the future (56%). Half (50%) agree/strongly agree that they do not want to leave. And below half agree/strongly agree that they will never leave (46%),

passed down to the next generation. O. here the local government takes care of the community. P. Here our land rights are respected.

¹⁵ A single unrotated factor was extracted with eigenvalue greater than one. Cronbach's Alpha = .60. Factor loadings: Here I can lead a healthy life (.75), Here I have freedom to live my life (.38), My home is strong enough to withstand (.31), I feel safe here (.71), and It is possible to get basic education here (.28).

¹⁶ Please tell whether you agree or disagree with the following is statements: A. Support from government has made it easier to cope and recover from climate impacts. B. External financial and capacity building has made it easier to cope and recover from climate impacts. C. climate change adaptation and disaster risk management interventions have made it easier to cope with hazards. D. Provision of social services have helped to manage climate risks. E. Emergency warnings have made it easier to manage climate risks. F. Information on climate hazards has made it easier for me to manage climate risks. G. I have sufficient support for livelihood transition. H. I have sufficient technical and capacity support for livelihood transition. I. I have received compensation for losses. J. social networks and community support has made it easier to cope and recover from climate impacts. K. Social issues such as crime and violence have made it harder for me to cope and recover from hazards. L. Not being able to be involved in the decision-making process (i.e. local government, planning decisions) has made it harder for me to cope and recover from hazards.

¹⁷ Please tell whether you agree or disagree with the following is statements: A. When affected by climate hazards and my family and I must move the right of a person to be valued and treated with respect should come first. B. the right of a person to be valued and treated with respect should come second when hit by climate hazards and my family and I must move.

¹⁸ A single unrotated factor was extracted with eigenvalue greater than one. Cronbach's Alpha = .60. Factor loadings: Climate interventions (.65), Social services (.94), and Emergency warning (.27).

¹⁹ Gender is measured by this study sex quota of 50-50% coded 0 = male and 1= female.

²⁰ How old are you? Coded 0=else and 1=18-35 year of age.

²¹ Over the past year, how often if ever, have you or anyone in your family gone without: A. Enough food to eat. B. enough clean water to drink. C. medicines or medical treatment. D. enough cooking fuel. E. A cash income. Coded 0-1-2-3-4 (never/don't known, once/twice, several times, many times, always). A lived poverty index was constructed. A single unrotated factor was extracted with eigenvalue greater than one. Cronbach's Alpha = .60. Factor loadings: food (.79), water (.29), medicines (.61), fuel (.75), and cash income (.63).

²² Indicated by Enumeration Areas/wards: Coded: first, 0=else and 1=Praia Nova. Second, 0=else and 1=Vaz. Third, 0=else and 1=Mungassa.

would remain even if climate change worsens (43%), and cannot imagine leaving (39%). In the other five separate measures of climate mobility in Figure 2, climate immobility appears overwhelmingly in two, whilst climate mobility emerges mostly in three. An overwhelming majority expressed that they (85%) or members of their households (82%) do not live anywhere else for short periods during the year. Below half said that they are originally from the area where they currently live (30%), moved and returned (24%), and have been living in their place for 6-10 years (23%).

Fig. 1 Patterns of Climate Mobility in Six Measures²³

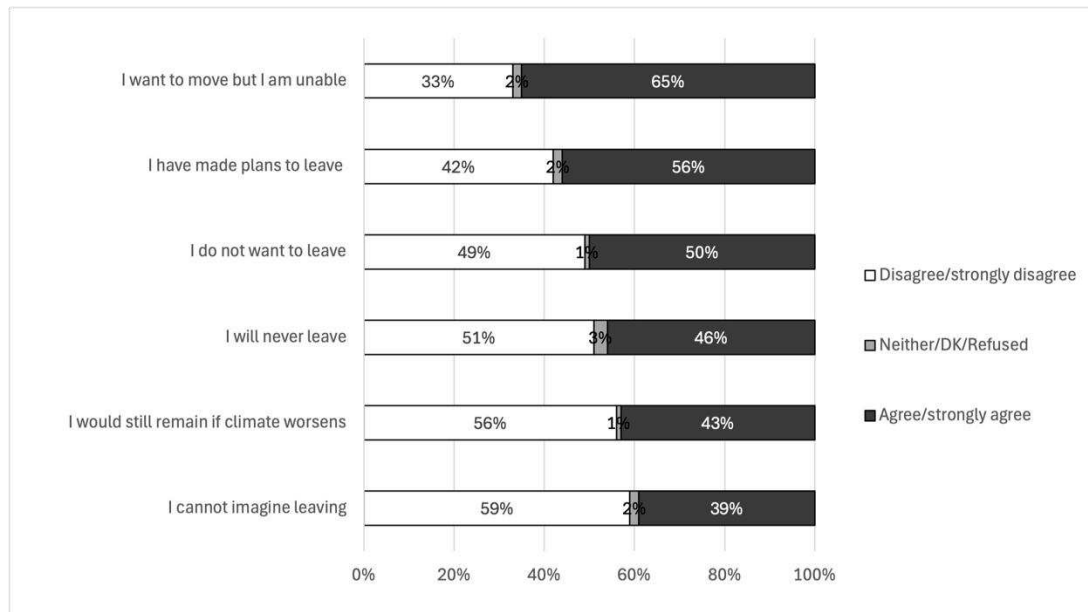
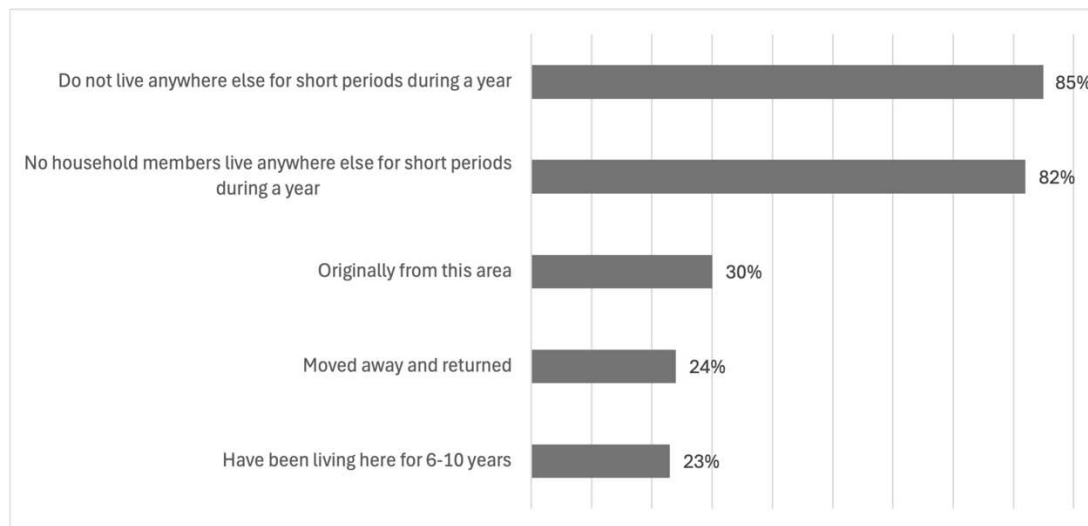


Fig. 2 Patterns of Climate Mobility in Five Measures²⁴



²³ Survey question: *Please tell whether you agree or disagree with the following statements: A. I do not want to leave this place. B. I would remain if climate impacts continued to worsen. C. I will never leave my current home. E. I cannot imagine leaving this place. F. I want to move somewhere else, but I am unable to leave.*

²⁴ Survey questions: *Are you originally from this area? Have you moved away and returned? How long have you been living here? Do you live anywhere else for short periods during the year? Do any of your household members live anywhere else for short periods during the year?*

The effect of climate hazards on climate immobility, controlling for aspiration to stay

As the first round of analysis, we test the effect of climate hazards on climate immobility, considering simultaneously the effect of aspiration to stay. OLS multiple regression results in Table 1 show that, on one measure of mobility, people who have been affected by climate hazards, and in particular rising average temperatures, are more likely to stay. On the other hand, people are less likely to stay. While these results show that climate hazards affect climate mobility, the climate hazards' explanatory power (as indicated by Adjusted R Square) on climate mobility is too shallow, ranging only from 0 to 1%. Alternatively, aspiration to stay appears to be the main explanation for climate mobility. People who voluntarily hold a deep-seated 'aspiration to stay' in their home community (due to non-economic factors like positive future, community services, neighbourhood safety, attachment to place, happiness and satisfaction, commitment to the people and institutions, religion and culture, and family, cultural heritage, and personal identity, and kept from negative influences) are more likely to stay than others. The explanatory power of the aspiration to stay model is more robust (2-49%).

Table 1 Ordinary Least Squares Multiple Regression Models Explaining Climate Immobility

	Climate immobility		
	Model 1 <i>Immobility index</i>	Model 2 <i>Unable to to leave</i>	Model 3 <i>Plan to leave in future</i>
<i>Climate hazards</i>			
<i>Flash flooding</i>	-.008	.012	.075
<i>Cyclone/tropical depression</i>	.030	-.063	.072
<i>Rising average temperatures</i>	.113*	-.125**	-.004
Adjusted R Square	.004	.012	.001
<i>Aspiration to stay</i>			
<i>Internal aspiration to stay index</i>	.331***	-.007	.244***
<i>External aspiration to stay index</i>	.376***	-.088	.263***
<i>Future economic safety</i>	.042	-.076	.044
<i>Social networks</i>	.020	.069	-.042
<i>Cultural heritage and personal identity</i>	.107*	-.031	-.077
<i>Kept from negative influences</i>	-.045	.124**	-.048
Adjusted R Square	.49	.02	.17

Reported figures are Beta standardized coefficients. Significant effects are stressed in bold.

Different than others, Model 3 – 'Plan to leave' was inverted coded: 0-1-2, where the high code is 'disagree/strongly disagree', the mid code 'neither/DK/refused', and the low code 'agree/strongly agree'. Those who disagree/strongly disagree with the statement: 'I have made plans to leave in the future' are deemed to be immobile.

*** = significant at level of .001, ** significant at level of .01, * = significant at level of .05

The power of aspiration to stay explanation continues to hold even in other tests using a binary logistic multiple regression model and other measurements of climate mobility (see Nagelkerke R Square in Table 2). Ten measures of aspirations to stay impact climate mobility, but half of them are negative. This inconsistency is an issue that might be associated with mobility types. In Model 2, the negative effect of aspirations to stay relates to circular mobilities since mobility refers to people who moved and returned, and in Models 3 and 4, with mobility that occurs for a short period of time as opposed to that which occurs between 6 and 10 years (Table 2).

Table 2: Binary Logistic Multiple Regression Models Explaining Climate Immobility
Explaining aspiration to stay

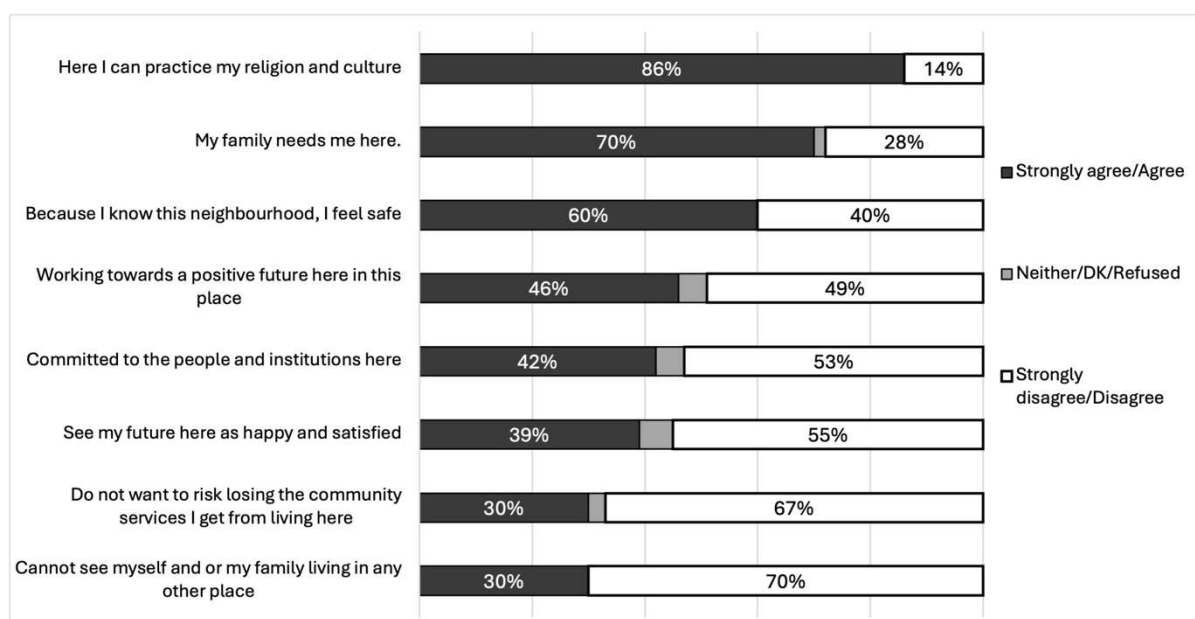
	Climate Immobility				
	Model 1 Originally from this area	Model 2 Moved and returned	Model 3 Been living here for 6-10 years	Model 4 I don't live anywhere else for short periods in a year	Model 5 No household member lives anywhere else for short periods in a year
<i>Climate hazards</i>					
<i>Flash flooding</i>	.756** (.265)	-1.149*** (.314)	-.409 (.307)	.578 (.387)	.462 (.330)
<i>Cyclone/tropical depression</i>	.067 (.313)	-.691* (.324)	-.281 (.338)	.864* (.424)	.256 (.356)
<i>Rising average temperatures</i>	-.368 (.344)	-.960** (.350)	.078 (.323)	.954* (.445)	.482 (.383)
Nagelkerke R Square	.047	.063	.010	.034	.011
<i>Aspiration to stay</i>					
<i>Internal aspiration to stay Index</i>	.062 (.891)	-.485** (.172)	.423* (.194)	.093 (.216)	.207 (.207)
<i>External aspiration to stay Index</i>	-.293 (.247)	.360 (.212)	.425* (.206)	.118 (.256)	-.036 (.239)
<i>Future economic safety</i>	.213 (.241)	-.195 (.155)	-.039 (.152)	.008 (.179)	.045 (.169)
<i>Social networks</i>	.430** (.166)	.132 (.167)	-.188 (.172)	-.404* (.194)	-.469** (.181)
<i>Cultural heritage and personal ID</i>	.905*** (.142)	-.037 (.140)	-.138 (.135)	-.139 (.168)	-.222 (.159)
<i>Kept from negative influences</i>	.318** (.147)	.244 (.149)	-.284 (.171)	-.367* (.167)	-.448** (.156)
Nagelkerke R Square	.27	.051	.074	.061	.11

Reported figures are B coefficients with Standard Errors in brackets. Significant effects are stressed in bold.

*** = significant at level of .001, ** significant at level of .01, * = significant at level of .05

Before testing and examining the effect of the five families of explanations for aspiration to stay, it is important to describe the patterns of the dependent variable, aspiration to stay. The results in Figure 3 show that aspiration to stay appears mostly in three out of the eight measures we employed, and aspiration to migrate mostly in four. Most respondents strongly agree/agree that, in their current place, they can practice their religion (86%), their family needs them (70%), and they feel safe (60%). Also a significant proportion strongly agree/agree that, in their current place, they are working towards a positive future (46%), they are committed to the people and institutions (42%), they see the future as happy and satisfied (39%), they do not want to risk losing the community service they get from living there by leaving, and cannot see themselves of their family living in another place (30%).

Fig 3 Patterns of Aspiration to Stay²⁵



Testing and examining the effect of each of the five explanations for aspiration to stay, the *capability to stay* accounts for more. The results in Table 3 show that of the seven measures of capability to stay, six have positive effects. First, among measures of capability to stay, *quality of life* matters more, with people who view themselves as happy with the quality of life more likely to aspire to stay. Second, on *family networks*, individuals whose family and social networks help them to live tend more to aspire to stay. Third, with respect to *education opportunities*, those who believe that educational opportunities help them to stay are more likely to stay. Fourth, observation of a *better future* is also relevant. Those who believe that the future will be better because of the actions they are taking now tend to prefer to stay. Fifth, moving to *economic capability to stay*, those who feel that they have resources and support, enough money and savings to stay, can stay because their family sends them money, or their privilege helps them to stay, are more likely to develop a deep-seated aspiration to stay. And sixth, on the *ability to decide to stay*, people with the ability to decide for themselves to stay tend to prefer to stay. Nonetheless, the *option to stay* has a negative effect. A simple option to stay leads people to not aspire to stay. We discuss this and other unexpected findings in the next section.

Needs equally account for variations in aspirations to stay. All five measures of needs have positive effects, with *cultural generations* having the biggest effect. People who believe that by staying their way of life is passed to the next generation tend to stay more than others. Second is the power of *social needs*. Those with social needs (that is, who view that where they are can lead to a healthy life, feel safe, have freedom to live, their home is strong enough

²⁵ Survey question: Please tell whether you agree or disagree with the following statements: A. I see my future here as happy and satisfied. B. I see my future here as economically secure. C. I am committed to the people and institutions here. D. I am working towards a positive future here in this place. E. I do not want to risk losing the community services I get from living here by leaving. F. This area is connected to my cultural heritage and personal identity. G. Because I know this neighbourhood, I feel safe. H. I cannot see myself and/or my family living in another place. I. I cannot gather the social network and support in any other place except here. J. Here I can practice my religion and culture. K. My family needs me here. L. People who stay here are seen to be kept from negative influences or situations.

to withstand shocks, and can get a basic education) are more likely to aspire to stay. The relevance of *mothers and children's protection* comes third. Respondents who observe that mothers and children are protected where they live tend to prefer to stay. Then follows, fourth, the importance of *land rights*, with those who view that, whereas their land rights are respected, are more likely to prefer to stay. Finally, fifth, is the power of *employment*. Respondents who said that here I can find work to support myself appeared to aspire to stay.

Moving to *adaptation*, of its five measures, four have positive effects. Adaptation through *climate information* comes first, positively affecting aspirations to stay. Those with climate information tend more to aspire to stay than others, as climate information makes it easier to manage climate risks. Being *excluded from decision-making* comes second, and it is positive, which is an unexpected finding. *Adaptation index* (composed of climate adaptation and disaster risk management interventions, provision of social services, and emergency warnings) comes third with a positive effect. People who experienced adaptation and disaster risk management interventions, provision of social services, and emergency warnings tend to stay, as these aspects make it easier for them to cope with climate hazards. Fourth is the positive effect of *social networks and community support*. As social networks and community support have made it easier to cope and recover from climate impacts, those who have it tend to stay. *Social issues* like crime and violence come last but also impact mobility outcomes. As crime and violence make it harder for people to cope and recover from hazards, people affected by it are less likely to stay than others.

Dignity affects human mobility as human rights matter. The *first* right has a negative (unexpected) effect, while the *second* has a positive one. Those who care less about their rights when hit by climate hazards are more likely to aspire to stay. They don't value their rights when they are treated unfairly by autocrats to leave. Finally, *intersectionality* matters, with young females less likely to aspire to stay than others. The interaction of being a destitute in Praia Nova has nothing to do with aspiration to stay at all, as its results are not statistically significant. In sum, while we have seen that all five families of explanations reviewed explain aspiration to stay, the explanatory power of *capability to stay* (43-49%) and *needs* (45-47%), followed by *adaptations* (15-16%), weighs more. *Dignity* only explains 2-4%, and *intersectionality* only 1% of people's aspiration to stay.

Table 3 OLS multiple regression models explaining aspirations to stay

	<i>Internal index of aspiration to stay</i>	<i>External index of aspiration to stay</i>
<i>Capability to stay</i>		
<i>Economic capability to stay index</i>	-.026	.112**
<i>Can decide to stay</i>	.065	.097**
<i>Have option to stay</i>	-.297***	-.132***
<i>Future will be better</i>	.093**	.160***
<i>Educational opportunities</i>	.145***	.210***
<i>Quality of life</i>	.166***	.296***
<i>Family networks</i>	.290***	.117**
Adjusted R Square	.43	.49
<i>Needs</i>		
<i>Social needs index</i>	.200***	.272***
<i>Employment</i>	.128**	.089

<i>Land rights</i>	.014	.153***
<i>Mothers and children protection</i>	.077	.175***
<i>Culture generation</i>	.351***	.066
Adjusted R Square	.45	.47
<i>Adaptation</i>		
<i>Adaptation index</i>	.065	.174**
<i>Climate information</i>	.132**	.202***
<i>Social networks and community support</i>	.163***	.124**
<i>Social issues (e.g. crime violence)</i>	-.165***	-.019
<i>Excluded in decision-making</i>	.181***	.030
Adjusted R Square	.16	.15
<i>Dignity</i>		
<i>Rights first</i>	-.096*	-.153**
<i>Rights second</i>	.180***	.036
Adjusted R Square	.04	.02
<i>Intersectionality</i>		
<i>Young females</i>	-.083	-.116**
<i>Praia Nova destitutes</i>	-.001	-.069
Adjusted R Square	.002	.013

Reported figures are Beta standardized coefficients. Significant effects are stressed in bold. Variables that are not significant for both dependent variables were omitted.

*** = significant at level of .001, ** significant at level of .01, * = significant at level of .05

DISCUSSION

Conventional wisdom and prevailing theories suggest that when people are seriously affected by climate hazards, they will migrate. This study's systematic data from the city of Beira in Mozambique, highly exposed to slow-onset and sudden climatic hazards, revealed, however, that the majority of respondents are unable to move, plan to leave only in the future, or do not want to leave at all. Further, a high proportion will never leave, would remain even if the climate impacts continued to worsen, or cannot manage leaving. This confirms reviews such as those by Thomas et al (2025). Immobility levels appeared in the majority, in five out of the eleven measures of climate mobility employed. And in those where mobility levels were the majority, the mobility majority levels were inferior to those of immobility. An important takeaway is that immobility is a complex, non-linear phenomenon that migration scholars often mistake for migration in the case of those who moved and returned – that is, circular im/mobility.

Probing the effect of climate hazards on climate mobility, controlling for aspiration to stay, using multivariate regression models, this study showed that the explanation of climate hazards has little effect, confirming the existing literature (Boas et al 2022; Wyngaarden et al 2022; Bettini 2013; Foresight 2011; Black et al 2011; Selby and Daoust 2021; Durand-Delacre et al 2021). But aspirations to stay matter, with people with a strong preference to stay in their home community more likely to be immobile. This study's novelty lies in the construction and use of two new dimensions of aspiration to stay: internal and external.

As we moved further, we tested and investigated the sources of immobility using aspiration to stay as the dependent variable and five competing explanations: *capability to stay*, *needs*, *adaptation*, *dignity*, and *intersectionality*. Multivariate regression models proved that all of them explain aspiration to stay, but the explanatory power of *capability to stay* and *needs*, followed by *adaptation*, weighs more. *Dignity* comes fourth, and *intersectionality* last. Nonetheless, the shallow effect of dignity might be explained by the limitations of this study's data measurements of dignity. There were only two measurements of dignity in this study's data (*rights first* and *rights second*), suggesting that further analysis needs to expand its measurements. With respect to needs, it is expected that when needs are not met or satisfied, the situation of those who decided to stay worsens by being trapped, hard to reach, or becoming an invisible population (Bergmann 2024). This study did not explore this, however. Instead of using the decision to stay as the dependent variable, it used preference to stay. This suggests that further studies must explore the effect of needs using the decision to stay as the dependent variable.

Building on these findings, as many people tend to stay in the context of climate change, policymakers should opt for an adaptation-in-place strategy for building their resilience, their capability to stay, and their unmet needs, respecting their right to choose to stay. Otherwise, their situation gets worse from being trapped to too difficult to reach, or invisible populations. Policymakers should also take intersectionality into account, paying attention to groups' vulnerability to immobility in a changing climate.

Finally, whilst the data confirmed most of the expected results, there were inconsistencies that the rest of this section discusses or tries to interpret. The first inconsistency deals with the negative effect of half of the aspiration to stay measure on climate immobility, which is explained with mobility types, either circular mobilities that refer to mobility of people who moved and returned, or that occur for a short period of time.

The second inconsistency is related to the negative effect of one measure of *capabilities to stay* – that is, the *option to stay*. People who expressed to have the option to stay were less likely to stay. This is because the option to stay is generally not connected to a particular aspect, either economic or other measures of capability to stay.

The third responds to the positive effect of one measure of climate *adaptation*, i.e., *excluded from decision-making*. Expectedly, those who participate in the decision-making process (i.e., local government, planning decisions) receive information to more easily cope and recover from climate shocks, leading them to stay. But in the context of this study, residential locations, those who are *excluded from decision-making*, prefer to stay. As most of these locations are predominantly informal and the government tends to ask (and even to force) people to leave, as well as having little government support provided to them over the long-term, this may trigger them to resist and form attitudes of staying.

The fourth is associated with the negative impact of one measure of *dignity* – i.e., *rights first*. The issue is that when people say they put their *rights first* when affected by climate hazards, it is expected that they will stay and remain in place. However, in the Mozambique case, the opposite is true, and they tend to move. This inconsistency could be explained by the country context of the political regime in which Mozambicans live. Even if they put their rights first, in the Mozambique context, people live in an electoral autocracy (Coppedge 2025:295) where citizens' rights are subverted, they tend not to accept human rights abuse, and they prefer to leave rather than stay, seeing their rights being neglected.

Finally, with respect to the *intersectionality* explanation, there is a negative effect on young females who are less likely to aspire to stay. That young females are likely to aspire to move could be explained by their reduced prospects of getting partners if they stay in a poor place associated with vulnerability, suggesting that this interconnected, compounded intersectionality does not represent vulnerability. As an alternative, young males could be viewed as intersectionality and vulnerability. But this remains an area for further exploration through in-depth interviews and/or focus group discussions. This study also makes a novel contribution to immobility studies using an intersectionality lens, involving the construction of compounded multiplicative intersectional measures for science and technology (Nielsen et al. 2025) rather than using isolated additive demographics.

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REFERENCES

- Ahmed B and Mallick B (2026) Introduction: Towards a just and inclusive framework for climate (im)mobility. In *Handbook on Climate Mobility*. Cheltenham, UK: Edward Elgar Publishing. <https://doi.org/10.4337/9781035329939.00007>.
- Bergmann J (2024) Sierra: Rural-to-Urban Migration and Immobility Related to Water Scarcity in Peru's Highlands. In: *At Risk of Deprivation. Studien zur Migrations und Integrationspolitik*. Springer VS, Wiesbaden. https://doi.org/10.1007/978-3-658-42298-1_5.
- Bergmann J and Martin SF (2023) Addressing Climate Change-Related Human Immobilities, KNOMAD Paper 54.
- Bernasconi C (2025) Navigating the (Im)mobility–Adaptation Nexus in the Context of Climate and Environmental Change: A Typological Discussion. *Climate* 2025, 13, 6. <https://doi.org/10.3390/cli13010006>
- Bettini G (2013) *Climatised moves: climate-induced migration and the politics of environmental discourse*. Lund University.
- Black R, Adger WN, Arnell NW, Dercon S, Geddes A, et al (2011) The effect of environmental change on human migration. *Glob. Environ. Change*. 21:S3–11 703. <https://doi.org/10.1016/j.gloenvcha.2011.10.001>
- Blondin S (2021) Staying despite disaster risks: Place attachment, voluntary immobility and adaptation in Tajikistan's Pamir Mountains, *Geoforum*, Volume 126, Pages 290-301, ISSN 0016-7185, <https://doi.org/10.1016/j.geoforum.2021.08.009>.
- Boas I, Wiegel H, Farbotko C et al (2022) Climate mobilities: migration, im/mobilities and mobility regimes in a changing climate. *J. Ethn. Migr. Stud*. 48(14):3365–79. <https://doi.org/10.1080/1369183X.2022.2066264>
- Collins FL and Carling J (eds.) (2019) *Aspiration, Desire and the Drivers of Migration* (1st ed.). Routledge. <https://doi.org/10.4324/9780429281181>
- Coppedge M, Gerring J, Knutsen CH, Lindberg S et al (2025) V-Dem Codebook v15. Varieties of Democracy (V-Dem) Project.
- Cundill G, Singh C, Adger WN, et al (2021) Toward a climate mobilities research agenda: Intersectionality, immobility, and policy responses, *Global Environmental Change*, Volume 69. <https://doi.org/10.1016/j.gloenvcha.2021.102315>
- de Haas H (2021) A theory of migration: the aspirations-capabilities framework. *Comp Migr Stud* 9:8. <https://doi.org/10.1186/s40878-020-00210-4>
- Debray A, Ruysen I and Schewel K (2023) The aspiration to stay: a global analysis. *Int Migr Rev*. <https://doi.org/10.1177/01979183231216087>
- Doyal L and Gough I (1991) *A Theory of Human Need*. Palgrave Macmillan. <https://doi.org/10.1007/978-1-349-21500-3>

Durand-Delacre D, Bettini G, Nash SL, Sterly H, Gioli G, et al (2021) Climate Migration Is about People, Not Numbers. In: Bohm S and Sullivan S (eds) Negotiating Climate Change in Crisis. Open Book Publishers, pp63-81. <https://doi.org/10.11647/OBP.0265>

Foresight (2011). Migration and global environmental change. UK Government Office for Science, London.

Freihardt J (2025) Trapped by climate change? (In)voluntary immobility in Bangladesh. Reg Environ Change 25, 117. <https://doi.org/10.1007/s10113-025-02452-3>.

Hidayati I, and Liang J (2026) Shifting Sands: Immobility and Adaptation in Rising Seas. In: Nurhidayah ., Young A and Handayani W (eds) Climate Change, Labour and Migration in Indonesia. Springer Climate. Springer, Cham. https://doi.org/10.1007/978-3-032-15334-0_15

IFRC (2019) Mozambique cyclone: “90 per cent” of Beira and surrounds damaged or destroyed. Press Release, International Federation of Red Cross and Red Crescent Societies (IFRC). <https://www.ifrc.org/press-release/mozambique-cyclone-90-cent-beira-and-surrounds-damaged-or-destroyed>. Accessed on 8 June 2026

Ivanova A, Singh D, Rai P, Richards C, Vasconcelos H et al (2024) Climate hazards and human migration: literature review. Environmental Research: Climate, 3(4):042002. <https://doi.org/10.1088/2752-5295/ad6fc4>

Lewis-Beck M, Bryman A and Liao T (eds) (2004) The SAGE Encyclopaedia of Social Science Research Methods. Vol. 1, pp 299-230. Thousand Oaks, CA: Sage.

Nielsen MW, Gissi E, Heidari S et al (2025) Intersectional analysis for science and technology. Nature 640:329–337. <https://doi.org/10.1038/s41586-025-08774-w>

Rufat S and Kuhlicke C (2025). Climate Captivity: When in-situ Adaptation and Moving Out Are No Longer Options. Progress in Environmental Geography, 4(4):393-411.

Schewel K (2021) Staying put: Why it’s time to pay more attention to mixed immobility. Mixed Migration Review 2021. Mixed Migration Centre.

Schewel K (2023) Migration, development and social change in the Himalayas: an ethnographic village study. J Hum Dev Capabil 24:307–308. <https://doi.org/10.1080/19452829.2023.2186527>

Selby J, and Daoust G (2021) Rapid evidence assessment on the impacts of climate change on migration patterns. London: Foreign, Commonwealth and Development Office. <https://www.gov.uk/research-for-development-outputs/rapid-evidence-assessment-on-the-impacts-of-climate-change-on-migration-patterns>. Accessed on 9 June 2026.

Semenza JC and Ebi KL (2019) Climate change impact on migration, travel, travel destinations and the tourism industry. Journal of Travel Medicine, Volume 26, Issue 5 <https://doi.org/10.1093/jtm/taz026>

Shenga C, Howe L and Macome A (2025) Public Opinion Survey on Immobility in a Changing Climate. Beira Mozambique Case Study, Summary of Results. Centre for Research on Governance and Development, Mozambique.

Skeldon R (2016) Mobility, Immobility and Migration. In: Grugel J and Hammett, D (eds) The Palgrave Handbook of International Development. Palgrave Macmillan, London. https://doi.org/10.1057/978-1-137-42724-3_20.

Thornton F, Serraglio DA and Thornton A (2023) Trapped or staying put: Governing immobility in the context of climate change. *Front. Clim.* 5:1092264. <https://doi.org/10.3389/fclim.2023.1092264>

Thomas A, Sircar A, Abu M, Boyd E, Howe L et al (2025) Immobility in the Context of Climate Change. *Annual Review of Environment and Resources*, Vol. 50. <https://doi.org/10.1146/annurev-environ-121923-120443>.

Transiskus SF and Bazarbash MG (2024) Beyond the binary of trapped populations and voluntary immobility: A people-centered perspective on environmental change and human immobility at Lake Urmia, Iran. *Global Environmental Change*, Volume 84, <https://doi.org/10.1016/j.gloenvcha.2024.102803>.

Tschakert P and Neef A (2022) Tracking local and regional climate im/mobilities through a multidimensional lens. *Reg Environ Change* 22:95. <https://doi.org/10.1007/s10113-022-01948-6>

Vezzoli S (2023) Understanding aspirations to stay: relative endowment within a time-space perspective. *Migr Stud* 11:259–285. <https://doi.org/10.1093/migration/mnad007>

Wyngaarden S, Humphries S, Skinner K, Lobo Tosta E, Zelaya Portillo V et al (2022) You can settle here: immobility aspirations and capabilities among youth from rural Honduras. *Journal of Ethnic and Migration Studies* 49(1): 212–231. <https://doi.org/10.1080/1369183X.2022.2031922>.

Yamaguchi JAR (2026) Integral ecology and climate (im)mobility: from securitisation to solidarity in local sustainability planning. *Local Environment*, 31(5):723–731. <https://doi.org/10.1080/13549839.2025.2519366>

Yang X, Chen D, Wahab I, Burman, A (2025) Evidence of climate and economic drivers affecting migration in an unequal and warming world. *Commun Earth Environ* 6:782. <https://doi.org/10.1038/s43247-025-02811-2>