

Why populations persist: mobility, place attachment and climate change

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Abstract Explanations of relationships between migration and environmental change now focus on multiple interactions, risks in destination and immobility. This research applies behavioural migration theory to examine the extent to which immobile populations experiencing environmental degradation exercise agency with respect to location and, in doing so, elucidates what it means to be trapped. This research uses individual survey data from a migrant-sending area in highland Peru where the population experiences negative health and livelihood impacts from climate-related phenomena. Analysis of these data reveals three reasons for non-migration: high levels of satisfaction, resource barriers and low mobility potential. Immobility in dissatisfied people is more likely to be caused by attachment to place than resource constraints. Thus, the results suggest that trapped populations exist along a continuum. This highlights the need for policy responses differentiated by the mobility characteristics and preferences of the individual. Caution, therefore, must be exercised when labelling populations as trapped and promoting relocation.

Keywords Immobility · Trapped · Place attachment · Behavioural theory · Environmental change · Migration · Peru

Introduction

Regional and international migration represents the sum of migration decisions taking place at the individual level in response to changes in life circumstances and the local environment. Migration allows individuals and populations to adjust to changes in livelihoods, risks and well-being caused by environmental change (Adams and Adger 2013a; Barnett and Webber 2010; Piguet et al. 2011) and is an

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acknowledged risk-spreading strategy as part of household livelihood portfolios; remittances help households adapt to stressors and increase well-being in sending areas (Deshingkar 2012). However, individuals and households decide to persist in their locations, even where there are apparent economic reasons for relocating, environmental hazards or long-term environmental change.

Empirical research on the environmental and resource dimensions of migration flows and decision-making (Afifi and Jäger 2010; Black et al. 2011a; Piguet et al. 2011) provides an increasingly nuanced understanding of migration under environmental change. The UK Foresight Report on Migration and Global Environmental Change (Foresight 2011), for example, reviewed diverse evidence to show that environmental risks affect migration flows through interaction with the economic and demographic drivers of migration. The report showed how migration is potentially an important and legitimate form of adaptation to climate change, but that migrant-receiving areas may be equally or more risky.

One of the most important outcomes of the UK Foresight Report was the insight that some populations are affected by environmental risk but lack the capacity to migrate away from worsening conditions. The report described such populations as “trapped” and highlighted a double vulnerability: the poorest people usually live in the most environmentally risky locations, for example, in flood plains and on steep hill slopes, while having the least resources to migrate away from that risk (Black et al. 2013; Foresight 2011). This correlation between vulnerability to environmental risks and immobility is noted in other empirical research. Warner and Afifi (2014), for example, identify immobile populations in a multi-country study of migration and water availability and describe such households as those “that do not possess the assets necessary to migrate, even to cope with food insecurity, or who cannot access migration options” (Warner and Afifi 2014; 12). In Bangladesh, Penning-Rowsell et al. (2013) suggest that women in a household can become unable to leave environmental risky areas when male family members migrate to urban areas seeking employment.

However, explanations for populations persisting in the face of difficult environmental conditions have focused on financial barriers to migration, and not socio-psychological or affective aspects of the decision to migrate. Therefore, understanding the persistence of populations and decisions *not* to migrate represents a gap in our understanding of migration–environment relationships (Bardsley and Hugo 2010; Black et al. 2011a). Black et al. (2013) recognise that labelling populations as trapped affects the agency, and possibly the rights, of individuals to make their own decisions. When governments intervene to facilitate relocations of individuals or communities, there is often a significant resistance since such socio-psychological considerations are not taken into account (Bronen and Chapin 2013; Marino 2012).

The roles of environmental scarcity or environmental risks and hazards have not featured prominently in theories of migration [discussed and explained by Piguet (2013), Hunter (2005) and others], but are now emerging as important dimensions, not least because of the changing nature of environmental risks and degradation throughout the world (Black et al. 2011a, b). Piguet (2013) suggests that focusing on environmental risks as a principal driver of migration decision-making is as problematic as omitting environmental dimensions altogether. Hence, the new wave

of environment–migration research has sought to examine the relative role of long-term resource scarcity, or of hazards and displacement as part of the wider landscape, drawing on all the theoretical traditions for examining decision-making (Kniveton et al. 2012; Warner and Afifi 2014, etc.). Yet much of this research continues to examine migration outcomes, rather than examining in detail how and why populations continue to live in places where difficult and worsening environmental conditions are perceived and reported by inhabitants.

For example, the nature of the conditions under which people become “trapped” has not been fully dissected and populations experiencing climate extremes have been prioritised over those experiencing slow-onset environmental change. People live under environmental risk, making trade-offs between income and security frequently, for example, living with risk of flood or volcanic eruptions for the benefits of soil fertility. Human and climate-induced environmental degradation and its negative impacts on livelihoods and well-being are diverse and well documented (Adger et al. 2014), yet widespread outmigration is not observed. Mobility under climate stress is known to be dictated by pre-existing vulnerabilities and capabilities (Fussell et al. 2010), yet pre-existing mobility characteristics of populations projected to be at risk from climate change have not been investigated. Material as well as subjective dimensions of the decision to migrate (both in the ways people experience impacts (e.g. Massey et al. 2010) and their capacity to respond through migration) is likely to be highly differentiated across the population, yet authors discuss a single “trapped” population.

This research applies behavioural migration theory to understand migration decision-making under environmental change. It focuses on the concept of place utility, a positive or negative quantity, expressing, respectively, the individual’s satisfaction or dissatisfaction with respect to that place (Wolpert 1965, p. 162). These theories suggest that individuals initiate migration decision-making processes only when they begin to experience residential dissatisfaction and place utility moves from a positive to negative state (Brown and Moore 1970; Speare 1974). Whether migration actually takes place depends on other aspects of the decision-making process—the level of mobility of the individual, the scope and results of search and evaluation of other locations, and the physical, bureaucratic and financial barriers to migration. This research focuses on the intermediate stage of migration decision-making between experiencing stress and migrating and seeks to determine what stops a person from relocating, even when they are dissatisfied.

Therefore, this article brings behaviourist ideas to the trapped populations thesis in order to create a more diverse conceptualisation of trapped in the context of immobility. The article builds on insights from social and behavioural theories of migration decision-making (e.g. Speare 1974) and ideas of place attachment and social capital, applying these to the context of populations that decide to remain in location, despite exhibiting dissatisfaction with their present location and living under difficult environmental conditions. The findings show that, despite previous assumptions to the contrary, populations are not homogenous with respect to attitude to place or capability to migrate. To understand how migration under environmental change may play out in the future requires, I argue, a model of mobility and satisfaction characteristics of the population under current circumstances.

Migration decision-making

The incorporation of existing migration theory into research on environmental migration has traditionally been weak (Piguet 2013). Theory, where incorporated, has been neo-classical economic—with a loss of income seen as sufficient condition for migration to occur (e.g. Feng et al. 2010). This follows the model of wage differentials as the driving force behind migration (e.g. Harris and Todaro 1970). This approach is countered by research that takes into account the non-material aspects of the decision to migrate, such as the sense of loss associated with a change in the environment in which one lives, solastalgia (Albrecht et al. 2007; Tschakert and Tutu 2010), the role of the natural environment in creating place attachment (Adams and Adger 2013b), the vulnerability of the cultural aspects that link people to place (Adger et al. 2011) and the sense of optimism within residents despite negative climate projections (Mortreux and Barnett 2009).

Cognitive approaches have been applied to climate change migration through a version of Grothmann and Patt's (2005) model of private proactive adaptation to climate change, itself based on Ajzen's (1991) theory of planned behaviour. These have been used as theoretical frameworks (Martin et al. 2014) or incorporated into agent-based models (Kniveton et al. 2011, 2012) to investigate how people may respond to increased climate stress in the future.

Cognitive approaches have been used to help explain migration since the 1960s in the form of behavioural theory. According to these theories, migration is a process, initiated by changes in the environment, with an outcome that is mediated by initial levels of satisfaction, ability to withstand stress and mobility potential (Brown and Moore 1970; Speare 1974). Recently, behavioural theories have been employed to understand how selective mobility into and out of neighbourhoods leads to ethnic segregation (Boschman et al. 2014), to explain migration as part of life-course migration models (Kley 2011) and to understand the migration decisions of foreign homeless people in Brussels (Mostowska 2014).

This paper applies behavioural theory to understand why, when a stress causes dissatisfaction to be experienced, and place utility changes from positive and negative, why migration still does not occur. Other authors have used behavioural theories to answer these questions (Mellander et al. 2011) but not in the context of environmental change. Behavioural theories feature the environment as a stressor that initiates the migration decision. While, traditionally, it was environment *writ large* describing the socio-economic, political and infrastructural setting (Piguet 2013), this concept provides a natural entry point for the reintegration of the natural environment into migration theory.

Dissatisfaction is “the direct result of changes in the needs of a household, changes in the social and physical amenities offered by a particular location, or a change in the standards used to evaluate these factors” (Speare 1974; 175). The amount of dissatisfaction that an individual tolerates before initiating the migration decision-making process is inversely related to mobility potential (Lonergan 1998). Mobility potential relates to how easy it is for people to move; some people are “easily movable”, while others are “virtually immobile” (Morrison 1972), and is

similar to ideas of perceived behavioural control in Ajzen's (1991) model. Behavioural theories tell us that migration might not take place because a stress threshold has not been reached (Speare 1974), because people readjust their expectations (Speare 1974); because the intervening obstacles are too high (Lee 1966); or because a suitable alternative location cannot be identified (De Jong and Fawcett 1981).

The concept of mobility potential can be enriched by incorporating related ideas from the place attachment literature. The importance of place in driving well-being and resilience under climate change impacts is increasingly recognised (Hess et al. 2008). Place can be defined as a meaningful location (Lewicka 2011a). Place attachment is defined as the bond between people and places (Altman and Low 1992), a function of the physical setting, human activities and human social and psychological processes rooted in the setting (Stedman 2002; 562). People attach to their location in a range of different ways, both positively and negatively and with different strengths (Hummon 1992; Lewicka 2011b). For example, a positive attachment to place can be traditional or active. A person can show ambivalence to his or her location, or they can have negative feelings towards the location. Finally, a person can be "placeless" with no attachment to a specific physical location (Hummon 1992; Lewicka 2011b).

People gain benefit from their location in a variety of different ways. Connections with place serve human needs related to identity, feelings of self-efficacy and attitudes towards the future (Twigger-Ross and Uzzell 1996; Fresque-Baxter and Armitage 2012), and disruption to these bonds is known to have negative psychological and health impacts (Brown and Perkins 1992; Lewicka 2013). Place attachment is a direct contributor to community resilience (Berkes and Ross 2013) and is closely tied to related concepts such as social capital and residential satisfaction (Stedman 2003).

While place attachment and social capital are known to increase capacity to adapt to incremental change (Pelling and High 2005), they can act as a barrier to transformational change, for example, through migration (Marshall et al. 2012). Furthermore, some dimensions of place attachment such as social capital can have negative facets such as downward levelling norms preventing upward social mobility, excessive obligations, excessive restrictions that dampen innovation and entrepreneurship and exclusion of those who are different (Portes 1998). Climate change has the potential to cause place detachment. People, knowing that their home is under threat, intentionally loosen ties and form new ones to other places (Agyeman et al. 2009).

Research design and methods

Life and livelihoods in the Peruvian Andes are dominated by the need to manage a varied and variable climate, a result of the steep gradients and high mountains. Mobility is one of many strategies employed by households to survive in this complex environment (Milan and Ho 2013). Traditional production strategies are increasingly difficult to implement in a context of increased market penetration and atomisation of communities, partly caused by increased rural–urban migration

(Valdivia et al. 2010). Climate change adds a further risk dimension. Mountain regions are experiencing warming in recent decades at rates higher than global averages (Urrutia and Vuille 2009). Glacial retreat has implications for local and regional availability of fresh water (Bury et al. 2011; Vuille et al. 2008).

This complex mix of environmental and social stress and high future vulnerability characterises the Rímac River valley in the central highlands of Peru (Fig. 1) where the data in this study were collected. A central feature of the valley is its transport infrastructure and ease of access to Lima. Mining, commerce and transport are readily available as off-farm livelihood sources. However, there is still a high level of engagement in agriculture, both commercial and subsistence, and a large variety of agricultural practices corresponding to different altitudes. While the valley has glaciated headwaters, reservoirs and hydro-electric generators are used to regulate the volume of water in rivers. Rain-fed springs provide irrigation during the dry season. Populations experience high environmental variability. While environmental change is not currently driving migration decision-making, it is a cause of dissatisfaction and the population is at high risk of being exposed to increasingly problematic climate change impacts (Mark et al. 2010; Pérez et al. 2010).

San Mateo and Surco represent two district centres in different climate zones along the Rímac valley, Chocna and Caruya are rural annexes in a tributary of the upper Rímac River. These villages were chosen because each settlement has a different set of social and environmental conditions according to altitude, access to off-farm labour opportunities and access to Lima. Table 1 provides summary statistics for each village.

A sample survey of 433 individuals was implemented in these four villages between March and July 2010. Since there were no reliable lists of all inhabitants in the village from which to sample, houses were sampled using town plans created in February 2010 and obtained from the municipality in April 2010. The survey used simple random restrictive sampling; each house on the map was numbered and

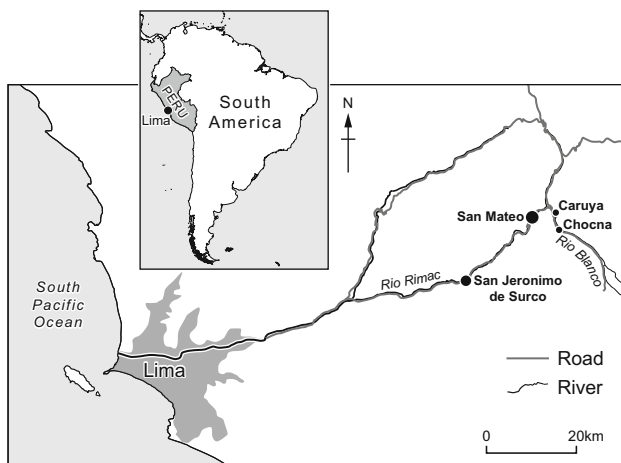


Fig. 1 Map showing location of study area

Table 1 Summary statistics on the altitude, ecological zone and population of each village surveyed, as well as the size of the sampling frame and the number of households reached in the survey

Village	Alt. (masl)	Ecological zone	Population (2007 census)	Households in sampling frame	Households surveyed	% of total responses
Chocna	3940	Alpine pluvial tundra	85	21	21	5
Caruya	3535	Subalpine grassland	80	18	16	4
San Mateo	3149	Subalpine grassland	5280	767	227	52
Surco	2018	Montane desert scrubland	1798	305	169	39

selected for sampling using a lottery method. Households that were not present on the plans were also sampled to include areas of the villages that had been omitted. The survey was representative at the household level for each of the villages. The survey represented a near census in Surco, Chocna and Caruya since the smaller number of households in close proximity allowed the enumerators to visit all households.

Enumerators targeted the household head for interview. Thirty-seven per cent of respondents were female household heads, and 27 % were male household heads. Other interviewees included single household heads (26 %); an adult child of the household head (8 %); sibling of the household head (3 %); and parent of the household (<1 %). Of the 433 individuals interviewed, 40 % ($f = 173$) were male and 60 % ($f = 260$) were female. In this cultural setting, the dominance of the male household head in decision-making was not marked. The dominance of women respondents reflects the fact that men often worked outside the village on permanent, temporary or rotational contracts. It also reflects the higher occurrence of family separation.

The question “Have you considered migration in the previous 5 years of residence in the village” was used to determine whether the respondent had initiated the migration decision-making process. If the respondent answered yes, an additional question was asked: “If you had considered migration, why did you choose not to leave?” This question provides information on the barriers to migration and the causes of immobility despite dissatisfaction. Barriers are self-defined and represent the phenomenon perceived to have prevented migration from occurring in response to a particular cause of dissatisfaction. The barrier mentioned may not still exist, and the person may not still be dissatisfied. All answers were coded, and similar responses were clustered to reveal drivers of dissatisfaction.

Weather, climate and residential satisfaction

While scientific studies identify environmental stress, especially on water resource availability, for this region, the local perception of change is critical to understanding of the role of environmental degradation in affecting residential

satisfaction. Previous studies have shown that environmental factors contribute positively to residential satisfaction in this area by providing clean air, recreational spaces, attractive surroundings and cultural meaning through agriculture (Adams and Adger 2013b). However, this research shows that aspects of the weather, predominantly extremes and unpredictability, are negative influences on well-being in this area through their impact on health and livelihoods.

The residents of this area are affected both in terms of their livelihoods and their health on an everyday basis by temperature extremes, excessive precipitation, abrupt changes in weather, abrupt seasonal changes and drought. When asked whether the climate or weather affects their life, 81 % of people responded positively. For 34 % of the population, mainly those not involved in agriculture, temperature extremes and unpredictable weather are associated with ill health: flu and bronchitis, sunburn and headaches; for 29 % of the population, such climate conditions are associated with a loss of income through reduced crop productivity, disease in livestock or lack of mobility. Eighteen per cent of the population experience negative impacts on both health and income. Table 2 summarises the ways in which the weather affects the health, lives and livelihoods of the population in this area. While the weather affects this population in diverse ways, extremes of cold temperatures dominate.

Perceptions of changing rainfall patterns and negative impacts on livelihoods have been reported in other central Andean watersheds (Milan and Ho 2013). When asked whether the climate had changed, 90 % of the population answered affirmatively. Of

Table 2 Summary of the ways in which the weather affects the health, lives and livelihoods of the surveyed population

Weather phenomenon	%	Impact on lives and livelihoods
Low temperatures, frost and ice	67	Low temperatures are associated with illness such as the flu and bronchitis; cold water delays household activities, e.g. washing clothes; frost reduces agricultural productivity
Excessively high temperatures and strong sunlight	9	High temperatures reduce agricultural productivity, reduce water availability and increase irrigation need strong sunlight burns skin and causes headaches
Excessive or heavy rain	10	Destroys adobe structures, reduces outside work opportunities, destroys crops such as alfalfa and creates a requirement for shelter for animals
Landslides (often resulting from heavy rain)	3	Block main roads, reduce mobility of goods and people and destroy land and property
Strong winds	4	Destroy crops such as barley and prevent harvesting of cochineal from cactuses
Abrupt changes in the weather or seasons	4	Cause crop blight and illness in both livestock and humans
Drought	3	Concentrates pollution in the river, reduces pasture for livestock and reduces crop productivity

those that had perceived a change in climate, 1 % described a positive change, 77 % described a negative change, and 22 % spoke about changes that were not having an impact on their life or livelihood but of which they had taken notice. This includes expressing a general concern or worry about the changes observed, for example, loss of glaciers, less snowfall or change in pastures that can be seen from the village. Therefore, the population is overwhelmingly experiencing changes in the climate, and those changes are overwhelmingly negative.

The perceived changes fall into four major groups: changes in temperature extremes, both high and low; changes in the timing, quantity and quality of precipitation; loss of glaciers, ice and snow at higher altitudes; and changes in the predictability of the seasons. Table 3 provides some representative quotes for each of these categories of perceived climate change. These show that the residents of this location are living under conditions of unpredictability and change, and there is a clear signal that temperature extremes are increasing, precipitation is becoming less predictable and glaciers, and snow packs are disappearing.

Together with the impacts summarised in Table 2, these quotes show the quotidian impacts of climate change, the everyday lived experience of gradual changes in temperature and precipitation, especially for the women who move only in the domestic realm.

Table 3 Representative quotes of perceptions of environmental change among respondents

Type of change	Characteristics of change	Representative quotes
Temperature	Hotter temperatures	It's a bit hotter, as if the sun is just a little bit closer
	Colder temperatures	The climate shouldn't be like this, there shouldn't be so much ice, it's really bad
	More extreme temperatures	The frost and the heat burn more strongly; I get ill and spend money on getting better
Precipitation	Less rain	There used to be more rain. Now you can't grow maize, potatoes...
	More rain	It rains more frequently and rots the [agricultural] goods
	More intense rain	It doesn't rain like it used to. Now it rains for a while but heavily, big drops
Glaciers	Loss of glaciers	The ice has changed, for example, in Ticlio there's no ice, in Huaraz as well, before there were more glaciers
	Loss of snow caps	There was ice, already now there isn't any snow, or snow-capped mountains
	No snow	Now there isn't any snow, just rain
Seasonal change	More variable	In summer, little rain, in winter the sun burns, it's completely changed, "this date, that date" now you can't [predict]
	Late/early onset	The winter is late, and the summer is early and lasts longer

Reasons for non-migration

This section examines the mobility characteristics of the people experiencing these climate impacts. Figure 2 summarises the results, and represents a theoretical framework for the analysis of non-migration under environmental change satisfied or dissatisfied with their location. Based on responses in the survey, dissatisfied people did not migrate because of resource barriers and low mobility potential. Low mobility potential can be subdivided into: positive attachment to place; fear of, or disinterest in, alternative locations; and negative attachment to place, expressed through obligations. Each of the reasons for non-migration is now discussed in turn.

Levels and drivers of dissatisfaction with place

Of the 433 individuals surveyed, 46 % reported that they *had not* considered migration in previous 5 years, representing the satisfied portion of the sampled population (Box 1 in Fig. 2), following Speare (1974). Fifty-four per cent of the population reported that they had contemplated migrating in the previous 5 years. This 54 % of the survey population is categorised as being dissatisfied with location. A binomial logistic regression analysis, not reported here, shows that responses do not vary significantly with age, gender or length of residence. Therefore, a location that appears externally to be difficult with respect to socio-economic and environmental indicators is not considered in those terms by almost half the population that lives there. Migration as an adaptation is unlikely to be palatable to these satisfied people. Individuals gain satisfaction from other characteristics, such

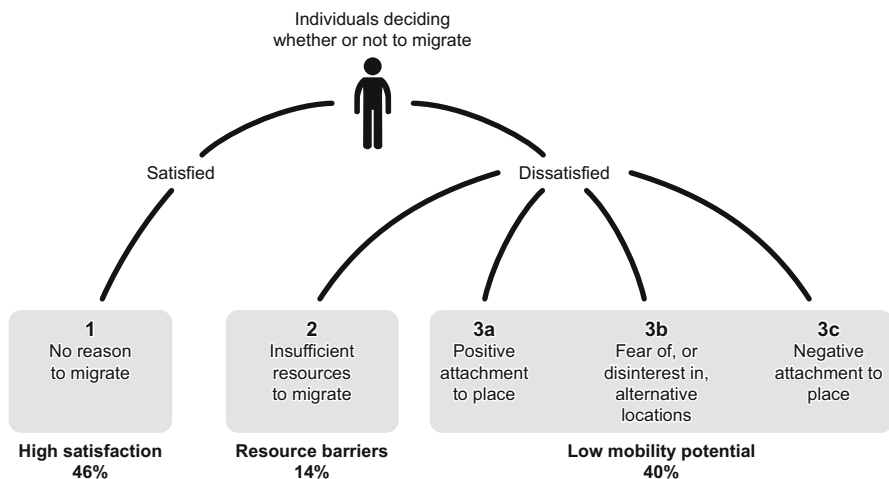


Fig. 2 Reported reasons for staying in location: satisfaction with place, resource barriers to migration and low mobility potential. Low mobility potential has three components: positive place attachment; fear of, or disinterest in outside locations; and negative place attachment in the form of obligations

as social relations, or from aspects of the natural environment that do not relate to economically viable livelihoods (Adams and Adger 2013b; Florida et al. 2011).

Drivers of dissatisfaction provided by the population were coded and grouped to produce five categories: a lack of income, a desire to improve income, a lack of education opportunities and possibilities, life-cycle stages and seeking change and adventure. These concur with widely accepted self-reported drivers of migration (White and Lindstrom 2005). Table 4 describes the drivers of dissatisfaction and the associated percentage of the population providing this response.

Aspirations to achieve more represent 43 % of all reasons for having considered migration. A typical response is: “For the betterment of my children, so that they can be something in life and not stay here like me”. Respondents without children expressed a desire “to know or achieve something better” for themselves. Aspirational migration is also reflected in the desire to improve income. A typical example is: “I think about working in another place to earn better and support my children. Here they pay you little money and it’s not enough”. Finally, it is exhibited by those that thought of migration because they were looking for a change “to live in another place”, or adventure “I was young, looking for fun”, “for the adventure, to take the risk”. An enthusiasm for, and openness to, the opportunities available in the outside world is a key dimension of mobility potential (Morrison 1972).

Contrast the aspirational drivers with these examples: “For a job, because there are no jobs here”; “to live with my daughter and be with her”; “when I am not able to work on the farm any more”. In these cases, the dissatisfaction has resulted from an external change in the conditions of that person, often due to different stages in life course. Another example is family break-up. Typical examples are: “my husband left me” and “I had had problems with my family”. The examples highlight push factors related to a negative change in circumstances and not the pull of other locations and opportunities. This group represents 33 % of the dissatisfied population. Such distinctions between aspirational and responsive migration have been made in other studies. Warner and Afifi (2014), for example, make a distinction between “content” migration to improve conditions and “erosive” migration associated with vulnerability that may actually increase insecurity.

Table 4 Classification of drivers of dissatisfaction highlighting the different economic and non-economic reasons for residential dissatisfaction ($n = 233$)

Driver group	%
To build a better future for their family and themselves: opportunities for education and employment	43
Lack of income: no work, insufficient business or a bad harvest	18
Life-cycle stages: family formation, reunification and separation; retirement and old age	15
Desire to improve income	9
Seeking change or an adventure	8
Miscellaneous	2

13 % of respondents did not provide a driver

Reasons for staying despite dissatisfaction

Resources barriers to migration

Table 5 shows reasons given by the dissatisfied subpopulation for not migrating. Their open-ended statements have been coded and clustered into nine groups: insufficient resources; obligations to family or property; children still enrolled in school; social and emotional attachment to place; negative outcome of search and evaluation of alternative locations; removal or disappearance of the driver of dissatisfaction; and physiological immobility.

Twenty-six per cent of people specifically cited resource barriers to migration. Migration from the study area is largely to the capital city Lima. Barriers therefore usually related to not having a property or stable job in Lima or lack of resources to move there. Common responses were: “Lack of money, everything is money in Lima, and if you don’t have a property you’ve got to pay to rent a place” or “I don’t have a house, nor work [in Lima], that’s why I don’t go”. This group most closely fits the description of “trapped” which is currently used in the environmental migration world: low income households that are not able to use migration as a strategy to improve well-being for their family (Box 2 in Fig. 2).

However, there are individuals who migrate to Lima without having already secured work, a plot of land on which to build a house or temporary accommodation. Therefore, a lack of social capital in the receiving area may be the underlying barrier to migration. In order to move to Lima without those resources requires a network of family and friends who are able to help the migrant when he or she first arrives and assimilates into city life. However, it may also relate to a low sense of self-efficacy, articulated as lack of capacity to successfully migrate to Lima with their available resources. Low self-efficacy is recognised in other forms of adaptation to climate change risks, such as defending a household against flooding or taking measures against heatwave risks, where the objective limits to adaptation are not reflected in behaviours exhibited during a crisis event (Grothmann and Patt 2005; Martin et al. 2014; Wolf et al. 2010). The barriers

Table 5 Self-reported reasons why respondents did not leave after having experienced dissatisfaction ($n = 233$)

Reason for staying	%
Insufficient resources	26
Obligations to family members, property or assets	23
Children are still in school	18
Affective and social ties to the location	11
No suitable alternative location	6
Needs changed and driver disappeared	6
Lack of opportunity	4
Perceived physiological immobility	2
“About to go”	2
“Didn’t feel like it”	<1

3 % of respondents did not provide a reason

associated with international migration such as restrictive immigration policies and the perceived dangers of migratory routes (e.g. Milan and Ruano 2014) were not mentioned by the population in this study, a reflection of the primacy of Lima as a migrant destination.

Importantly, whether real or perceived, resource restrictions only represent 26 % of the responses. Therefore, interventions that aim to assist people in migrating away from environmental degrading or risky locations would only benefit 26 % of the dissatisfied population (representing 14 % of the total population sampled) in this location. The following section examines the other reasons for non-migration that represent different facets of low mobility potential.

Low mobility potential

There are three elements of low mobility revealed in the Table 5 categories of: “Obligations to family members, property or assets”, “Affective and social ties to the location” and “No suitable alternative location”. These are: obligations to place, fear of other places and positive place attachment”. Combined, these categories represent 40 % of the stated reasons for not migrating.

The first dimension of low mobility potential translates to positive affective attachment to place and people in that place (Option 3a in Fig. 2): a reluctance to leave family or the familiarity of the surroundings and way of life to which the respondent has grown accustomed and in which he or she can function effectively (Fresque-Baxter and Armitage 2012). The place in which a person lives not only meets his or her instrumental needs, but also contributes to the conception of self through place identity (Stedman 2002). This group of respondents is making compromises between different forms of well-being. They are trading off aspirations or an attraction to the outside world (characteristics of a high mobility potential) with another aspect of well-being—the benefit gained from being in the location. This is highlighted in responses such as: “So as not to leave my parents, I would have missed them” or “There are lots of memories of our mum here”. A less strongly expressed form of attachment is shown through responses such as “I’d got used to San Mateo” or “You would never get used to it in another place”. These people may be defined as “traditionally” attached (Hummon 1992; Lewicka 2011b).

The second dimension of low mobility potential relates to a fear of the outside world (Option 3b in Fig. 2). This also represents an attachment to place; however, it has negative implications for the person experiencing it. Instead of trading off different aspects of well-being—for example, being with family against furthering a career or education—this person is prevented from doing what they want to do by a lack of confidence. This group demonstrates clearly the idea of intrinsic low mobility potential—the dissatisfaction experienced by the individual is not sufficient to overcome his or her reluctance to leave. Representative responses include: “For fear and being afraid to go alone” and “I stayed because...I couldn’t tell you...I didn’t feel...it’s hard to leave on your own”. These quotes show how people can be “trapped” by themselves from taking actions that may increase their well-being. Attitude to risk, both in general and to migration specifically, has

previously been associated with mobility characteristics with the least mobile shown to have a lower risk tolerance (Williams and Baláž 2014).

Some respondents made direct comparisons with other locations: “I think it’d be the same or worse somewhere else” or “Lots of bad things happen in other places, kidnappings, they even kill for 10 soles”. Lima is very much in the *activity space* (the places people move between) and the *contact space* (the places people know about) (Quigley and Weinberg 1977; White 1980) of the residents of these villages—through television reporting, talking to relatives and visiting.

The third form of low mobility potential relates to negative place attachment reflected in the obligations that people feel to family or property within a place (Option 3c in Fig. 2). Twenty-three per cent of the dissatisfied population gave obligations and ties in the village as reasons for not acting on their dissatisfaction with migration. Examples of obligations include: a stable job: “Because of my husband’s job. There’s no mine in Huancayo”; a spouse that wanted to stay in the village: “Because my husband doesn’t have the courage. He wants to spend his whole life at his mum’s side!”; a mother that needed to be cared for: “Because of my mum, I’ve got to look after her”; or a house or smallholding that required their attention: “There isn’t anybody to leave my animals and my house with”.

This form of low mobility potential represents a trade-off between the potential to increase personal well-being and social and personal obligations. Obligations to family members represent an attachment to a person who has a strong attachment to place (usually a spouse or elderly parents) and shows that people are trading off their own satisfaction against the satisfaction of others. Other people do leave their elderly relatives to care for themselves, or live apart from their partners, so it may also represent a form of low mobility potential expressed through social obligation.

Therefore, this population exhibits six different reasons for remaining in location. Nearly half the population (46 %) is in the location because they have no reason not to be—they are satisfied despite hardships created by difficult climate conditions and socio-economic marginalisation. Of those who have experienced dissatisfaction with location, only 26 % are “trapped” by the current definition, that is to say, unable to migrate because of resource barriers. Even then, these responses may reflect a low perceived self-efficacy on the part of the potential migrant, rather than an actual lack of resources to migrate. Forty per cent of the population is in location because of social and affective attachment to place, “trapped” by their own internal attachment or fear of the outside world. This represents 74 % of the dissatisfied population.

Discussion

While the barriers to migration highlighted in the section above are not uncommon and may be considered obvious or minor in other contexts, the importance of these quotidian intra-household dynamics (Kley 2011) and attachment to place is critical to understanding migration. Yet they are continually underestimated in climate change migration literature. The Andes are consistently highlighted as a climate change hot spot. However, migration analyses in this region focus on agricultural

productivity and are less concerned with the lived realities of climate change for the wider population in these complex environments.

Differential sensitivity (based on preferences and exposure, for example whether the person moves within a domestic, agricultural or commercial sphere) in combination with mobility characteristics (influenced by levels of place attachment), will alter the point at which an individual experiences stress, re-evaluates his or her location and considers migration as an option. The point at which a person reaches their stress threshold depends upon the mobility characteristics of the individual (Lonergan 1998). The lower the mobility potential of the individual, the more stress he or she will endure before the benefits of migration outweigh the costs. This lower mobility was demonstrated in those that expressed fear of leaving or who were positively or negatively attached to place (Option 3 in Fig. 2).

The results show that a lack of socio-economic development is driving migration decision-making in this area, and not climate change and variability. However, the negative impacts of environmental change are already being perceived by the population and are projected to increase in severity in the future. To understand how populations will react under future climate change, it is useful to understand current mobility characteristics. Behavioural migration theory tells us that between being completely satisfied with location, and migration actually taking place, there is a period during which an individual lives under stress, trading off the dissatisfaction with location against the costs of migration (Brown and Moore 1970; Speare 1974; Wolpert 1965). I would argue that this form of immobility can be interpreted as the individual being “trapped”. This contrasts with the current definition of trapped populations as people or households without the means to escape a dangerous natural disaster, for example those without transport who could not leave New Orleans during Hurricane Katrina or without the resources to overcome barriers during agricultural decline or environmental degradation (Warner and Afifi 2014).

Therefore, just as it is accepted that migration under environmental change exists on a continuum from forced to voluntary (Hunter 2005), a similar continuum exists for trapped populations. At one end, is the traditional definition of trapped, where people are physically unable to leave a risky location and their lives are under threat. Both the source of the dissatisfaction and the source of immobility are externally imposed. At the other end of the scale, both the source of dissatisfaction and the source of immobility are imposed by the individual, on themselves. In this population, the sources of dissatisfaction were socially, not climatically driven, but in the future, livelihoods and lives will be increasingly impacted by climate change. Levels of self-imposed immobility, however, may remain the same.

It cannot be assumed that as the situation became more severe, people would overcome their low mobility potential and leave. Obligations, representing both negative and positive place attachment, are as important under life-threatening disruptions as they are under less severe triggers of dissatisfaction. For example, in Hurricane Katrina, people refused to evacuate so as not to leave their pets behind (Gemenne 2010). In Bangladesh, mortality of women during cyclones is much higher than men, partly because of the role of as women primary carers with responsibilities to the elderly, children and the home (Begum 1993).

While this research has demonstrated, using behavioural migration theory and ideas of place attachment, that trapped populations exist along a continuum, there are a number of areas for improvement which can form a basis for future work in this area. While the results show that the population is living under considerable climate stress and that the population perceives the negative climate change impacts, it does not link perceptions of climate and weather impacts with residential satisfaction and mobility characteristics of the individual. Nor is it within the scope of this paper to analyse whose residential satisfaction will be most sensitive as the impacts of climate change increasingly felt. However, further work should establish these relationships and investigate how mobility characteristics interact with sensitivity of residential satisfaction to future climate change. The integration of ideas of place attachment and residential satisfaction could also be further advanced through the collection of data on residential satisfaction alongside place attachment measures, and a dedicated review and development of theory in this area. The concepts of residential satisfaction, mobility potential and place attachment could all be tested in this context using in-depth, qualitative investigation; this analysis was limited by the short-answer nature of the responses. Finally, thresholds are fundamental to behavioural migration theory. Further research in this area could attempt to define levels of stress that an individual can tolerate before the balance between mobility potential and residential satisfaction tips in favour of migration.

Conclusion

The concept of a trapped population, as it stands, masks the complexities of why populations persist in difficult conditions and assumes a population homogeneous with respect to its mobility and residential satisfaction and place attachment characteristics. This paper investigated whether people in a socio-economically and environmentally marginal location, vulnerable to future climate change, were dissatisfied with their location and, if they were, the barriers to migration. The use of behavioural migration theory was extended to understanding migration under climate change and applied to the particular case of populations immobile under harmful environmental change. The concept of place attachment was used to enrich analysis of residential satisfaction and immobility.

This research contributes to discussions of trapped populations which are usually defined by immobility during natural disasters due to a lack of resources. However, this research has shown that this type of immobility is only part of a continuum. At the other end of the continuum are socio-psychological barriers consistent with migration decision-making processes and ideas of place attachment.

However, the research also showed that not everyone is dissatisfied with location and that the non-economic aspects of the migration decision-making process should not be underestimated. Even in a place that is suboptimal both in a relative sense (compared to the capital city Lima) and in an absolute sense (when considering the negative social and environmental impacts, people are contending with on a daily basis) with a highly developed migrant flow to the capital (low costs of migration and a high level of knowledge about the location) people choose to stay.

The policy implication is that governments should not make assumptions a priori about whether a location is undesirable and promote migration as a blanket solution to the negative impacts of climate change. The non-economic benefits of place and the attachment people form to them cannot be overestimated (Mortreux and Barnett 2009; McNamara and Gibson 2009; Shen and Gemenne 2011; Adams and Adger 2013b). In this regard, there are lessons to be learned from past resettlement of communities due to the development or disaster, and the social and economic problems that arise in resettled populations when these place-specific factors are not taken into account (Cernea and McDowell 2000; Scudder 2005).

Such findings are widely applicable as the characteristics of this area—a highly centralised economy with well-established migrant networks, small-holder farmers on the periphery of urban expansion, and fragile and varied ecosystems—are common to many urbanising economies, from deltas to islands to mountain environments (Massey et al. 2010; Seto 2011; Tacoli 2009). An understanding of the highly differentiated nature of mobility, residential satisfaction and place attachment illuminates some of the reasons why rural populations continue to persist across the globe, even in the face of difficult conditions. This expanded view of what it means to be “trapped” suggests that such rural populations will continue to persist even under a climate-changed future.

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