Bolivian Andes: from climate change to human displacements?

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Abstract

This research explores the impact of climate change on population migration in the mountainous regions of Bolivia. Migration, considered here as an "ex-situ" adaptation strategy, can be chosen to cope with the worsening environmental conditions. In this case-study based research, some preliminary results are presented in order to better understand the weight of perceived climate change impacts on migration decisions. Additionally, some issues related to glacial retreat, especially the visual dimension, are stressed.

Keywords: climate change, glacier, perception, migration, Bolivia, Andes

1 Introduction

This paper provides insights into the nexus between climate change and migration, documented by a case study in the mountainous region of the Bolivian Andes. In this area, one of the most noticeable effects of global warming is glacial retreat. Glacial run-off is essential to the region, supporting local ecosystems as well as providing water for drinking, farming, and energy production. At the moment, mountain communities are facing seasonal water shortages, which threaten the livelihood of their inhabitants. Migration, mostly from rural to urban areas, can be chosen as a strategy to cope with these worsening conditions. In this brief review, the main epistemological issues about the concept of climate refugee are presented in a first step followed by a brief synthesis of the main empirical results in this study area. Afterwards, the paper focuses on the mountainous Khapi's community, outlining the relationship between migration patterns and climate change impacts with a special focus on, glacier retreat. Considering that "*perceptions of climate change risk are also central to how individuals respond to climate change*" (Mortreux & Barnett 2010), the results focus on how the environmental changes are perceived by the villagers.

2 The concept of "climate refugee"

The terms "climate refugee" or "environmental refugee" have been widely used in both political and academic contexts over the last twenty years, giving rise to numerous debates amongst academics. Despite this interest, the amount of empirical research on the issue remains rather limited. There are uncertainties concerning the actual mechanisms at play, the geographical areas concerned and therefore the

number of persons potentially affected. The main debate is taking place between those who stress the direct impact of the environment on population flows and those who rather insist on the social, economic, and political contexts in which such flows occur (Castles 2002).

Describing a category of migrants as "climate refugee" is thus scientifically arguable, even if it remains a "*powerful way to catch the imagination of the public*" (Piguet et al. 2011). The multiplicity of factors that might cause migration is not taken into account by this concept. Furthermore it does not correspond to the 1951 Geneva Convention refugee' definition (Castles 2002). Hence, it is now rather consensual for the scientific community to employ the notion of "*environmental induced migration*" or the shorter term "*environmental migrants*" (the latter is adopted by the International Organisation for Migration). Thus, it allows designating a general category of migration for which the environmental dimension is considered as being critical, but not necessarily unique (Piguet 2008).

3 Some insights from empirical studies

Currently, the climate change migration issues are subject of a burgeoning literature. However, the number of in-depth studies remains surprisingly low. Among the global warming impacts, the following effects are generally recognised as potentially leading to displacements: episodes of droughts and water shortages, increasing frequency and intensity of hurricanes, heavy rains and flooding, and sea level rise[1]. Such climate change manifestations are very heterogeneous; they fluctuate in scale and in potential damages and thus can lead to various form of mobility. A rough distinction is usually made between sudden-onset and slow-onset environmental deterioration events: "*In the case of sudden-onset environmental disruption, such as floods, the causality of migration is relatively clear. In the case of slow-onset environmental deterioration, such as land degradation, there is usually a set of overlapping causes at play (multi-causality). Political and socioeconomic factors combine with environmental degradation to undermine the resource base of affected people. On the other hand, sudden-onset disruptions tend to be temporary while more gradual deteriorations tend to be more permanent or at least hard to reverse."* (Van der Geest 2008).

Whether slow or rapid degradation, case studies focusing on migration impacts give very diverse results. This can be illustrated by different studies seeking to assess the influence of rainfall on migration in Mexican emigration. Using similar data but different methodologies, some studies tend to underline the correlation between low rainfalls at the original location (Mexico) and the migration to the United States, whereas the findings of others emphasize that as more rainfall occurs more migration occurs (Munshi 2003; Kniveton et al. 2008; Schmidt-Verkerk 2009; Feng et al. 2010). These contrasted results illustrate the complexity in assessing this kind of phenomenon, and in particular to assess the multi-causal nature of migration. In this paper, we thus consider migration as one possible adaptation form among many,

[1] For recent synthesis on empirical studies see Hugo (2008), Kniveton et al (2008), Kaenzig & Piguet (2011), Piguet (2008)

and which is at the same time not necessarily accessible to everyone. For example, Valdivia et al. (2010) describe various income diversification strategies of Bolivian highlands farmers that have to cope with these climate variability risks. These coping strategies usually are mobilised after environmental disruptions and can consist of sending household goods, increasing the remittances income and/or temporal migration.

In order to cope with environmental changes, decision-making processes are rarely based on a rational or scientific assessment of climate changes. As it is underlined by Mortreux & Barnett (2009), decisions related to adaptation strategies are informed by a variety of sources including what "experts" say, what their peers say and what the media say. Thus, in order to better understand how individuals may respond to environmental changes, it seems essential to assess the way these changes are perceived (Grothmann & Patt 2005; Marx et al. 2006).

So far, only one case study with a special focus on the linkages between climate change and migration has been conducted in Bolivia. The research of Balderrama et al. (2011) tends to assess the characteristics of migration in the Bolivian highland (Altiplano in Spanish: the high altitude plateau located between two ranges of high altitude mountains), a region particularly affected by drought episodes and desertification. In this area, migration (mostly internal) is a long-standing strategy of income diversification for communities depending on farming. This research points that environmental variables are intrinsically connected to the economic situation of the region that suffers of very high unemployment rate due to the mining sector decline. Results underline displacements characterised by short distances to other rural areas or neighbouring towns. Furthermore, the migration temporality tends to vary according to the severity of the environmental conditions; where degradation and soil erosion are higher, people tend to move more permanently.

3.1 Global warming and glacier retreat in Bolivia

It is difficult to draw a homogenous portrait of the Bolivian highland climate because of the region's complex topography (Vergara 2005; IPCC, Magrin et al. 2007). However, data show a warming trend over the last fifty years, especially for the temperature maximum. Projections suggest that "*(…) mean temperature increases of 1.5 °C are likely by 2030 and greater than 4 °C (5–6 SDs) through the annual cycle by the end of the century. Expected precipitation changes are negligible when averaged over all seasons. Our analysis suggests, however, that the early rainy season (September–November) is likely to be drier and the peak rainy season (January–March) is likely to be wetter, implying a shift toward a later and stronger rainy season, consistent with a larger scale analysis.*" (Valdivia et al. 2010: 828).

In the Andean region, one of the most tangible global warming manifestations is glacier retreat. Despite a high degree of knowledge of the physical processes of ice melting and a strong interest of the media, this phenomenon is only very marginally taken into consideration by social science or migration studies. Since 1970, glaciers in the Andes lost almost half of their surface and the melting process tends to accelerate significantly over the years (Coudrain et al. 2005; Soruco et al. 2009). In Bolivia, for example, some small tropical glaciers of low and medium altitudes

have entirely disappeared during this period, and projections indicate that many others are likely to vanish completely in the decades to come (Vergara 2005; Ramirez 2006; IAI 2010).

The decrease of water supply is one of the main effects already observed in this mountainous region (Paz Rada 2007; Viviroli et al. 2007; Hoffmann 2008). Run-off from glacier basins is an essential element of water that poses serious challenges in terms of adaptation to global warming, but little research is done to assess the socio-economic impacts of glacial retreat. Only in the recent years ethnographic studies considering these issues can be found (Young & Lipton 2006; Rhoades 2008; Orlove 2009; Carey 2010). They provide valuable insights on the adaptation of the communities surrounding the receding glaciers in Peruvian and Ecuadorian reliefs in particular. Although migration processes are occasionally mentioned in these studies, they do not focus specifically on it. Research on this issue and more generally on climate change consequences in the Andes seem therefore highly required.

3.2 Hypotheses

According to the previous inputs on empirical studies and climate context in Bolivia, we consider glacier retreat and its subsequent environmental effects like water problems availability, as "*slow onsets environmental disruptions*". To cope with these conditions, migration appears as an adaptation option for some villagers. Migration patterns are considered as a possible result of a set of overlapping causes, whereby the environmental factor is only one factor among several others in explaining mobility dynamics (Piguet 2010). As it is underlined by Grothmann & Patt (2005) "*(…) the perception of risks of change may be a far more important factor in decision-making than the realisation of biophysical change per se*". We thus assume that villager's decisions regarding adaptation options are mostly based on their own environmental observations and perceptions. In the following analysis, we thus focus on migration patterns, perception of environmental change and the role of the vanishing glacier image.

4 Fieldwork context

The methodological approach is first and foremost qualitative, using semi-directed interviews. In the first stage of this research[2], 15 interviews were conducted with experts (academics, journalists, NGO stakeholders, government stakeholders) in order to raise and identify the main issues around this migration-climate nexus in this bolivian mountainous area. Afterwards, 15 semi-directive interviews have been conducted in the Andean Khapi community.

We tried to reduce the bias related to a deterministic approach (considering glacier disappearance causing migration) and no interrogations explicitly mentioned[3]

[2] In following stages of the study, questionnaires will be provided (to migrants and non-migrants) in order to broaden the number of interviewed people and the studied areas

[3] Likewise, we did not present our fieldwork mentioning the climate change dimension

climate change or glacier issues when we approach the subject of migration decisions, as suggested by Mortreux & Barnett (2009). Interviews were realised in Spanish and in Aymara[4].

4.1 Khapi community

Khapi is a modest farming community situated on the hillsides of the Illimani, one of the glaciers that form part of Cordillera Real. A dozen of houses made of adobe are situated around the main village place. Other houses are disseminated in the surroundings. In terms of infrastructure, there is a little church and a primary school. According to the village leader and other sources (SENARI 2009; AguaSustentable 2009) around thirty-five families are living there[5]. All of them are indigenous part of the Aymara ethnic group; Aymara is thus the native tongue but most of the inhabitants speak fluently Spanish (national language). The community mainly lives from farming. In crops on terraces with irrigation, villagers mostly grow potatoes, onions, corn and beans. The community is located at an altitude of 3,480 m, on an ecological floor called "highland plateau" or "valley heads" (2,700–3,900 meters). It is characterized by a landscape with sparse forest vegetation, interspersed with mosaics of shrub and herbaceous.

In the last few years, the Andean community of Khapi, has gathered the attention of numerous international media, as well as an increasing number of NGOs. In 2009, some villagers were invited to the Copenhagen Climate Conference (COP 15) as climate change witnesses to describe their living conditions. The experience of this farming community facing glacier shrinkage has spread worldwide through press articles and reports[6]. Villagers are portrayed as climate change victims embodying the figure of "environmental migrants" in international Medias like *The New York Times*, *BBC* and *CNN*[7].

5 Migration patterns: leaving or staying?

The area is experiencing a high rate of outmigration where approximately 70% of the population have family members living outside the village (UMSA 2010). La Paz and El Alto, constituting the main urban areas[8] of the highland, are the major migration destinations cities. For example, since the 1970s, the city of El Alto has grown

[4] The author does speak Spanish but not Aymara Thus, when it was necessary, some interviews have been done with the help of a translator speaking both languages

[5] Quantifying the community population should be considered very thoughtfully because people are often in a circulatory process made of temporary migration and multiresidency

[6] This is analysed more in depth in the paper (work in progress) presented the 08 06 2011: Kaenzig, R *From Khapi to Copenhagen: how some Andean villagers became world famous climate migrant figures?* Public Geographies CUSO Bienne

[7] 19 04 2009 BBC News: *Bolivian community sees its future melt*; 14 12 2009 New York Times: *In Bolivia, Water and Ice tell of climate change*; 17 01 2010 CNN Mexico: *El deshielo empuja la emigracion en una comunidad indigena de Bolivia;* etc

[8] El Alto (Spanish for *The Heights*) was first a suburb of the adjacent city of La Paz They form now two different municipalities El Alto is located around and it is today one of Bolivia's largest and fastest-growing urban centres

from a small town of some thousand inhabitants to one of the three largest cities of Bolivia. El Alto has an estimated population of more than 1,200,000 inhabitants[9]. This massive expansion is often attributed to large rural-urban migratory processes. According to Hubert Mazurek (2007), more than 80% of people living in El Alto are migrants coming from the surrounding highlands.

People who are migrating are mostly young men who have a profession. In general, it is the family's father who goes to the city to seek employment. Young adults, after finishing school, are also very prone to move to La Paz and El Alto or sometimes to further destinations. Women and older persons stay in the village to work the field. These mobility patterns affect the community social structure on redistributing roles and responsibilities among those who stay. Those who stay are indeed responsible for farming the crops and for taking care of the young children, the house and the livestock.

These movements are temporary, and multiresidency is widely practiced. Indeed, most of the migrants keep a farming activity (plots or livestock) in the community of origin where relatives are in charge of it. The distance separating the community from the city influences the temporality of the migration cycles. For example, Palca, a community also located on the Illimani hillside, is only a two-hour drive from La Paz. This location allows the migrants to go to the city on Monday and to return to their original community for the weekend. Khapi is less accessible from the city and therefore people tend to stay longer in the city, occasionally coming back to the village to help their relatives with farming activities, to participate in the traditional celebration or accomplish their social function within the community. The migration cycle is also strongly season related. Migration movements are more intense during the low rain season when farming activities are less intense. Journeys to the city tend to be more permanent for the younger migrants. Older migrants go to the city to ensure their livelihood, diversifying their activities. They get temporally unqualified jobs in the construction sector, but they tend to keep their farming activity. The young interviewees[10] say they have different employment and living condition aspiration than their parent might have.

The reasons to move to cities like La Paz and El Alto, temporarily or permanently, also vary according to generations. Family leaders tend to migrate in order to diversify their income and many of them keep the agriculture activity. Whereas young villagers distance themselves from farming activities as they perceive it as more and more uncertain. In addition, the young coming from a large family can not ensure a sufficient income from farming because of the successive fragmentation of the land plots, as it is expressed by a young man "*Look, my parents have a plot which provides food for my family and some more to sell in the market, but I have six brothers and sisters! If we divide the plots in six, no one would be able to live with.*" (Khapi, man 19 y. o.).

Local manifestations of climate changes, like seasonal deregulations, are often cited as accentuating this insecurity. Few young people pretend to have the intention to stay in the original community. In addition, they benefited from a better education

[9] According to the national statistical institute (INE)

[10] Approx 15–25 years old

than their parents generation and they aspire to do longer studies, which is impossible to find in countryside. There, it is important to note that migration experiences from the older persons tend to facilitate and encourage the mobility of the younger.

In the last section we underlined how mobility is integrated into community life. Rare are the inhabitants who are not engaged in a mobility process, themselves or indirectly through relatives. Many variables enter into consideration in talking about migration decisions where environmental changes are often considered as incentives to move; as push factors in order words. In the following section we try to summarise the different environmental dimensions that Khapi inhabitants perceive as being related to their decision to migrate.

6 Climate change perceptions related to migration

To understand the complex links between environment and migration in a non-deterministic perspective we argue that climate perceptions are fundamental. Climate change impacts do not only affect livelihood through their concrete and measurable changes like water availability. We assume that people's decisions are mediated through the perception that they have of their environment (Grothman & Patt 2005). In this sense, perceived changes and measured changes are not necessarily the same and both may influence the migration decision. In the two following chapters we focus on the way climate change impacts are perceived and how the image of the vanishing glacier play a role.

The year can be divided into two seasons: the rainy season (from September to March) and the dry season when there is almost no rain. During the dry period, irrigation water and drinking water are mostly provided by the glacier run-off, with Illimani constituting a water reservoir all year round. Even if it is still difficult to measure the exact glacier contribution, it is obvious that its disappearance will severely affect the water availability, especially during the dry season[11].

According to the lead author of the PNCC report (Bolivian National Program on Climate Change), Javier Gonzalez, the effective environmental issues related to climate change are not only the glacier run-off but the uncertainty about the seasons and the precipitation patterns: "*It is very hard to measure the exact contribution of the glacier, but it is certain that this is not the only climate change impact at play. Mountainous villages have to face the seasonal variability and growing uncertainties related to climatic conditions. It directly impacts community decisions about farming. Their ancestral knowledge is confronting new forms of climate patterns.*" (Gonzalez 2010).

Nearly all villagers live from agriculture and future perspectives regarding this activity are perceived as rather compromised. Farmers are aware that they need to counterbalance the rain irregularities and the diminishing glacier run-off: "*We do not*

[11] According to the experts from IHH (Institute of hydrology and hydraulic, University of San Andres La Paz): In general, from La Paz to Titicaca lake, the glaciers do not contribute to more than 15% to the community's water It may be more in mountainous areas, but no data are available The temporal issue is also hard to assess but it is sure that the glacier melting rate is accelerating meaning that water run-off is irremediably declining

have water enough to sow our field, even if we have good quality soil. […] Water is not sufficient for families who are living here. We need to irrigate more and more." (Khapi, man 45 y. o.). Irrigation issues are particularly important considering the increasing precipitation variability, which means more intense but shorter periods of rain and longer periods of drought. Increasing the irrigation efficiency is a manner to reduce community vulnerability to these changes. Precipitation and seasonal irregularities may cause farming disturbances, provoking uncertainties regarding the seeding periods: "*We miss security. What we want is to know more about changes. To organize ourselves*" (Khapi, man 45 y. o.). Climate unpredictability is often perceived as one of the most important issue that this community has to cope with.

Higher variability of temperature and more frequent hail and frost episodes are other types of environmental disruptions identified by Khapi villagers. The preparation of *chuños* ("frozen potatoes" in Aymara) is a very efficient temperature indicator because the way to cook this traditional meal is entirely climate dependant. Potatoes are buried in the soil, thereby exposing them to very low night temperatures and freezing them, and then they are exposed to intense sunlight during the day. Thus, farmers can have a precise idea about temperatures evolution, at least about the coldest periods. They note that in July, the month when they originally prepare this meal, has less and less frequently cold nights than usual because they are often unable to cook this traditional food.

Water availability and climate condition unpredictability are identified by Khapi community members as the most problematical environment issues that they have to cope with leading community member to be more sceptical about their future farming possibilities and consequently their living condition: "*if we can not get more water, going away would be the solution. Going to city or to another place.*" (Khapi, woman 38 y. o.). In the following part we assess more deeply the role of the glacier image in migration decisions.

6.1 The disappearing glacier image as an early warming

A diminishing glacier is probably the most tangible impact of climate change; it can be visually assessed. Melting glacier processes embody the evidence that climate is rapidly changing and may compromise future living possibilities. The glacier represents thus a climate evolution indicator.

The image of the vanishing glacier has a strong impact for people living in Khapi. Adults and elder people do remember the location of the snow limit in the past and they can visually assess the retracting phenomena. Some villagers directly link the water scarcity to glacier: "*Our drought is coming from Illimani*" (Khapi, man 65 y. o.).

This is reinforced considering that Illimani is an important dimension of the Andean cosmological vision of the relationship between human being and mother earth. For the Andean peasants the *apus* (highest peaks) are tutelary spirits, held responsible for water sources and fertility of the fields and are the residence for the *Illapa* or thunder and lightning, a powerful god that is revered both for its water-producing facility and for its capability to produce damage to crops through hail (Vergara 2007). Based on these observations, villagers express preoccupations mostly

about their future livelihood. They formulate it talking about life conditions of their children or grandchildren: "*I hope my children will support me. But I would like they can do studies, at least two of my five children.*" (Khapi, woman 45 y. o.).

Therefore, when the ice is melting it is also the likelihood to live in this area that is diminishing, which impacts mobility strategy decision. The visual characteristic of the melting process allows us to underline the weight of symbolic and performative dimension of the glacier. So, beside the effective impact on water availability, the glacier plays an important iconic dimension through embodying climate change impacts and represents the difficulties that Khapi community may face in a close future. This dimension seems to be seriously considered when villagers are thinking to their livelihood and thus influencing migration decisions.

7 Concluding remarks

In this short paper we aimed to give some insights about environmental changes and migration in Bolivian highlands with a special focus on glacier retreat process. The emergence and the limits about the "climate refugee" concept have been briefly stressed and illustrated with some empirical results. This allowed us to adopt a non-deterministic approach, considering the migration process as dependant on a multiplicity of factors. To consider environmental variables we assumed that besides the measurable physical changes, it is also necessary to take into account the way these changes are perceived by the exposed community. In this perspective, we specifically underlined the weight of the retreating glaciers considering their concrete but particularly the symbolic dimension. Moreover, the growing variability of temperature and precipitation added to the seasonal deregulation provoke uncertainties that strongly affect farming practices, which raise doubts about living conditions in the community. Furthermore, other variables shape mobility patterns. We stressed different factors like the cities' attractiveness and the role of the distance, the migrants' profiles – especially their age – and their aspirations in terms of employment and livelihood.

Migration patterns from Khapi are thus characterised by short distances and are until now rarely permanent. Mobility can be considered as a livelihood diversification option; a strategy to minimise the risks associated with traditional farming activities. These insights are thus consistent with other results from empirical studies focusing on slow onset degradation. However, through focusing on a mountainous region, this study succinctly outlines a rarely studied climate change consequence like the impact of a retreating glacier on the community living condition. These preliminary results focus on the dimension of perception and the performative role that may have the visual dimension of a retreating glacier. Within the next steps, the study will imply to proceed to investigate this immaterial dimension but also to assess the other mechanisms (like the water availability) at play between glacier retreat and human mobility.

To conclude, in considering climate changes impacts on vulnerable societies, we have to recognize the responsibility of northern and more industrialised countries for their contribution to global warming processes. However, recognizing that cli-

mate change manifestations play a role in the community mobility pattern should not supplant structural factors that might undermine their adaptation capacity. The community exposure cannot be only environmental; deficiencies in equipment as a lack of institutional aid do also contribute significantly to its vulnerability and thus to its adaptation options.

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