

Micro-narratives on people's perception of climate change and its impact on their livelihood and migration: Voices from the indigenous Aymara people in the Bolivian Andes

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Abstract

Millions of people are being forced to migrate involuntarily due to extreme weather events¹ and anthropogenic climate change each year. Climate-induced human migration is now contemplated as a colossal humanitarian challenge. Climate migration is an emerging issue that has long been neglected for political reasons. Most recent works in this field are primarily linked to defining or estimating climate migrants and constructing theoretical frameworks on the potential drivers of population mobility. However, the miseries of the marginalised people and climate migrants are still overlooked and insufficiently researched, especially in the frontline indigenous communities residing in high-altitude regions of South America.

To overcome such limitations, we studied Aymara, an indigenous people in the northern Bolivian Altiplano. We collected thirty micro-narratives from some selected case study areas through in-depth interviews and conducted two focus group discussions. The fieldwork was conducted between April and May 2021. We aimed at understanding the impact of climate change on livelihoods, local economy and the migration pattern of the Aymara people and their adaptation strategies in the face of global warming and extreme weather events.

The participants stressed that climate change adversely affects the Aymara community despite their inherited traditional knowledge. They face severe water scarcity, weather variability, glacier melting, changes in precipitation and farming seasons, loss of biodiversity, and environmental degradation. Climate change exacerbates pre-existing vulnerabilities associated with livelihoods, poverty, people's health, and food security. Consequently, young Aymara adults predominantly migrate to larger cities or sometimes even cross borders, searching for alternative occupations and better living standards. We recommend that high-level intergovernmental and local policymakers recognise climate

¹ Climate Extreme (extreme weather or climate event): The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, extreme weather and climate events are collectively referred to as 'climate extremes' (IPCC, 2012).

migrants and take urgent steps to protect them and rebuild communities by safeguarding their human rights, cultural heritage, and dignity.

Keywords: Indigenous people, climate change, vulnerability, traditional knowledge, environmental migration, Bolivia.

1. Introduction

Human-induced climate change is the defining development challenge of our time. It is predicted that the adverse impact of climate change will intensify in all regions worldwide in the coming decades (IPCC, 2021). Although climate change is a global issue, there is compelling evidence that the Andean mountains in South America are highly vulnerable because of their unique geophysical features (Global Environment Facility, 2021; Schoolmeester et al., 2016). Indigenous mountainous communities in the Bolivian Altiplano (high plateau) are already experiencing climate change's effects on their lives and livelihoods. Moreover, unpredictable climatic conditions challenge traditional knowledge and threaten people's livelihoods, the development and maintenance of their culture, and their survival (McDowell & Hess, 2012; OXFAM, 2020).

In the Bolivian Altiplano, Aymara, an indigenous people in the Andean region of South America, are particularly vulnerable because they live in a harsh environment, face pervasive poverty, have unequal access to land with high fragmentation, are exposed to the impacts of climate change and variability, and have limited access to technology, infrastructure, and financial resources to support their livelihoods and preserve their environment (Ministerio de Planificación del Desarrollo et al., 2015). Consistent evidence indicates that people in the Bolivian Altiplano have adapted to different climatic conditions over generations. People's capacity to adapt to environmental change has been based on an in-depth understanding of their land and ecosystems (Ayala et al., 2016; Dupuits, 2021; Ford et al., 2020). However, as climate change increasingly affects these populations, they respond and adapt in unique ways.

They combine their traditional knowledge with modern technical knowledge to adapt to climate change and develop other income-generating activities. Furthermore, migration is part of a broader livelihood portfolio and is an important adaptation strategy in the context of climate change. The IPCC Sixth Assessment Report (2020) states that there is now robust evidence that the impacts of climate change are driving rural communities to diversify their income sources, such as urban wage labour, migration, and remittances.

This study explores the Aymara people's perception of climate change and its impacts on their livelihoods and migration in five selected municipalities (Batallas, Pucarani, Puerto Pérez, Huatajata, and Taraco) in the Northern Altiplano in the department of La Paz, Bolivia.

The research questions are:

- a) How do the Aymara people perceive the effects of climate change?

- b) What are the impacts of climate change on the Aymara people's livelihoods and well-being?
- c) How are the Aymara people responding to the impacts of climate change?
- d) How have climate change impacts impacted Aymara people's decisions to migrate?

2. Conceptual framework

The conceptualisation of critical issues such as vulnerability resilience, traditional knowledge, and human mobility in the context of the Bolivian Altiplano will give us the framework to understand the effects of climate change on people's lives and livelihoods and their coping mechanisms, including migration.

2.1. Vulnerability and resilience

Extensive evidence indicates that climate change and variability are disproportionately distributed among vulnerable and marginalised population groups (IOM, 2018; Thomas et al., 2019). Furthermore, the IPCC (2014) indicates that "climate change will exacerbate multidimensional poverty in most developing countries, including high mountain states [where Aymara population live and thrive]" (Olsson et al., 2014). Indigenous peoples are among the first to face the direct impacts of climate change and variability due to their strong dependence on their ecosystems and natural resources for their livelihoods and food security (United Nations, 2022).

This is relevant for the Aymara people in Bolivia, who live in fragile areas that are particularly exposed to climate change and environmental degradation (Gonda, 2020; Schoolmeester et al., 2016). Even though climate change disproportionately affects indigenous communities, they have demonstrated resilience in the context of slow- and sudden-onset events. A growing number of research provide evidence of indigenous resilience grounded in cultural aspects, history, and traditions that connect people to their communities and environments (Cuesta et al., 2012; Ford et al., 2020; IOM, 2018; Nakashima et al., 2012).

While there is evidence of indigenous people's resilience, in most cases, they are still depicted as victims of climate change because their needs, problems, and challenges are generally ignored in policy debates. These narratives are incomplete, and they can delegitimise indigenous people's agency and portray them as unable to decide their future. Moreover, traditional knowledge is presented as romanticised and generally as a means of corroborating scientific knowledge (Belfer & Maillet, 2017). Indigenous peoples' long history of resilience and adaptation has long been neglected in research and policy. They must be recognised as agents of change, and their voices need to be heard (Baird, 2008; Etchart, 2017; Oelz et al., 2017).

Resilience in Aymara communities is rooted in their traditional knowledge. The IPCC Assessment AR4 noted that traditional knowledge is "an invaluable basis for developing adaptation and natural resource management strategies in response to environmental and other forms of change" (IPCC, 2007). Traditional knowledge and wisdom on how to live in harmony with nature have been

accumulated over many generations by indigenous people in the Andean region. Since ancient times, they have developed a remarkable capacity to adapt to harsh environmental conditions, manage their ecosystem, conserve biodiversity, and domesticate a great diversity of food plants and animals. In addition, irrigation technologies and terraces have been built on the slopes to increase and stabilise cultivable areas (Fundación Tierra, 2019; Meldrum et al., 2018). Although Andean communities' resilience is threatened by their vulnerability to the adverse impacts of climate change and variability, people still use their traditional knowledge to inform decision-making about fundamental aspects of day-to-day life.

2.2. Migration

Extensive literature has documented that Andean communities in Bolivia are characterised by high levels of mobility which is a traditional way to reduce vulnerabilities. Over the years, large numbers of Andean people have migrated internally and across borders to escape harsh environmental conditions, land scarcity, poverty, unemployment, lack of access to infrastructure, health, education, technology, and other agricultural support systems (Balderrama et al., 2011; Kollmair & Banerjee, 2011; UDAPE & INE, 2018). However, climate change is exacerbating existing vulnerabilities and causing new ones.

In the Andean region, those who usually migrate are the young adults who move to urban areas and abroad. Few youths aspire to remain in rural areas and make a living out of agriculture as they do not have access to assets, goods, and services or opportunities to acquire new skills. Too often, their only option is to migrate (Urioste, 2012). These mobility patterns affect the social structures of communities as new redistributions of roles and responsibilities emerge among those who stay behind. Women, the elderly, and children are often left in the communities to look after plots of land and animals. Meanwhile, male family members migrate to urban areas to seek employment and diversify their family income (Gil Montero, 2006).

In the Andean region, four types of migration have been identified: (i) long-term migration to another province in the country and abroad, mainly to Argentina and Brazil (ii) temporary migration to urban areas or rural municipalities, mainly in the lowlands (rural-rural migration), (iii) circular migration and multi-residency to neighbouring cities, and (iv) return migration mostly of elders (Kaenzig & Piguet, 2014; Schwilch et al., 2017).

2.3. Environmental migration

According to IOM (2019), the working definition of climate migration refers to “the movement of a person or groups of persons who, predominantly for reasons of sudden or progressive change in the environment due to climate change, are obliged to leave their habitual place of residence, or choose to do so, either temporarily or permanently, within a State or across an international border”. Climate migration is thus a subcategory of environmental migration; it defines a particular type of ecological migration, where the change in the environment is due to climate change (IOM, 2019).

Environmental factors have always impacted human mobility; throughout history, people have left places with deteriorating or harsh conditions. However, the accelerated and combined impacts of climate change have become so severe that the scale of movement is increasing and has unparalleled implications on people's lives and livelihoods (Brookings, 2014; IPCC, 2007). Over the last decades, there has been a growing recognition that environmental and climate changes are important drivers of migration. Policymakers and researchers worldwide have advocated incorporating migration into climate change debates (Foresight, 2011; Flores-Palacios, 2016).

Many studies in the Andean region of South America have anticipated that the impacts of climate change will become increasingly severe in the decades ahead, contributing to human mobility (Kaenzig & Pigué, 2014). In the southern Ecuadorian Andes, Gray (2009) found that environmental factors were correlated to short-distance migration but not to international migration. Milan and Ho (2013) studied the relationship between increasing rainfall variability, livelihoods, and human mobility in the highlands of Peru. They found that rainfall variability and climatic conditions, in general, play an essential role in shaping local livelihoods and thereby influence migration decisions primarily driven by broader economic considerations.

In the highlands of Bolivia, migration in the context of climate change is a topic still underexplored. However, there is growing evidence that the adverse effects of climate change contribute directly and indirectly to both temporary and permanent migration and displacement within the country and across borders. Climate impacts add new layers of vulnerability to the Andean populations living in this region. Like other Andean countries, Bolivia has experienced an average increase in temperatures, and one of the most severe consequences is the acceleration of the melting of glaciers. This is severe because entire communities depend on glaciers for water, irrigation, power generation, and ecosystem conservation. In the last fifty years, many tropical glaciers in Bolivia have entirely disappeared, and projections indicate that many of the rest are likely to melt over the coming decades (Barnett & Lettenmaier, 2005; Ramirez, 2006).

There are few studies on the impacts of melting glaciers on population movements in the Bolivian Altiplano. These have shown that glaciers retreat due to climate change, leading to water scarcity and migration. For instance, Alurralde et al. (2011) pointed out that if the temperatures continue to increase and the rainfall patterns keep changing, the Illimani glacier's melting rate will become faster and devastate the downstream communities depending on its water resources and could boost future migration rates in the area.

Kaenzig (2013) also studied the Illimani glacier and the communities situated on the hillsides of the mountain in the municipality of Palca. He found that climate change has no direct implications on migration patterns as glacier retreats cannot be considered a driver. Episodes of seasonal droughts or hazards cannot be solely attributed to glacier retreats. Still, they must consider other climatic factors, such as precipitation and temperatures, and non-climatic factors, such as the governance of water distribution (Brandt et al., 2016).

Balderrama et al. (2011) studied the Northern Potosi region, which experiences gradual environmental degradation, drought, and desertification. The authors found that ecological degradation coupled with a reduction in the amount of land available for farming, mining enclaves, desertification, and climate variability has led to the impoverishment of the indigenous population, triggering migration in the region to other rural areas or neighbouring cities.

3. Study area profile

The study area is in the West of the Department of La Paz and belongs to the Northern Bolivian Altiplano. This area is part of the ancestral territory and the cradle of ancient Andean civilisations. It is inhabited by the Aymara people, one of the largest ethnic groups in Bolivia. The fieldwork was conducted in the Municipalities of Batallas, Pucarani and Puerto Pérez in Los Andes Province, the Municipality of Huatajata in Omasuyos Province, and the Municipality of Taraco in Ingavi Province.

The region's altitude ranges from 3,000 metres above sea level in the inter-Andean valleys to almost 6,500 metres above sea level in the peaks of the Cordillera Real, which is home to most of Bolivia's glaciers. A large part of this region is influenced by the presence of Lake Titicaca (the largest lake in South America) and the glaciers of the Cordillera Real Mountain range. The estimated population for 2020 of the selected municipalities is 66,000 inhabitants. All municipalities are rural, except for Batallas, which has a small urban centre. Poverty in the study area is widespread. In Batallas, the proportion of people living in poverty is 76.4%; in Pucarani is 82.2%; in Puerto Pérez is 83.2%; in Huatajata is 29.6%, and in Taraco is 85.3%. Many households lack essential services such as water supply, electricity, and sanitation. Water consumed comes from streams, natural springs, and wells in unfavourable conditions.

Communities in the Northern Altiplano are highly vulnerable to climate change due to several factors: (i) agricultural production is dependent on climatic variables such as rainfall for sowing and cultivation, and it is vulnerable to frost and hailstorms, (ii) water scarcity, (iii) small landholdings, (iv) loss of agrobiodiversity, and (v) low level of investment in households farming system (Devenish & Gianella, 2012; Rangelcroft et al., 2013).

The study area is characterised by small farms comprising various plots at different altitudes. Farmers grow potatoes, barley, oats, broad beans (*Vicia faba*), quinoa, oca (*Oxalis tuberosa*) and papaliza (*Ullucus tuberosus*). Livestock is also raised, and small-scale fishing is performed by the communities on Lake Titicaca's shores. Other incipient activities include trade, transport, and tourism. The Aymara population living in the study area presents high levels of mobility. Over the years, many people have migrated internally and abroad for employment, education, family reunification, and a better life.

4. Methodology

4.1. Rationale

This qualitative study explores the intersections between climate change, people's livelihoods and current mobility patterns and trends in the Northern Bolivian Altiplano. The approach considers people's knowledge and experiences at the centre of the study as it is crucial to give prominence to people on the front line of climate change. As Paton and Fairbairn-Dunlop (2010) wrote, "the voices of academics, scientists, politicians and development practitioners dominate the climate change debate, yet local knowledge and beliefs, local realities, as well as local voices and actions are essential elements of navigating the way forward". While listening to the people's voices may serve a political purpose and be seen as a right to be engaged, axiomatic also is that the voices carry considerable knowledge (traditional and other), which must be counted, and which can valuably inform future initiatives (Flores, 2016). Ethical awareness and appropriate engagement with Aymara communities were the study's core.

4.2. Design

The fieldwork, including pilot interviews for the study, was carried out between 12 April to 28 May 2021 by maintaining all the local COVID-19 regulations. The data collection methods were in-depth semi-structured interviews and focus group discussions (FGDs). Thirty participants were selected for qualitative micro-narrative collections, and two FGDs were conducted. The participants' voices provided diverse and rich sources of information. Due to the spread of COVID-19 in the country, travelling to all municipalities was limited. Thus, the fieldwork was conducted in Batallas and Pucarani. Participants from Puerto Pérez, Huatajata, and Taraco participated in the fieldwork in Batallas.

As oral tradition is congruent with Aymara culture, we emphasised making people's knowledge noticeable through oral testimonies. Twenty-six open-ended questions were formulated for the in-depth semi-structured interviews (Appendix-I) and fourteen for the FGDs (Appendix-II). Both methods helped to collect crucial qualitative information. The questions were oriented towards knowledge creation, especially around people's perception of the impacts of climate change on families' livelihoods, natural resource endowments, and population movements.

In addition, a comprehensive literature review of different disciplinary insights relating to climate change and human mobility and the government policies and practices in the study area was undertaken to contextualise the study.

4.3. Participants' profile

The respondents were selected with the support of a research assistant, an Aymara community leader fluent in Aymara, who identified the participants based on their knowledge and experience. A total of thirty people (twenty-three male and seven female) participated in the study, aged between 36 and 75 years old. There were more male than female respondents, and most were also in the middle-aged group, with the mean age of participants being 49 years old. Of the 30 participants, 18 were engaged in agricultural and livestock activities, nine were involved in farming and livestock activities, and were public servants. Three

Aymara participants were associated with universities; one was a historian, a master's student, and a university lecturer.

4.4. Process of gathering information and data analysis

The first author and principal researcher for this study conducted in-depth semi-structured interviews and FGDs with the support of the local research assistants. Participants had time to elaborate on their comments based on their knowledge, experiences, values, and beliefs. In conversational methods, silence and other forms of non-verbal cues have meaning. Therefore, awareness of cultural issues is essential (Kovach, 2010). Participants were not simply knowledge providers; their role was to bring their traditional knowledge and experiences to light. This study applied a qualitative thematic analysis to identify, analyse and report patterns within the data.

5. Results and discussion

5.1. People's perception of climate change

5.1.1. People's perception of changing weather patterns

The participants' perceptions of climate change and variability correspond with meteorological information and scientific estimates made in the Andean region. Rising temperatures, glaciers retreat, and shifts in the frequency and intensity of precipitation and frost events have been documented in the Andean highlands over the last decades (Hock et al., 2019; Meldrum et al., 2018).

Male, 41 years (BATALLAS)

We have experienced temperatures, rain, and frost changes in the last few years. But before, everything had its season; we knew when it was going to rain and what time there was going to be frost. Ice has come very early and affects our production, same with hailstorms. Our seasonal calendar has changed.

When participants were asked about specific weather-changing patterns, they described many processes of change that have occurred in the last decades. They pointed to abnormal weather variability, increases in mean temperatures, changes in precipitation, and hailstorms and frosts during unusual times.

Male, 55 years (HUANCANÉ BATALLAS)

Talking about climate change hurts us. Now with these changes, everything is happening unexpectedly. Frost, hails come suddenly, and we do not know when it will rain.

Historical records show that the climate regime - temperature and precipitation - is changing in the Altiplano, and forecasts indicate that such variations will continue for several decades, as well as an increase in extreme events (Seth et al., 2013). Given climate's significant influence on people who depend on agriculture and livestock in the Altiplano, climate change and variability imply challenges to the traditional relationships between people and their environment

and impose additional pressures on the agriculture-based economy and natural resources (Young & Lipton, 2006).

A standard view amongst interviewees was the shifting seasons due to climate change. Some mentioned that the higher-elevation zones previously excessively cold for arable farming have become productive and now support the cultivation of hardy crop varieties. These perceptions coincide with well-documented studies in the Bolivian Altiplano that link shifting seasons to warmer global temperatures (Hoffmann & Requena, 2012; Valdivia et al., 2010).

Male, 55 years (HUANCANÉ BATALLAS)

Everyone is worried. Now you cannot farm well anymore; nothing is in its season. Before, we had seasons when we planted different crops, but now we do not know when to cultivate what. As soon as the frost starts, there is no more production.

5.1.2. People's perception of glacier retreat, water scarcity, and loss of biodiversity

Melting of the glaciers

The most visible impact of climate change in high mountain regions is glacier retreat. The IPCC (2007) reports that Andean inter-tropical glaciers will likely disappear in the coming decades, negatively impacting water availability in the region. In addition to global increases in temperature, the greater frequency of El Niño in recent decades has contributed to rapid glacial retreats (Cook et al., 2016; Radford, 2016). Participants said they depend on glacial melt for some of their water supply, and now they are facing seasonal water shortages, threatening their livelihood.

Male, 41 years (BATALLAS)

Glaciers are melting because of the heat. Now it is very sunny. You must imagine how impressive was the mountain range. Now the snow-capped mountains are in a hot frying pan. They are going to melt. The problem is that this trend will continue; the glaciers will melt, the snow will disappear, and it is all because of the heat.

Water scarcity

In the study area, like in the many parts of the Bolivian highlands, water supply mainly originates from rainfall, glacial melt, and groundwater aquifers. Although there is no information on how much of their water supply comes from glacial melt, there is some evidence that it represents a significant percentage (Oxfam, 2009). As highlighted by the participants, drinking water and irrigation schemes are urgently necessary for the area.

Male, 42 years (PAJCHIRI PUERTO PÉREZ)

I remember in the 90s that there was water. We are worried that there is no water, and it will worsen. We know that water is life. It is a fundamental

element for humans and animals. If you do not have water, you will not produce anything. We depend on water for our food.

Some participants said that water scarcity could lead to conflict over access to and control over resources. These conflicts can escalate into violence if not addressed, disrupting the communities. Brandt et al. (2016) and Field (Rangecroft et al., 2013) mentioned that water scarcity is associated with lower water runoff due to climate change, increasing glacier melting, water overuse, technical irrigation problems, social conflicts, and the lack of water governance.

Male, 63 years (CHIRAPACA BATALLAS)

Water shortage due to melting glaciers will bring instability to our communities. That is the reason why today we must fight for water. My community is having problems with another community because they will not let us access the water. So, the other communities may not mention this, but they say they own the water.

Loss of biodiversity

The Andean region is one of the most critical biodiversity hotspots in the world. Yet, they represent one of the region's most severely threatened by human activities and most vulnerable to climate change. This double pressure makes this area a key priority for global conservation efforts (Gonda, 2020). In the study area, biodiversity loss is linked to environmental degradation, overexploitation of natural resources and climate change. Moreover, the loss of agrobiodiversity is the primary concern for people in the Bolivian Altiplano. Andean families have accumulated knowledge of their ecosystems and natural resources, including developing and using plant genetic resources, soil conservation, and pest management. They also have specialised knowledge of wild plants used for food, medicinal plants, and fodder (FAO, 2012). However, the temperature increase and precipitation variability adversely impact water supplies and crop yields. Native Andean crop varieties risk disappearing, and entire ecosystems are deteriorating with the drastic shift in weather patterns (Valdivia et al., 2010).

Participants reported that the number of varieties of some crops decreased due to the loss of seeds post-harvest and the adverse weather effects, notably the irregular rain and frost. Participants expressed concerns that potatoes and other edible tubers' genetic diversity are being lost at an alarming rate. They pointed out that they cannot afford to lose further agrobiodiversity when resilient varieties are needed in times of climate change. It is essential to mention that the area surrounding Lake Titicaca is an important centre of origin for the genetic diversity of potatoes and other edible tubers (Graves, 2006).

5.1.3. People's perception of environmental degradation

Besides the effects of climate change and variability, environmental degradation is critical in these fragile ecosystems. Land degradation and soil erosion in the study area are mainly due to intensive land use, reduced vegetation cover, inadequate livestock practices, reduced fallow periods, and use of chemical

inputs and tractors, combined with insufficient rain (NCAP Project, 2011; Orsag, 2009).

Male, 55 years (HUANCANÉ BATALLAS)

When I was a boy, we had many animals, cows, and sheep, but now we only have up to 5 to 10 cows, and the same with sheep; families rarely have more. Decreased soil quality, limited grazing land, and climate change are the main reason for miserable livestock.

Another issue highlighted by participants was the pollution in Lake Titicaca; they said that this situation is adversely affecting them. High levels of pollution have been documented in Lake Titicaca resulting from mining activities and domestic and industrial waste from rivers of nearby cities of La Paz and El Alto that drain into the lake. Lake Titicaca is only about 281 metres at its deepest, and climate change has dried up several areas near the shore, concentrating the pollutants dumped there by factories, mining activities, farming, and industry (Bloudoff-Indelicato, 2015).

Male, 44 years (COHANA PUCARANI)

Cohana Bay is polluted. Totora (*Schoenoplectus californicus subsp. tatora*) was food for our livestock; now, it looks like cardboard. Moreover, birds like *chhuqha* (*Fulica ardesiaca*), tiki tiki (*Gallinula chloropus*) and *qiñu* (*Rollandia microptera*) have gradually disappeared, and fishing is not good. Besides damaging the environment, pollution is forcing young people to migrate to different destinations. We are abandoned, and there is no response from the state authorities.

5.2. The impacts of climate change on livelihood and well-being

5.2.1. Impact on people's livelihoods

Families in the study area depend on natural resources for their livelihoods, and their main income-generation activities are carried out through traditional practices. They are mainly engaged in rainfed agriculture and livestock. Besides, off-farm income represents an essential source of livelihood for many farmers with part or full-time employment by some household members. As Urioste (2017) mentions, pluriactivity is a vital characteristic of rural economies in Bolivian highlands. The author states that while traditional peasants lived from agricultural and livestock work and with strong links to endogenous productive systems that connected agro-ecological regions more intensely through the exchange in-kind, today's pluriactive peasants are more related to urban markets, which in turn requires knowledge of new codes such as mercantile exchange or the use of technology. Farming is not the only occupation of rural people; non-farming employment is a complementary source of income.

Female, 36 years (IGACHI BATALLAS)

We are farmers; we produce potatoes, quinoa, and broad bean. We also make oats to feed the livestock. We have it mainly for our consumption, but if there is a surplus, it is for sale. In the case of potatoes, half is for consumption and half for sale. Cheese for consumption and milk for sale; we consume little cheese.

The fishery has been a traditional activity in Lake Titicaca that generates income and provides a source of animal protein. However, various local species have gone extinct due to overfishing and pollution.

Male, 55 years (HUANCANÉ BATALLAS)

My community is Huancané, on the shores of Lake Titicaca. We produce potatoes, broad beans, barley, oat, and alfalfa [*Medicago sativa* L.]. We also have seaweed in the lake, called chanco (*Myriophyllum elatinoides*), but it is nearly all gone. We use totora to feed our livestock, although there is not much totora. Fishing is not good now; there is pollution, maybe.

Climate change is seriously affecting people's livelihoods in the study area. Precipitations have become irregular and unpredictable. The dry season is now extended, causing delays in sowing due to a lack of rainfall. On the other hand, rain is often heavy during the wet season and causes flooding, especially around Lake Titicaca. When participants were asked about the effects of climate change on their livelihoods, community members mentioned the impacts on agriculture, livestock, and fishing. They said that the traditional agricultural calendar has changed and referred to losses in production because of frosts, droughts, and hailstorms, seriously affecting people's food security and income. In addition, environmental degradation associated with human activities was also mentioned.

Female, 36 years (CHIRAPACA BATALLAS)

The problem now is climate change. Ten, twenty years ago, you could produce quite well, there were not so many frosts, or at least they were not so harsh and abrupt. There was plenty of water and the rest.

Higher temperatures and reduced water availability are spreading pests and diseases, affecting crops, and prompting people to use more pesticides.

Male, 63 years (CHIRAPACA BATALLAS)

Twenty years ago, we didn't use fertilisers or pesticides; we used natural fertilisers. With that, our product was better. We need more chemicals and fertilisers, but production remains low and is sometimes wormy. This is due to climate change.

Diseases in livestock resulting from the increase in daily temperatures and decrease in nightly temperatures have also been reported. Participants said that limited irrigation access is an issue affecting all the communities. The communities benefiting from irrigation grow potatoes, broad beans, quinoa, alfalfa, and barley, which ensure a higher income than that earned by the communities which do not rely on irrigation water.

5.2.2. Impact of climate change on well-being

Climate change and variability impact depend on biophysical factors, people's resilience, and social and institutional support systems. Participants pointed out that the effects of climate change exacerbate the poverty trap, food insecurity and health. Moreover, it also affects people's traditional knowledge and social

cohesion necessary to make a living from the land and preserve their cultures (Garcia-Alix, 2008; Minority Rights Group International, 2019).

Poverty

Poverty and climate change are deeply intertwined because climate change disproportionately affects the most vulnerable communities. People in poverty have a higher chance of experiencing the impacts of climate change due to increased exposure and vulnerability (Kronik & Verner, 2010; OXFAM, 2020). This is particularly relevant for the Andean communities because climate change is already disrupting livelihoods, forcing families to leave their communities, and pushing people further into poverty, as observed in the study area.

An additional problem affecting Aymara farming systems is *minifundio*, or smallholding predominates in the highlands. Extreme land fragmentation is prominent constraint farmers face in improving their living conditions in rural areas (Fundación TIERRA, 2013; Regalsky et al., 2015). Land scarcity associated with *minifundio* prevents traditional crop diversification and rotation methods, which require some plots of land to rest fallow each year instead of planting irrigated parcels twice annually.

Male, 45 years (EL ALTO)

Family sizes are growing, people have more children, and the land is being parcelled; there is less land to cultivate.

Male, 50 years (PUCARANI)

Families do not have enough land, and no water comes down from the mountains, forcing people to migrate.

In a limiting context such as the *minifundio*, families in the study area are already experiencing the consequences of climate change. Still, they are not equipped to adapt to the present and future impacts. Climate change sometimes renders traditional practices obsolete and puts harvests at risk, affecting food security and incomes.

Male, 63 years (CHIRAPACA BATALLAS)

Climate change has affected my income. We look for means of work because sometimes life teaches us that. If production does not give us enough, we must find other work means. To cope with climate change's impacts, we must diversify and invest more money in our activities. Since agriculture and dairy farming are not going well, I decided to dedicate myself to farming cuniculture, giving me better results.

Food security

Climate change has significant implications for food insecurity. It creates uncertainty regarding the availability of water and other resources needed for agriculture and shapes the frequency and intensity of extreme weather events that can adversely affect rural livelihoods (FAO, 2015).

In the study area, it was observed that climate change is jeopardising nutrition and food security. With changes in the hydrological cycle and other extreme weather events, farmers produce less, have lower yields, and obtain less income from their produce. Decreases in food production are causing problems of malnutrition, which endangers particularly young children's health and compromises people's immune systems, making them more susceptible to infectious diseases (FAO, 2015). Participants mentioned the reduced ability to produce staple food, such as *chuño*, because of shorter seasons and fewer viable locations.

Male, 55 years (HUANCANÉ BATALLAS)

Before, we had plenty of food, also fish, which is so rare now; it used to be food that the poor would eat; currently, only the rich can afford it.

Health

Climate change poses many threats to people's health, such as disorders linked to the availability and quality of water and food, conditions related to extreme heat events, respiratory disease, vector-borne infections, cancer, and other pathologies associated with climatic disasters and extreme temperatures (Feo et al., 2009). People in the study area are worried about climate change's threat to human health.

Female, 45 years (TARACO)

Our health is affected by the intense heat; you cannot do anything when it is scorching. Now at 6-7 o'clock, we start managing the cattle, but as soon as the sun comes out, it burns you, and you do not want to do anything. It takes away your strength and your energy. You will faint if you go on with that tremendous heat and sun. That is why I could tell you that if you wanted to harvest the potatoes in the sun, you would not be able to do it.

Narratives of impending climate change, apart from the actual impacts experienced, have generated anxiety about the future. IOM adverts that the adverse effects of climate change have a profoundly negative impact on indigenous communities' daily lives and psychological well-being (Traore Chazalnoel & Carini, 2018).

5.3. Adaptation to climate change and indigenous knowledge

Climate change impacts are expected to increase the vulnerability of Aymara communities in the coming years. To face these challenges, they are mobilising their in-depth knowledge of the territories that have been the source of their livelihoods for generations. As in the rest of the Altiplano region, families in the study area have long passed on knowledge from generation to generation. However, climate change is threatening ancestral wisdom that may endanger the survival of their culture (Nakashima et al., 2012; Ramos-Castillo et al., 2017).

This study highlights six essential aspects of traditional knowledge in the context of climate change: weather forecasting and early warning systems; conservation of agrobiodiversity and crop diversification; food preservation; soil and water

management; water harvesting; and a combination of traditional and modern knowledge.

5.3.1. Weather forecasting and early warning systems

Traditional knowledge has helped Aymara communities forecast local weather and extreme events by observing the stars, plants, animal behaviour and natural phenomena at certain times and seasons. With the onset of climate change, the Aymara traditional knowledge system has been challenged. However, it is still a source of crucial information on weather forecasting, as mentioned by the participants in the study area.

Male, 63 years (CHIRAPACA BATALLAS)

Our parents and grandparents taught us how to predict the weather through animal behaviour. Animals gave us indications, for example, through differences in egg-laying behaviour or animals digging in the earth. All this taught us what stage we were in and when it would rain, but nowadays, even the animals do not know.

Male, 55 years (HUANCANÉ BATALLAS)

Before, our grandparents understood animal behaviour, but now most of us don't know what it means. Now the *leque leque* [*Vanellus resplendes*] lays its eggs anywhere. The *churi churi* used to put its nest on top of the totora when the rain was coming and when there was no rain, it would put lower down. And regarding foxes, they howl a lot in some seasons and others.

5.3.2. Conservation of agrobiodiversity and crop diversification

Andean traditional farming systems have adapted to changes in agroecological conditions according to norms and practices to ensure sustainable management of resources for the use of present and future generations (Fundación Tierra, 2019; Meldrum et al., 2018). In the study area, Aymara farmers have used their traditional knowledge to domesticate, improve and conserve thousands of crop species and varieties. For instance, in the community of Corquemaya in Batallas, participants explained how they choose, at sowing time, the varieties that can best respond to the climatic challenges they foresee. They also spread the risk between different crops and types as a measure of adaptation to climate change. Preserving crop diversity is vital for food security, the environment, and sustainable development (Esquinas-Alcázar, 2005; Flores-Palacios, 1997; Khoury et al., 2016). Moreover, the need to preserve crop diversity in climate change adaptation is crucial, as highlighted in various studies (de Haan, 2020; Bedmar Villanueva et al., 2007). Crop diversification is a traditional risk management practice and may find renewed importance in spreading the risk of harvest loss, enabling long-term crop adaptation, preserving seeds, and conserving wild crop relatives (Walshe & Argumedo, 2016).

5.3.3. Food preservation

In the study area, it was observed that food preservation is another traditional form of adaptation to climate change. Aymara communities use an ancient technique to preserve foods, such as the transformation of potato into *chuño* [black sun-dried potato] and *tunta*, [white sun-dried potato], and oca (*Oxalis tuberosa*) into *kaya* through processes of freezing drying, and dehydration. Once dried and with minimal care in storage, the products can be preserved for many years, even decades, making food available in times of scarcity (Guidi et al., 2002).

5.3.4. Soil and water management

Traditional practices to manage soil are still in place in Aymara communities, as observed in the study area. Participants mentioned that communities near Lake Titicaca use a traditional *camellones* or *waru-waru* (high beds) technique. The *camellones* are elevated fields surrounded by channels. During the rainy season, the gutters fill with water that would have otherwise flooded the land, and during the dry season, this same water is used for irrigation.

5.3.5. Water harvesting in America

As observed in the study area, some ancient rainwater harvesting technologies are still used, such as the *wijiña* (conical deposit dug in the ground to accumulate rainwater) and the *kurmi khotas* (traps to harvest rainwater) (Loayza-Aguilar et al., 2020). People also use rainwater harvesting practices with traditional agroecological methods, *q'otañas* (a form of rainwater harvesting using clay layers of soil) and *q'ochas* (shallow depression that stores water). These practices improve the local water supply as it enhances soil infiltration and biomass production and is structured to trap sediments (Mwenge Kahinda et al., 2021).

5.3.6. Combination of traditional and modern knowledge

Apart from using their traditional knowledge, Andean people are also incorporating modern technologies and practices. For instance, in the Lake Titicaca region, communities are implementing traditional and contemporary adaptation measures such as the conservation of water springs, water courses, wetlands (bofedales), pastures, and soil. Moreover, farmers are promoting ecological production and land use planning mechanisms to support the development of Municipal Land Use Plans and local prevention strategies to reduce the impacts of climate change (NCAP Project, 2011).

5.4. Human migration

5.4.1. Drivers of migration

Several reports have shown that migration is time and place-specific, and it is a multifaceted phenomenon in environmental migration (FAO, IFAD, IOM & WFP, 2018). Economic, social, cultural, and political drivers still dominate migration decision-making. However, in the case of societies dependent on agriculture, like the Aymara communities in Bolivia, environmental factors have always played a

significant role in migration decisions, as changes in agricultural productivity are associated with climate-related factors. Research in rural areas of Latin America shows that increased temperatures, rainfall variability, and extreme weather events can negatively affect crop yields in ways that may induce migration (De Sherbinin, 2020; FAO, 2018; Milan et al., 2016).

This study shows that migration in the study area is multifaceted and that migrants have not moved due to a single cause. People migrate because of better work opportunities, unemployment, environmental change, climate change and environmental degradation, food insecurity, and limited access to health and education in their places of origin. Moreover, participants reported that the scarcity of farming land is one of the main reasons rural people migrate, especially to the nearby urban centres and neighbouring countries.

Female, 36 years (IGACHI BATALLAS)

My brothers have already left; they are joining friends working in Argentina. They left because of poverty here and lack of opportunities in Batallas. We have small land holdings, and climate change affects our agriculture.

5.4.2. Migration patterns

In the study area, four types of migration have been identified: (i) long-term migration, internal and international, (ii) temporary migration to urban areas or rural municipalities, mainly in the lowlands (rural-rural migration), (iii) circular migration and multi-residency to neighbouring cities, and (iv) return migration of elders.

All the participants mentioned that they have family members who have moved internally and across borders. Temporary and permanent migration is a livelihood strategy to escape poverty and land scarcity and adapt to climate change and variability. Internal migration in the study area is both temporary and permanent. Migrants moving to urban areas work primarily in the construction, commerce, and transport sectors. The relative proximity of the communities to La Paz and El Alto allows for a form of multi-residence. One particularity of the population movements in the Andean region is that migrants do not cut off ties with their place of origin.

Participants noted that those who move to urban areas, particularly El Alto, try to buy a house while maintaining their farmland.

Female, 38 years (EL ALTO)

In the 1970s, 80s and '90s, people migrated to La Paz and El Alto; some of them had their houses there, so they lived there and sometimes here. They work in commerce or as taxi or minibus drivers in the city.

Circular migration is also familiar with shorter movements to urban areas. This option allows migrants to maintain their land and family ties with their communities while working outside for short periods. Rural - rural migration also exists in the study area. Some people migrate to the lowlands, for instance, to Yungas, a low-lying ecoregion of the department of La Paz. One of the research

findings was that the municipality of Batallas is receiving migrants. It seems that this municipality is creating bridges among rural communities, providing the population with the opportunity to access essential services and commerce.

Male, 60 years (CORQUEMAYA BATALLAS)

Here in Batallas, there are people from Batallas. We are receiving migrants from other provinces, not only returnees. Even people from Peru are coming.

In the study area, some young people are migrating abroad. Participants said they have family members living in Argentina, Brazil, and some others in Spain. Usually, migration abroad is long-term; one participant noted that it is harder to come back often when you are far away.

Female, 36 years (IGACHI BATALLAS)

Some family members have migrated to Brazil, Argentina, and other foreign countries. They migrate mainly because there is not much work here. Besides, the young people are all leaving to search for opportunities; only the older people are left behind here.

Male, 41 years (CANTÓN HUANCANÉ BATALLAS)

People from Huancané migrate because our agriculture is not good. Young people go to countries like Brazil and Argentina. Those are the two main destinations for our migrants. The youth are the ones that are looking for a better life for their family and themselves.

There is evidence of return migration in the study area. Some people return to their communities to look after their elderly parents, and other adults return because life in urban areas has become difficult for them.

Male, 55 years (HUANCANÉ BATALLAS)

I used to live in La Paz, but now I am back in Huancané. Before, people used to migrate to the cities; now, some return to their communities. We are coming back because of the pandemic, and there are no jobs in the city. We are coming back, although we know that life in rural areas is very hard.

Male, 41 years (CANTÓN HUANCANÉ BATALLAS)

Older adults are returning to their communities. I think they have accomplished their goals in the city; their children are grown up. So, it is time for them to look after their land.

Male, 41 years (BATALLAS)

...at the moment, migration is the other way around in Batallas. People who migrated to the city for economic reasons are returning; even those who emigrated to Argentina are returning.

Some people prefer to stay in their communities because of the strong sense of belonging to their lands and communities and because they believe their

traditional knowledge will help them adapt to climate change. In the case of returnees, particularly elders, they do not want to migrate again.

Female, 36 years (IGACHI BATALLAS)

Older adults are not migrating anymore. They are so used to living here. They do not go because they must look after their property and livestock.

Male, 74 years (PUERTO JAJACHI COHANA PUCARANI)

I am not thinking of migrating. I have already lived in other places; now it is my time to live here, in my house, in my area of origin. This is the place where I belong.

Some stay in their communities as they cannot migrate because they lack support such as capital and networks in potential destinations. However, those who remain cannot be considered “trapped populations”, as defined by Warner et al. (2012), namely people who struggle to survive in their areas of origin and cannot easily use a migration to adapt to the adverse impacts of climate change. Families and communities usually play an essential role in buffering socio-economic and environmental risks because practices of solidarity are part of the Aymara culture. As regards remittances, most participants pointed out that they are scarce. Several participants said that remittances are used to improve food security and nutrition, part is invested in agricultural improvements, and there is not much left for other purposes.

Male, 36 years (PUERTO JAJACHI COHANA PUCARANI)

Generally, when family members leave, like the husbands or young men, they send money back to support their families, their mothers, and their fathers who are struggling. They know the situation here; loved ones are being helped.

Although families in the study area receive some remittances, migrants often buy urban plots or houses in their destination places or invest their earnings in their children's higher education.

In the case of the study area, migration is not only common for men but also for women. Our results are consistent with the findings of Balderrama et al. (2011) and Kaenzig (2013), who conducted research in the Altiplano region. People who are migrating are primarily young men and women. Participants reported that usually, the head of the household, especially men, moves to urban areas, mainly La Paz and El Alto, to seek employment and then the rest of the family follows them. Another group comprises young people who move to urban centres after school to look for jobs or pursue technical and university studies. These migration patterns affect the communities' social structures as there is a redistribution of roles and responsibilities among those who stay, mainly women and older people. The outflow of the younger age group is creating imbalances in the population's age and skillsets that remain in their communities.

Female, 37 years (COHANA PUCARANI)

Families in Corquemaya are having trouble growing food and maintaining their livestock; there is now no food for them. So, some family members are thinking about leaving to find jobs elsewhere.

Female, 55 years (CORQUEMAYA BATALLAS)

Primarily young people migrate from Batallas. They move out because there is not much work here. They migrate for economic reasons, which is why they go to the cities; some even go to neighbouring countries.

5.4.3. Linkages between climate change and migration

The nexus of climate change and migration is emerging in research, policy, and practice. It is increasingly being recognised that mobility can be used to improve adaptive capacity and further development agendas and outcomes, particularly in developing countries (Foresight, 2011). Environmental migration, like general migration, usually occurs within national boundaries, and when international migration is reported, it is generally to neighbouring countries. Social networks are essential for destination migration as people tend to choose places where they have contacts and people who can help them settle in and find work (Obocata et al., 2014).

The pattern of climate migration in the study area is internal, but cross-border migration is also to neighbouring countries and Europe.

Male, 45 years (BATALLAS)

Climate change is what causes migration. How will we sustain the increased population in the communities if there is no production? We need rain for agriculture and livestock. If it does not rain, how will we do it?

Families may follow a mixed strategy in which some household members move while others stay behind.

Male, 48 years (HUATAJATA)

Climatic changes affect us; unpredictable rain and frequent hailstorms reduce our crop productivity. With no help from our local and national governments, we have to do everything to survive; one strategy is moving to the cities to look for jobs, and young people are migrating.

Although there are cases in which it is possible to disentangle migration drivers, such as sudden-onset events, environmental migration must be recognised as a multicausal and multidimensional phenomenon. Ecological and climate factors often act in combination with economic, social, political, and demographic aspects, as pointed out by IOM (2014). Regarding the study area, both climatic variability and water scarcity alone may not directly drive migration, but they are usually combined with other stressors impacting agricultural production and livelihood security.

Male, 63 years (CHIRAPACA BATALLAS)

I am not sure if climate change is the only reason to migrate, I would say more for work because there is not much work in rural areas. But our livelihoods depend on climatic conditions, so I think climate change is influencing migration. How are we going to deal with this situation? We do not receive support from the government; we do not have access to technology, and we receive very little help when we lose our crops because of frost or hail. We live independently, do what we can, and move away.

Female, 36 years (IGACHI BATALLAS)

I think climate change could be a contributing factor to migration. Weather conditions were extreme this year, there has not been any good harvest this year, and our livestock got sick. When this situation happens, people look to go to other places. In Yungas, for example, you can diversify your crops, plant fruits and coca, and increase your income.

Male, 41 years (CANTÓN HUANCANÉ BATALLAS)

I think that a combination of factors is driving migration. The first one is that we have small plots. Secondly, climate change has affected the productive capacity and economic incomes. The third is water scarcity. These are causing migration. It all adds up.

6. Conclusion and policy implications

Over centuries, the Aymara people have been protectors and custodians of biological diversity, landscapes, and natural resources. They have accumulated knowledge of their ecosystems, including soil conservation, management of pests, and the development, use, and preservation of plant and animal genetic resources. Their resilience is rooted in traditional knowledge, as their capacity to adapt is based on an in-depth understanding of their environments.

The study aimed to explore the linkages between climate change, livelihoods, and migration in selected municipalities of the Northern Bolivian Altiplano to understand how they respond to human-caused climate change and other multiple challenges in their rural communities. The study reveals that families are still marginalised due to poverty, unequal access to land with high fragmentation, and limited access to health, education, technology, credit, and infrastructure.

The study establishes that climate change exacerbates people's pre-existing vulnerabilities affecting their livelihood patterns as they greatly rely on natural resources in fragile environments. The risks associated with climate change increase with poverty, land scarcity and limited institutional support. Vulnerability to these risks often depends on specific local contexts and public policies, which in the case of the Bolivian Altiplano have, in many cases, failed to address the struggles of the local communities.

Despite the enormous challenges facing the Aymara communities in the study area, participants said they had developed various mechanisms to strengthen their adaptive capacity to cope with both slow and sudden onset events. They are combining their traditional knowledge and modern technology to respond to

climate change. They are also building on their family and community social support systems and using population movements to enhance their adaptive capacity. How families respond to climate change and environmental hazards depends on the severity of the event, levels of vulnerability, and the resources and strategies available to the households.

In the selected communities, human mobility in the context of climate change is a risk management and livelihood diversification strategy to reduce vulnerability to environmental and non-environmental risks. In this case, migration generates additional income with off-farm activities. Migration appears very strongly as a multi-causal phenomenon shaped by economic, social, demographic, environmental, cultural, institutional and climate change drivers. Evidence of circular, temporary, and permanent migration has been a traditional household strategy in the studied communities. In recent years, involuntary migration has increased due to low agricultural productivity, poor economic growth, limited access to land, off-farm work opportunities, and the impacts of anthropogenic climate change.

Migrants from the study area are primarily young adults who move to pursue a better living standard, find better jobs, diversify income, and respond to climate change. The destinations are typically large urban areas, mainly La Paz and El Alto, and other urban centres and rural municipalities in the lowlands. International migration is also directed to Brazil, Argentina, and Spain, where migrant networks often facilitate people's social and economic integration in the destination places.

Four implications for policy design have been identified in this study. First, people's perceptions and experiences must be incorporated into research and policy. Their knowledge of struggles and proposed solutions should be central in understanding and addressing climate change-related challenges. Second, environmental migration must be studied within specific social and cultural contexts to implement tailored interventions. Third, the design of any climate change adaptation initiative must be conducted in consultation with local communities to ensure that their priorities are considered. Finally, data production and research are necessary to contribute to a broader understanding of the linkages between climate change, people's livelihood, and migration.

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Appendix-I: Guiding questions for in-depth interviews

DEMOGRAPHICS

Age (years):
 Gender:
 Marital status:
 Number of children:
 Source of income:
 Place of residence:

BACKGROUND INFORMATION

1. How long have you/your family lived in this community?
2. What crops do you grow? Are you also involved in livestock and fishing?
3. How have agriculture and livestock changed in the last ten years? Do you produce more crops today than in the past? Compare how it is today and how it was ten years ago.
4. How has the weather changed in the last decade, e.g., temperatures, rainfall, frost? Are droughts more frequent? Compare how it is today and how it was ten years ago.
5. Have you noticed that the glaciers are melting? Why? How does it affect you?
6. Do you think these changes in climate and melting glaciers will continue in the future?

IMPACTS OF CLIMATE CHANGE AND DISASTERS

7. Are you concerned about climate change?
8. Do you think your family have been affected by climate change?
9. How are the changes in climate affecting your health?
10. How are the changes in climate affecting your work? Agriculture, livestock, and fishing?
11. How are changes in climate affecting your food consumption? Are you producing less food?
12. What do you (or your family) do with your crops? For your consumption, for sale?
13. How are changes in climate affecting your income? Do you have to look for other jobs besides agriculture, livestock, or fishing?
14. Do your family have ways of dealing with climate change? Could you give examples? Do they move to other places?

15. Do you think climate change has also affected other families in your community?
16. Is there anything else you would like to say about climate change?

MIGRATION

In the past ten years

17. Have any of your family members migrated to other places? Where (internal movements, abroad)? Why?
18. What is migration like in your community? Do people migrate for short periods or stay permanently in other places? Or do they come and go? How often?
19. Who leaves? Young people (men and women)? Adult men/women? The elderly? Who stays?
20. How many people have migrated from this community to another place? What percentage, more or less? Where do they go?
21. Are changes in the climate a reason to migrate to other places? Since when have people been migrating because of changes in the climate?
22. Do you plan to migrate because of climate change or for other reasons?
23. Do you think more people will migrate in the future? Why?
24. Do you or your family receive financial support from your family or friends who have migrated?

COVID-19

25. How has COVID affected the community?
26. Have people from the community migrated because of COVID? Or have people returned to the community?

Appendix-II: Guiding questions for focus group discussions (FGDs)

CLIMATE CHANGE

1. Have you heard the words climate change? What do these words mean to you?
2. Why do you think climate change is happening and is becoming "worse" today?
3. Do you think your family/community has been affected by climate change? How?
4. Do you have ways of dealing with climate change (examples)?
5. Anything else you would like to say about climate change?

MIGRATION

In the last ten years

6. Have any family members moved out of the village (any idea of the number)? Where have they gone? What would be the main reasons they moved (school, work, other reasons)? Who is leaving? (Men/women)? (young/adult)?

7. Do you think they have moved because of climate change (Yes, No)?
Reasons (% related to climate change?)
8. Do they keep in contact with you? Do they come back to the community on occasion? Do they support the community?
9. Do you think family members who have moved influence family and community life? How?
10. What are the effects of this emigration on the community?

Future

11. Do you think you will move away from here shortly? Why?
12. Where would you go?
13. Would you say that climate change would be a reason to leave? Or would it force you to move?
14. If you migrate, what would you miss most about the community?