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Migrações na Comunidade Campesina de Phinaya, Cordilheira Vilcanota, Peru

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RESUMO

O artigo investigou a ocorrência de migrações ambientais na comunidade de Phinaya, Cordilheira Vilcanota, Peru, nas duas últimas décadas (2000 e 2010). A metodologia foi estruturada em três etapas: primeiro, mapeou-se a rede hidrográfica. Posteriormente, realizou-se entrevistas semi-estruturadas e observação direta. Foram aplicados critérios para verificar a hipótese de migração ambiental. O mapeamento foi relevante para dar suporte às discussões sobre como os entrevistados percebem o ambiente e suas mudanças recentes. Constatou-se que as migrações são um problema atual na comunidade, intensificado há aproximadamente 10 anos, sendo as principais cidades de destino dos migrantes Sicuani, Cusco, Arequipa e Puno. Os principais impulsionadores das migrações recentes citados foram: condições climáticas extremas, diminuição do rendimento da produção de alpaca, educação que não prepara para a vida rural e falta de acesso a meios de comunicação e eletricidade. Questões políticas, econômicas e/ou sociais também foram apontadas como responsáveis por causar os deslocamentos. As migrações são apontadas como um problema para a comunidade, e relacionadas ao envelhecimento populacional e perda da capacidade produtiva das famílias. O despovoamento causa preocupação por vários motivos, principalmente porque pode significar o início das atividades de mineração e, conseqüentemente, o aumento de conflitos, violência, empobrecimento e degradação ambiental.

Palavras-chave: Geleiras tropicais. Mudanças climáticas. Migração interna. Vulnerabilidade. Sociocriosfera.

Migrations in the Phinaya Peasant Community, Vilcanota Range, Peru

ABSTRACT

This article investigated the occurrence of environmental migrations in the Phinaya community, Cordillera Vilcanota, Peru, over the last two decades (2000s and 2010s). The methodology was structured in three stages: first, the hydrographic network was mapped. Subsequently, semi-structured interviews and direct observation were conducted. Criteria were applied to verify the hypothesis of environmental migration. Mapping was relevant to support discussions about how interviewees perceive the environment and its recent changes. It was found that migrations are a current problem in the community, which has intensified for approximately 10 years, with the main destination cities for migrants being Sicuani, Cusco, Arequipa and Puno. The main drivers of recent migrations cited were: extreme weather conditions, decreased yields from alpaca production, education that doesn't prepare for rural life and lack of access to means of communication and electricity. Political, economic and/or social issues were also indicated as responsible for causing displacements. Migration is seen as a problem for the community, and is related to population aging and the loss of productive capacity of families. Depopulation is a cause for concern for several reasons, mainly because it could mean the beginning of mining activities and, consequently, an increase in conflicts, violence, impoverishment and environmental degradation.

Keywords: Tropical glaciers. Climate change. Internal migration. Vulnerability. Socio-cryosphere.

Introduction

Climate change represents an urgent and potentially irreversible threat to human societies and the planet (UN, 2015). The International Organization for Migration (IOM) states that the role of these changes as forcing factors for population displacements is undeniable (IOM, 2008).

The Andes mountain range (South America) concentrates approximately 99% of tropical ice masses (Kaser; Osmaston, 2002). However, recent studies show that many of these glaciers have been experiencing large reductions in their areas, with the increase of about 0.8°C in the average annual temperature in the region, throughout the 20th century, being one of the main factors for that (Veettil; Souza, 2017; Inaigem, 2018; Schoolmeester et al., 2018).

The long and continuous occupation of communities in the Andean glacial and periglacial regions can be called “socio-cryosphere” (Figueiredo, 2021). These populations develop economic and social activities interconnected with the environment in which they live and its elements, such as glaciers, rivers, pastures, etc.

Although environmental changes are not the only deciding factor for migration, they represent an important aspect, as they affect other variables, such as socioeconomic activities and health. Altamirano (2014, p. 130) corroborates that: “*if the reason for migration has a fundamentally climatic origin, then we can define it as such*”. Therefore, it is not necessary to dissociate the other factors when investigating the occurrence of environmental migrations in a given place, but rather to analyze the environmental changes and assess whether they are determinants for human displacement.

The general objective here is to investigate the occurrence of environmental migrations in recent decades (2000s and 2010s) within the scope of the peasant community of Phinaya, Vilcanota mountain range, Peru. To elucidate the general objective of the research, the following specific objectives were structured: to recognize the main drivers of migratory movements in the community; and investigate the perceptions of local actors about recent environmental changes, their consequences and adaptations.

The P.C. of Phinaya is a population of shepherds (Sendón, 2003). About 95% of the population carries out livestock activity, treated in

the present work as “*alpaqueira*”, a nomenclature used by the peasants and which emphasizes alpacas, the main camelid that makes up the herds. The other 5% are engaged in other activities, such as tourism, commerce and transport (BIOANDES, 2009).

Livestock activity is mixed, composed of alpacas, llamas and sheep, species that are highly dependent on the quantity and quality of existing pastures. The raising of these animals is the most relevant source of income, from which the main products sold are fiber, breeding animals and meat. In addition, the community also has the right to use and exploit vicuñas (only for shearing), animals protected by law, existing in its territory (Estrada; Moscoso, 2014).

Methodology

Study area

The Vilcanota Mountain Range (VM) (14°33'08.86" and 13°07'23.82" S and 71°45'11.64" to 70°28'14.91" W) is 134 km long and the highest altitude (6,364 m) is found in the Ausangate snow-capped mountain (UGRH, 2014). It covers 374 glaciers, with a total area of 255.4 km² (INAIGEM, 2018). Its watershed, between the slopes of the Atlantic Ocean and Lake Titicaca, gives rise to the Urubamba, Inambari, Alto Madre de Dios and Azángaro hydrographic basins.

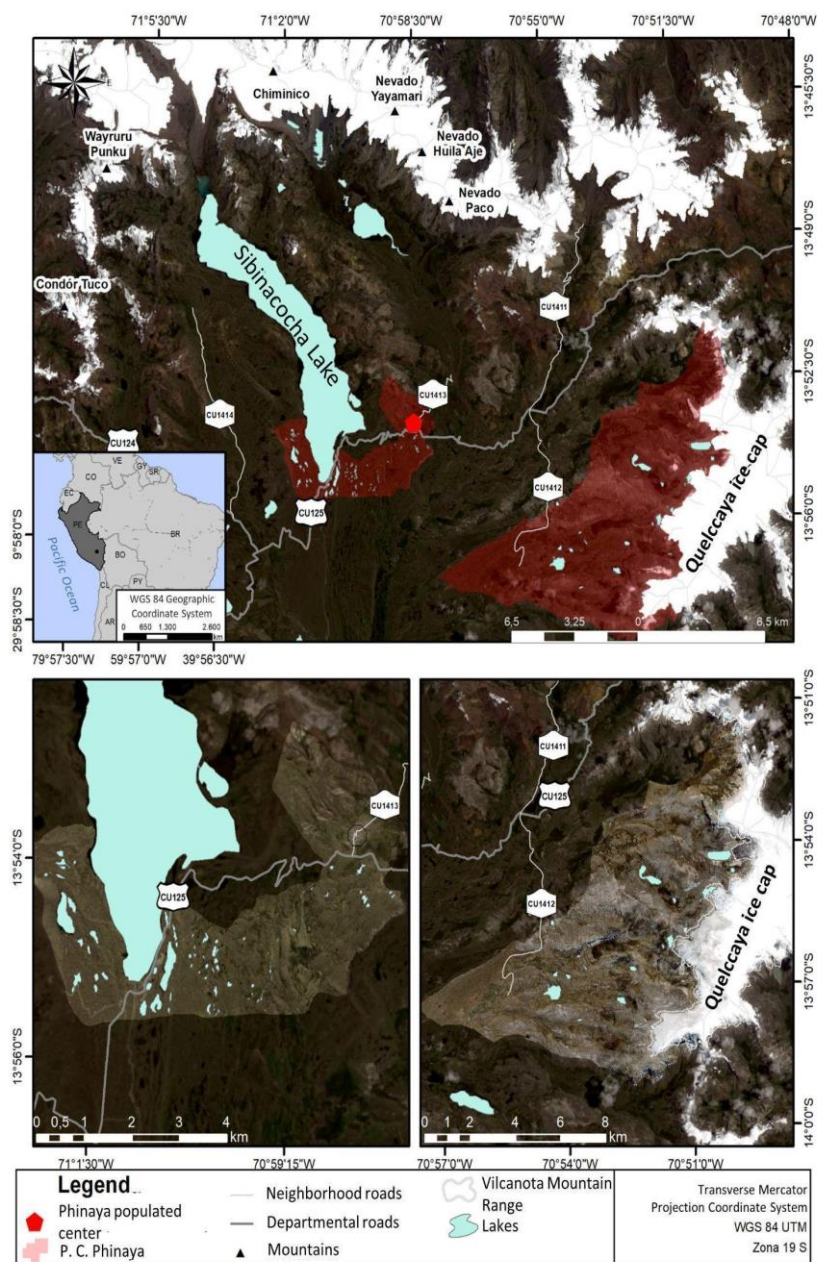
The VM is at the southern limit of the Intertropical Convergence Zone (ITCZ) and, therefore, between tropical and subtropical climate patterns (Salzmann et al., 2013). Humidity comes mostly from the Amazon basin (Perry; Seimon; Kelly, 2014). According to Thornthwaite's climate classification (Senamhi, 1988), the region is classified as rainy, and the distribution of precipitation throughout the year shows that autumn and winter are dry. Regarding the average annual temperature, the values are between 10°C and 12°C between 3000 and 3500 m, decreasing with increasing altitude, reaching an average annual temperature of 6°C at 4000 m (Lavado et al., 2016).

The study area is in the zone of influence of the VM and within the scope of the Atlantic slope, specifically the Peasant Community (P.C.) of Phinaya, located in the district of Pitumarca (province of Canchis, department of Cusco), at an average altitude of 4,500 m and 50 km away from the district capital (city of Pitumarca). It belongs to the Quechua indigenous people, whose original

language is homonymous (INEI, 2018). The population is 368 people, distributed in 191 homes (INEI, 2018) and in 12,000 hectares (SICCAM, 2016).

The term “Phinaya” is also attributed to the populated center that is within the scope of the

community, concentrating the main service structures, such as school, health center and shops. Some families maintain a residence in the populated center and another in the less dense regions of Phinaya, where they raise their animals. 1 shows the location of the study area.



Field research

Fieldwork was carried out between November 25 and December 3, 2021 at P.C. of Phinaya. It consisted of conducting semi-structured

interviews, based on the methodology proposed by Angrosino (2009). It sought to understand the interviewees' perception of the socioeconomic relevance of local environmental factors and, in

particular, how they influence migration. The interview script is in Appendix A.

The interviews were analyzed using Category-based Content Analysis, carried out in three stages, as proposed by Bardin (2011): 1) pre-analysis; 2) exploration of the material; 3) treatment of results and interpretation. In the first stage, textual

analysis took place, followed by content exploration and construction of categories based on themes and, finally, interpretation of the results according to literature data. By adopting a qualitative approach, this stage of the research did not aim to carry out a large number of interviews. Fictitious names were adopted, maintaining genders (Table 1).

Table 1. Interviews carried out in field research.

Name	Observations
1. Afonso	Education specialist, teacher trainer, peasant and trader.
2. Beatriz	President of Talla sector and peasant.
3. Carlos	President of community and peasant.
4. Diego	Community school director and peasant.
5. Eva	President of Yayamari sector, peasant and trader.
6. Fátima	ACCA biologist.
7. Gonzáles	President of Ángel de los Andes sector, peasant and trader.
8. Hugo	ACR Ausangate biologist.
9. Inácio	Agricultural engineer at INAIGEM.
10. Joana	ACR Ausangate park ranger and peasant.
11. Luís	Comunitary nurse.

Definition of the occurrence of environmental migration

Criteria were applied to define the occurrence of environmental migration (Table 2),

which were delimited with the help of the results obtained in the survey and analysis of research with case studies on the topic for the Andean region. It is noteworthy that the criteria are not mutually exclusive, that is, they can occur simultaneously.

Table 2. Criteria adopted to define the occurrence of environmental migration and the methodological basis.

Criteria adopted	Methodological basis
1) Identify the drivers of migration in the reports of residents in interviews and, among them, see if there are any related to environmental changes.	Kaezing (2015)
2) Identify that the impacts of environmental changes and conflicts over natural resources are determining factors for displacement.	Hosmer-Quint (2020)
3) Identify in the discourse of residents that migration is an adaptation strategy adopted in the face of environmental changes.	Wrathall et al. (2014) Hosmer-Quint (2020) Gray e Bilsborrow (2013)

Results and discussions

Migrations in the Phinaya community in recent decades (2000s and 2010s)

The interviewees pointed out that population displacements are a current problem in the community, and intensified approximately 10 years ago, which is evidenced by Beatriz's speech: "we are few and we are coming to an end. Many are migrating, few are staying. The young people are no longer here. I don't know, maybe in the future there will be no people in the community". The absence of young people in the community was noticed during the fieldwork, with most of the people present in Phinaya being children, adults (over 30 years old) and the elderly. The interviewees also pointed out that the absence of young people is an indicator of recent migrations, such as Afonso, a teaching specialist:

Young people study and leave, many of them never come back and don't want to know about raising alpacas. It's not my case, nor my brothers', even those who are in Lima. All my brothers have alpacas, my father always asked us not to stop being alpaca farmers (*alpaqueiros*). My children did not grow up around raising alpacas, so they do not have that feeling. I believe there was this generational cut, in my generation. (Interview report by Afonso, obtained in fieldwork in November 2021).

In this sense, Aguilar (2015) states that in most cases and under normal conditions, the population that participates in internal migratory movements in Peru is essentially young, this being possibly the most generalized characteristic of the migrant population. At the same time, these migrations affect the demographic structure of communities, with an aging population, which, in turn, generates losses in the productive capacity of families – and consequently, greater vulnerability (Aguilar, 2015).

The main cities of destination for migrants, pointed out by the interviewees, were Sicuani, Cusco, Arequipa and Puno, especially the first. Sicuani, Cusco and Puno were pointed out as attractive to migrants mainly due to the trade and services sectors. In Arequipa, industry and mining activities are added to the math.

When asked about the gender of the migrants, the interviewees, in general, reported that men and women migrate, but especially the former, as they have greater chances of entering the job

market in the cities, such as taxi drivers, delivery people, in construction, among others. In this sense, Aguilar (2015) points out that recent migration data (2002-2007) show that migratory flows between Peruvian departments are composed of more men than women.

In Phinaya, women tend to stay, as Beatriz says: "Here most women dedicate themselves to alpacas, they are in the countryside, herding their animals, some dedicate themselves to handicrafts. More than anything, we dedicate ourselves to the house". Despite this, Joana – park ranger at ACR Ausangate and peasant – highlighted that, in recent years, women have started to participate more in public life and hold leadership positions in the community.

We always grew up with our glaciers, our rivers, our pastures; it is part of our experience, it is like part of our family, because they have always been present, they have always been here. The Phinaya River, for example, never dried up. So it's like he's our brother. I, particularly, do not consider it a resource, because it is our complement and for our animals. (Interview report by Afonso, obtained in fieldwork in November 2021).

Afonso's account expressed his feelings towards the environment, as well as that of the other peasants interviewed. The environment has always been related to human existence and permanence in the community, as Joana reported: "The lives of all people are linked to glaciers, rivers, pastures. That's why it's so important to me." In this sense, Tuan (2012, p. 136-141) states:

[...] The small farmer's attachment to the land is deep, they know nature because they make a living from it. [...] The farmer's topophilia is formed from this physical intimacy, material dependence and the fact that the land is a repository of memories and holds hope (Tuan, 2012, p. 136-141).

Glaciers were related to the existence of water and this, in turn, to the existence of life, since the main source of income for the peasants depends on it, as Gonzáles highlighted:

[...] glaciers are a source of life for us, if there were no glaciers we would have no life, because water comes from them. Likewise the environment, soil, water, all of this is important so that we can raise our alpacas, which is the only livelihood of the families here. With our alpacas we educate our children, we feed ourselves, we buy our clothes, our alpacas are for everything. So if there were no glaciers there would be no life, because water comes from them. (Gonzáles interview report, obtained in fieldwork in November 2021, author's emphasis).

Thus, for the peasant way of life, the consumption of animals and their products – meat, fiber, oil, etc. – is enough, opposing, according to Afonso, to “the consumerist culture of capitalism”. However, the interviewee pointed out that this way of life changed with the arrival of the road (in 1995), the increase in exchanges and the possibility of consuming new products.

Environmental and climate changes: perceptions and impacts.

The environmental and climate changes most cited by the interviewees were: increased frequency and intensity of extreme weather events and conditions, glacier retreat, water scarcity, pasture degradation and loss, and increased illness and animal mortality. Gonzáles reported that, currently, cold and heat are more intense, with the former causing alpaca mortality and a higher occurrence of pneumonia, mainly in children and the elderly. Eva stated that the biggest difficulty in relation to the community's climate issue is the extreme cold which, in her opinion, has intensified in recent years. In addition, some of the interviewees pointed to the intense cold (and its higher increase on some days in recent years) as the main extreme weather condition that acts as a forcing factor for migrations.

Anomalies in precipitation throughout the year are perceived as one of the current problems in the community. Gonzáles and Afonso reported that, compared to approximately ten years ago, rainfall is currently more intense and there is much less snow and hail – the most common forms of precipitation in the past. The change in precipitation patterns in recent years has also been reported: Joana stated that before there were fixed rainy and dry seasons, and now there are not, as there are droughts at any time, as well as rains. According to the peasant labourer woman, this greatly impacts the pastures, as there are places where they have already completely dried up. In this sense, Carlos stated that:

When I was a child, until I was 15, winter and summer were normal, in their places; but nowadays it is possible to notice that there is no longer this distinction of the seasons, now we are entering summer and it is very cold, heavy snow is falling. This is a consequence of global warming and climate change. It affects us, not only the development and growth of natural pastures, it also causes the mortality of our alpacas. (Interview report by Carlos, obtained in fieldwork in November 2021, author's emphasis).

The problems faced in the community show that this is a region greatly affected by extreme weather events, with El Niño-Southern Oscillation (ENSO) being one of those responsible factors. Thompson and Davis (2014), identified through stratigraphic records of Quelccaya, that ENSO often resulted in drier conditions and less snow accumulation in the ice field. Recently the study region has been under the impact of several sequential years of La Niña and this may have increased vulnerability. The aforementioned event caused, in November 2020 and February 2021, the driest months of the last 56 years in the study region (Senamhi, 2021).

Climate change influences the dynamics of ENSO events, as they affect their frequency and magnitude (CAI et al., 2014), which makes the need for forecasting, management and adaptation relevant. Studies for Peru have already stated that the frequency of these events has increased in the last 50 years and there are projections for the occurrence of extreme ENSO in the coming years and decades (Takahashi et al., 2011; MarjanI; Alizadeh-Choozari; Irannejad, 2019). However, there are still uncertainties about its influence on droughts and floods in many locations and each event is unique and can be a different signature (NOBRE et al., 2019).

According to Gonzáles, the occurrence of frosts (*heladas*) – an abrupt decrease in average air temperatures in the high Andean areas (Senamhi, 2022), increasingly frequent and intense, causes the pastures to dry up, food for the animals that, thus, become weak and can even die. In this perspective, Afonso stated that in recent years, these events have started to occur after snowfalls, which was not common and delays the melting of snow, causing a lack of pasture for the alpacas to consume. *Heladas* can also be associated with drought events as, due to low cloud cover at night/early morning, there is a sudden drop in air temperature; including, during the most recent La Niña, minimum temperatures below normal climatology were recorded in the study area (Senamhi, 2021).

Anomalies in the patterns of surface melting of glaciers were reported by the interviewees as one of the environmental changes perceived in recent years. Luís, a nurse at the community health center, stated that the peasants always mention that “in the past the mountains were white, unlike today”. The reduction in the area and volume of ice in the Vilcanota mountain range is associated with the accelerated atmospheric warming that has occurred in recent decades (2000s and 2010s) (Salzmann et al., 2013;

Hanshaw; Bookhagen, 2014; Veettil; Souza, 2017; Inaigem, 2018).

Carlos showed concern about what he called “glacier wearing”, as they are starting to melt more intensely in October, something which used to happen in November. However, in this month (October) the wet season begins and, therefore, there would be no need for meltwater. The increase in days of surface melting of glaciers throughout the year contributes to accelerating the loss of glacial mass. Other interviewees also pointed out that the retreat of glaciers has a specific relevance due to its impact on the availability of water and pasture. Thus, glacial and water monitoring at the local scale becomes relevant, as Diego states:

Ten years ago, the glaciers were bigger. And the rivers, even in times of drought, were well loaded, and there was almost no shortage of water for the animals and to irrigate the land. But nowadays there is a lot of scarcity. The rivers have turned into streams. (Diego's interview report, obtained in fieldwork in November 2021, author's emphasis).

Water scarcity is one of the current problems reported by the peasant labourers, which intensifies during the dry season, when the main source of water depends on melting glaciers. According to the interviewees, it is at this time that the pastures dry up, harming the food supply of the alpacas.

Problems related to water security have already been found in the region in previous works: Chirinos (2019) observed a relationship between the decrease in water flow in the rivers of the Vilcanota sub-basin and increasingly frequent negative precipitation anomalies, as well as Estrada and Moscoso (2014) and Flores et al. (2011). Villavicencio (2020) found that in the months of the dry season, the flow trend was significantly negative, showing a decrease of -3.2 and -1.1 m³/s per decade (1984 to 2019), respectively.

Many interviewees expressed concern about the degradation and reduction of vegetation cover in ecosystems – pasture – related to the decrease in water availability in recent years, mainly due to its economic importance, as Diego reported: “As there is no water, the pasture becomes scarce. There is no pasture, so there is almost no food for the alpacas. There is mortality. They are weakened by the lack of grass. This didn't happen before.” In this perspective, Eva also reported that “Before, when there was snow, the rivers were strong, so there were good pastures. Now, on the contrary, there are no pastures, and the size of the fiber and meat of the animals, as well as the quality, have started to decrease”.

Possible degradation of ecosystems and the environment as a whole, caused by mining – mainly gold and lithium – was pointed out by Fátima as the biggest collective concern of the peasants. Many interviewees highlighted the role of the community as protector of water sources for cities, as, by carrying out alpaca activity, it does not allow the entry of mining and, consequently, the contamination of water resources. In contrast, Joana warned of the possible mineral exploration in Phinaya, if people continue to migrate, due to the depopulation of the community.

Aguilar (2015) highlights the processes related to globalization and Peru's insertion in the international market (in a neoliberal context) – liberalization of the economy, free flow of goods, capital and human resources, departure of Peruvians and entry of foreigners – as the main responsible for the expansion of mining activities in the country.

Subalternized populations, such as indigenous people, invariably occupy remote or difficult to access areas (Porto-Gonçalves, 2006), which applies to the Phinaya community. However, currently, due to social revolutions and the power of technology and due to its biological diversity, availability of water, energy, etc., these areas have become strategic from a hegemonic point of view (Porto-Gonçalves, 2006), such as the area of study, of interest to mining companies.

Territories are constantly changing. However, it is essential to ask who are the actors of the most impactful changes. For the study region, for example, private mining companies and the State (for embracing the processes imposed by globalization) aim to modify the territory through the implementation of mining companies. However, the territory, as a “space-time living organism”, is always multiple, diverse and complex, unlike the “unifunctional” territory proposed by the hegemonic capitalist logic (Haesbaert, 2004). Is there an intention to transform the territory into a unifunctional one by installing mining companies in there?

Adaptation strategies to environmental and climate changes

Some of the strategies to adapt to environmental changes adopted in the community, cited by the interviewees, were: water harvesting (*cosecha*), recovery and conservation of pastures, use of medicines for animal diseases and genetic improvement of the same, as well as construction of

sheds (*cobertizos*) and investment in tourism (Table 3).

Table 3. Environmental and climate change, consequences and adaptations: perceptions.

Environmental and climate change	Consequences	Adaptations
Increased frequency and intensity of extreme temperatures	↑ Animal mortality ↑ Pneumonia in humans	Construction of <i>cobertizos</i> Migrations
Changes in weather patterns (seasons)	↑ Rains ↓ Snow and hail More intense droughts Unpredictability of extreme events Pasture degradation	Unidentified
Increased frequency and intensity of <i>heladas</i>	↓ Pasture ↓ Animal growth	Unidentified
Glacier retreat	↓ Pasture Water reserves Water scarcity	Cosecha of water
Pasture degradation	↓ Pasture ↓ Water availability Greenhouse gas emissions ↓ Biodiversity	Recovery, conservation and recomposition of pastures
Animal disease and mortality	↓ Alpaca production	Use of medication Genetic improvement

Water harvesting (*cosecha*), through the construction of small dams in smaller lakes, is the main strategy adopted in the face of water scarcity. Inácio pointed out that this measure ensures that water production does not decrease, in order to maintain alpaca production yields. According to the interviewee, the integrated management of water resources, that is, considering them in their hydrographic basin context, is evident as a necessary measure in the adoption of water harvesting. Still, Inácio stated that:

[...] this measure of adaptation to climate change is also a measure to fight poverty. It took many years to have this conception. They asked themselves what we were going to fight against first, climate change or poverty, and now we know that the fight is against both, it goes together. (Interview report by Inácio, obtained in fieldwork in November 2021).

The recovery, conservation and recomposition of pastures are adaptation strategies cited for the problem of their degradation and reduction. Hugo reported that in some areas of the Phinaya community, some hectares are being fenced off for fallow and, in others, new pastures are being

planted, especially in the areas most affected by drought and overgrazing. The recovery of natural ecosystems is cited by the IPCC (2019) as a Carbon Dioxide Removal (CDR) measure, in addition to offering benefits such as improving biodiversity, soil quality and food security of communities, contributing to the maintenance of ecosystem services.

The use of medicines for animal diseases and the genetic improvement of the same were pointed out as adaptation measures that imply high economic costs for families. In addition, Joana stated that the medications do not always work and that it is increasingly necessary to use larger quantities. Even so, the possible “entry of higher incomes” was highlighted when carrying out genetic improvement, as the animals cost up to seven times more and take less time to grow.

The construction of *cobertizos* – an infrastructure similar to a shed, used to facilitate the shearing and handling of animals, in addition to protecting them against adverse weather phenomena (Agrorural, 2020) – for sheltering animals, is adopted as an adaptation strategy for cold waves and intense rainfall, as they cause illness and mortality of camelids.

One of the economic alternatives is investment in tourism. Currently, the main tourist destinations in the community are the Ausangate snowy mountain, Sibinacocha lake and the Quellcaya ice field. Hugo reported that many tourism agencies are looking for Phinaya managers to partner with, but few residents have enough resources to invest, for example, in the construction of small hotels. The biologist pointed out that young people in particular are seeing tourism as an economic opportunity. Eva, one of these young people, stated:

I migrated to study administration. Since I was a child, my father encouraged me to work with tourism here in Phinaya, so I came back with that intention. My motivation is to work in tourism with people to generate economic “income” little by little, but more than anything that with this tourism we do not make way for the mining industry. That we can show that tourism generates more “income” than mining. (Interview report by Eva, obtained in fieldwork in November 2021).

Fátima argues that tourism is a good alternative for the community by stating that “Despite the pandemic, many people are coming to see the Quellcaya snowy mountain. Maybe it won't last long because the snow is going away”. The projection of glacial retreat for the coming decades may, therefore, decrease tourism-related income, undermining this adaptation strategy.

The interviewees reported that problems in the management of the community make it difficult to adopt adaptation strategies. Gonzáles reported that there are management problems due to lack of preparation of the leaders, the result of a deficient education. In this sense, Inácio stated that political training is relevant, especially for people who are on the board of directors (president, vice president, secretary, treasurer, inspectors, secretaries, among others), as so far their negotiating skills are very limited.

Furthermore, Hugo and Inácio stated that the lack of investments also restricts adaptation measures in the community. Hugo reported that one of the problems is the lack of funds to implement electricity service, for example. Inácio stated that there is a lack of public projects to pay for the construction of small dams for the dry season, both labor and material. Both interviewees cited that state resources are mainly allocated to infrastructure works in urban cities and the countryside is left behind.

This way, as Wrathall et al. (2014, p. 3) state, in a study for another region of Peru with similar

conditions, “the political economy configures migration as an increasingly viable adaptation alternative amidst a shrinking set of adaptive choices”.

Migration as an adaptation strategy to climate and socio-environmental changes in the Phinaya community

The main displacement drivers reported by the interviewees were: (1) extreme weather conditions (mainly intense cold); (2) decrease in alpaca production yield; (3) education that does not prepare for rural life; and (4) lack of access to means of communication and electricity. Pushing forces 2, 3 and 4 were discussed in topics 4.2.1 and 4.2.2. In this topic, push force 1 will be discussed, in addition to the relationship of force 2 with climate and environmental changes.

The decrease in income, the loss of productive capacity of families and the search for the local labor market, together with the context of urbanization since the mid-twentieth century in the country, are part of the context of migrations that occurred in the community. Peruvian urbanization (currently three quarters of the country's population lives in cities), which occurred in the last half century, is related to internal migrations that, in turn, occur mainly from rural areas and small towns, communities and populated centers, especially Andean – such as Phinaya, towards coastal cities and the jungle (Aguilar, 2015).

Interviewees who work directly with education in Phinaya – Diego (school principal) and Afonso (teaching specialist) – approached it as one of the forcing factors for migratory movements because, according to them, it does not prepare for rural life. On the contrary, the education of children and young people prepares them for life in the city and for urban work, which encourages them to migrate. In addition, they pointed out that school teachers did not grow up in the community context and, therefore, do not fully understand this way of life.

Afonso emphasized the importance of updating the curriculum in schools located near glaciers. He noted, “The work plans that come from the State in Lima do not address environmental changes, such as those affecting pasture and alpacas. As a result, the education provided lacks situational relevance and significance.” He also stressed the importance of children's understanding of their community's territory and the development of a sense of belonging to that territory. This awareness is

crucial for defending their environment and, ultimately, for the preservation of life itself.

All adaptation strategies mentioned depend on investments and public policies to be expanded and/or implemented, which are very restricted today. The lack of access to means of communication and electricity was also pointed out as one of the forcing factors of migration, as it makes it impossible to develop activities other than alpaca. Furthermore, Inácio reported that young people leave Phinaya, initially to study, and are faced with another way of life, with access to the internet and energy, they learn new trades, but they are unable to develop them in the community. Kaenzing (2015) also reports that in his study, in the Bolivian Andes, the perception of some interviewees was observed who mentioned the contrast between rural and urban lifestyles, the latter being perceived as more attractive.

As Carlos reported, off-season low temperatures (during the summer) have become more and more frequent, corroborating the departure of people from the community:

Even now that we are in November, at night you can see that it is getting very cold, something that did not happen a few years ago. It was quiet, just a little rain and snow, but now the wind is blowing as if it were August. And the nights are freezing as if we were also in August or June. This obviously affects and is causing the following generations to leave here. It's a concern. (Interview report by Carlos, obtained in fieldwork in November 2021, author's emphasis).

González reported that the intense cold reduces the time it is possible to work and Joana stated that “people no longer want to live here because it is very cold and they are migrating to the city. There is almost no life here, there is survival”. In this sense, Eva made a criticism by stating that young people migrate because of the cold and because they see the city as an easier place to live. Furthermore, he states that Phinaya is “a place for warriors”, evidencing his attachment to home which, according to Tuan (2012, p. 142): “may, paradoxically, appear from experience with the intransigence of nature”, where despite the difficulties, the person remains because he loves the land and the challenge of making it produce.

The decrease in alpaca production yield was pointed out as one of the drivers of migratory movements in the community, being, in fact, the most reported reason by the interviewees for the intensification of displacements in recent years. As already mentioned, animal husbandry is the main

economic activity in Phinaya and is intrinsically associated with climatic conditions and the availability of natural resources. Considering the impact of climate change on these resources and, consequently, on migrations, Carlos stated that:

This is the most critical, only people of my generation are left. Young people who are a generation before mine are migrating to Sicuani or other nearby cities due to climate change and because it is causing the mortality of our animals and work is no longer stable, so they are migrating. Today they finish high school and there is nothing to work on, because there is no longer much hope in the production of our alpacas, as climate change is affecting a lot. (Interview report by Carlos, obtained in fieldwork in November 2021, author's emphasis). In this sense, Joana stated that her generation will possibly be the last to live in the community, since her children, as well as the children of people her age, have migrated or intend to do so, without the prospect of returning. Diego, as well as other interviewees, highlighted the relationship between the low costs of alpaca products and the migration of young people from the community, especially:

Before, young people stayed here, because alpaca fiber and meat were used a lot. Nowadays, their costs are very low, so you get a cost of living so that they can survive here, so they have to migrate to other places to work. There are no more young people here, only adults. **I think that, over time, we will have to end the alpaca activity, because there is no one to take care of it, as everyone migrates.** (Diego's interview report, obtained in fieldwork in November 2021, author's emphasis).

According to those interviewed, the price of alpaca products (fibre and meat, mainly) has decreased a lot in recent years, which harms family income peasants, as stated by Eva – president of the Yayamari sector, peasant and merchant:

Unfortunately, the price of alpaca fibre has fallen significantly and we no longer work so much. Before, 20 or 15 years ago, the cost of fibre was 20 soles per pound, now it's 10, 12 soles. And the cost of living is now more expensive. For the love of our alpacas that we are practically here [...] unfortunately the government does not support us. Before the government supported us, buyers from other countries bought our fibre. Unfortunately in this government and governments, there is no appreciation, they forget about the alpaca sector (Report from an interview with Eva, obtained during fieldwork in November 2021).

Joana highlights that, in addition to the decreased price of alpaca products. Therefore, peasants do not have a fixed monthly income from this product, which contributes to many migrating in search of jobs.

Inácio stated that climate change and Peru's structural problems (lack of resources, investments and opportunities), associated, are the main drivers of migratory movements. Among the main consequences of climate change that affect the community cited by the engineer, is the disappearance of glaciers, the consequent decrease in water availability in the dry season and less pasture production – the main food for animals.

The retreat of glaciers, as well as the scarcity of other natural resources, environmental degradation and

contamination of water and soil – intensified by climate change – have been found to be motivators for human displacement in the Andean mountain environments (Gray; Bilsborrow, 2013; Wrathall et al., 2014; Kaenzig, 2015; HOsmer-Quint, 2020).

Climate variability and environmental degradation drive migration among the most vulnerable populations, especially in rural areas, where livelihoods are highly dependent on natural resources (Gray; Bilsborrow, 2013). In this sense, Hosmer-Quint (2020) reinforces the need to consider social inequalities as intensifiers of the vulnerabilities of a portion of the population.

Table 4 presents the results of applying criteria to define the occurrence of environmental migration:

Table 4. Result of applying the criteria to define environmental migration.

Criteria adopted (methodological basis)	Application of the criterion
1) Identify the drivers of migration in the reports of residents in interviews and, among them, see if there are any related to environmental changes (KAEZING, 2015).	Applied
2) Identify that the impacts of environmental changes and conflicts over natural resources are determining factors for displacement (HOSMER-QUINT, 2020).	Partially applied
3) Identify in the discourse of residents that migration is an adaptation strategy adopted in the face of environmental changes (WRATHALL et al., 2014; HOSMER-QUINT, 2020; GRAY E BILSBORROW, 2013).	Partially applied

That said, it is undeniable that environmental changes (many related to the impact of climate change) act as forcing factors for migration, although they are not the only ones. It was found that political, economic and/or social factors are also responsible for causing displacement, as well as environmental ones – that is, migrations are multi-causal.

Therefore, climate change increases socio-environmental vulnerability and reinforces the problem of migration in the community, as it acts by expanding the existing forcing factors for migration, and also as a direct forcing factor (in the case of extreme weather conditions, mainly cold, as mentioned earlier). In this sense, Hosmer-Quint (2020, p. 31) contributes by stating that: [...] migration is always joined by many variables, climate change pressures all the other factors that contribute to migration, which many call a 'threat multiplier' (HOSMER-QUINT, 2020, p. 31).

The identified environmental forcing factors point, for the most part, to changes in the environment that can be considered progressive (RAMOS, 2011). The possible environmental migrants affected by these forcing factors can be classified as “deterioration migrants”, due to the depletion of natural resources, by anthropogenic and unintentional actions that occurred over time (years), which forces migration as restrictions on human survival increase (Bates, 2002).

Wrathall et al. (2014) clarify that, while it is tempting to praise migration as a form of adaptation, it strengthens unequal structures. Migrations seemed to be the most easily adopted (in)adaptation strategy, in a scenario where the others are dependent on investments that are not happening or that are happening slowly, at a slower speed than the impacts are felt and thus cause migrations.

Final considerations

The population displacements are a current problem in the community. This problem has intensified in approximately 10-15 years and the main cities of destination for migrants are Sicuani, Cusco, Arequipa and Puno. Men and women migrate, but especially the former, as they have greater chances of entering the job market in the cities. The main drivers of migration cited were: extreme weather conditions (mainly intense cold), decrease in alpaca breeding, education that does not prepare for rural life and lack of access to means of communication and electricity.

The impact of climate change act as forcing factors for the migration of people from P.C. of Phinaya in recent decades (2000s and 2010s). However, environmental forcing factors are not the only ones to act, as it was found that political, economic and/or social factors are also responsible for causing displacement. Therefore, migrations are multi-causal based.

In view of the adaptation strategies adopted in the community – that is, its various attempts to remain in its territory, it is noteworthy that, even immersed in environmental and socioeconomic difficulties, it seeks to resist. However, one of the strategies of (in)adaptation to climate change is migration, which causes the de-territorialization of peasants.

Migrations are approached as generators of problems in Phinaya, among which: depopulation, aging population and loss of the productive capacity of families. Depopulation causes concern for several reasons, mainly because it can mean the entry of mining activities and, consequently, an increase in conflicts, violence, impoverishment and environmental degradation in the area. The impacts of environmental deterioration will also be felt downstream, in larger cities in Peru that depend on water from the glaciers in their full quality and quantity.

Regardless of the causes of migration, they have always been approached negatively by the interviewees. In short, the main problems reported, generated by migration, were: depopulation of the community, discontinuity of the way of life in that area, aging and loss of the productive capacity of local families. Depopulation causes collective concern, as it can mean the entry of mining and negative

consequences such as increased conflict, violence, impoverishment and environmental degradation (reflecting even in large cities, such as Cusco).

Thus, many peasant laborers adopt their permanent departure from the community as an adaptive measure. Climate change may amplify the problem of environmental migration (due to deterioration) in the coming decades. In a future scenario, where there are no structural changes with more investments in the community, concomitant with the accentuation of climate change, migrations will keep on happening and only increase.

It is clear that peasant laborers have relevant knowledge of local geography, as well as a deep relationship with the environment and its elements – glaciers, rivers, ecosystems, etc. In the same way, they perceive environmental changes and experience their social and economic impacts. In view of this, there is a need to consider the knowledge and perceptions of local actors about their environment in scientific research.

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APPENDIX A – SEMI-STRUCTURED INTERVIEW GUIDE

1. Identification details

- a) Name:
- b) Occupation:
- c) Education:
- d) Role in the community:
- e) Length of residence in the community:

2. Questions

A) Perception of the environment and environmental changes

- 1) What do glaciers, ecosystems, rivers, and the environment as a whole mean to you?
- 2) Do your parents and grandparents mention that the community's environment has changed compared to the past? If so, in what ways?
- 3) Have you noticed any changes in the community's environment? If yes, what changes have you observed? When do you think these changes began?
- 4) Do you feel that these changes affect your life? If so, how?
- 5) Do you believe these changes are affecting the lives of other community members? If so, in what ways?
- 6) In general, what are the biggest challenges the community faces due to environmental changes?
- 7) What actions do families take to adapt to these environmental changes?

B) Environmental Migration as an Adaptation Strategy

- 1) Has anyone in your family, or have you personally, migrated in recent years? If so, when did this happen, and what were the reasons behind the migration?
- 2) Do you know of anyone in the community who has had to migrate, or someone with a family member who migrated recently? If so, when did this occur, and what were the reasons for the migration?
- 3) In general, do you think migration patterns have changed over the past few decades? If so, do you believe migration has increased or decreased? If it has increased, what do you think are the main reasons for this? Why?
- 4) Do you believe environmental changes are contributing to migration? If so, why do you think that is?
- 5) Where do you think people tend to migrate to when they leave the community? What are the reasons for this?
- 6) In terms of age, which group do you think migrates the most: young people, adults, or elderly individuals? What are the reasons behind this?

- 7) In terms of gender, which group do you think migrates more: men or women? What factors influence this trend?
- 8) What impact do you think migration will have on the future of the community?