University of Zurich[UZH]

The meanings of water: changing landscapes and water management in a sub-basin from the Southern Peruvian Andes

GEO 630 Master's Thesis

Author
Maria Dulce Burga Hidalgo
16-702-839

Supervised by
Prof. Dr. Norman Backhaus
Dr. Christine Jurt

Faculty representative
Prof. Dr. Norman Backhaus

01.10.2018
Department of Geography, University of Zurich

ACKNOWLEDGMENTS

During this time, many people have helped me in many ways and made this master thesis possible.

First of all, I would like to thank my mother, Ana, for her tireless support in every way and for being so close to me every time.

To my supervisors Prof. Norman Backhaus and Dr. Christine Jurt for all their important advice and motivation over the last year.

To Isabel Häberli and Philipp Schläfli whose friendship and encouragement made me feel at home during my studies in Switzerland.

To Dr. Christian Huggel, whose support has been significant to start my studies in the UZH.

To my family in San Isidro de Chicon: Mama Julia, Lucy, Liz, Angel, Guiler, and Liam who welcomed me into their family as one more daughter. Their affection and help during my fieldwork was a great impulse for me.

To the residents and authorities of San Isidro de Chicón, Yanacona, Ccatán Pino and Chichubamba for sharing their time and knowledge with me.

To Verónica Miranda for her inputs about San Isidro de Chicón, for helping me to get access to San Isidro, and all the interesting conversations in the way.

To my brothers Miguel and Jose Miguel, my sister Livia and my niece Arianna for being always with me despite the distance.

This thesis is also dedicated to my father Miguel and my grandmother Susana, whom I know they are always looking after me.

SUMMARY

Glaciers in Peru have been retreating in more than 40% between 1970 and 2010 (Colonia *et al*., 2017: 2) raising concerns regarding the possible shortages in water availability and their consequences, such as conflicts and tensions for the competence of this resource. Moreover, researches about further scenarios state that the number and intensity of extreme events (specifically Glacier Lakes Outburst Floods (GLOF's) will increase (Salzmann *et al*., 2009; Bury *et al*., 2013; Carey *et al*., 2012; Haeberli *et al*., 2016) as glaciers continue receding.

The Chicón sub-basin is one example of this scenario. Located in the Peruvian Southern Andes, the Chicón sub-basin is crowned by the Nevado Chicón (5,530 m.a.s.l) (Carlotto et at., 2012; INDECI, 2005), a glaciated mountain that has retreated 50 meters by the year 2010 (Cárdenas *et al*., 2013). Moreover, on 2010 a glacier lake outburst flood (GLOF) in the lake Rit'icocha caused floods and material losses in the sub-basin. The event led to risk management actions in the plain of Ocoruruyoq (located at the foothills of the Nevado Chicón) and the attempt to continue those actions in the lake Rit'icocha. However this last initiative created a strong distrust among the residents of the sub-basin, causing the stop of such measures in 2013.

Considering this scenario, the main concerns among the Chicón sub-basin residents are undoubtedly linked to the present and future of the glacier water, which is the main source for agriculture and human consumption in the Chicón sub-basin. On the other hand, this is a resource that is managed collectively at the sub-basin level; so that the four localities that comprehend the Chicón sub-basin: San Isidro de Chicón, Yanacona, Chichubamba and Ccatán Pino are responsible for the distribution of water in the sub-basin; despite of the different uses, representations and meanings around water.

In this regard, my master thesis addresses the current water management in the Chicón sub-basin by exploring the different meanings of water, and how they are changing after the rapid changes in the landscape. And secondly, how these different representations of water are reflected in the decision-making process regarding water management in the sub-basin.

The fieldwork for this master thesis took place between November 2017 to March 2018, and it was conducted in the four localities that are part of the Chicón sub-basin: San Isidro de Chicón, Yanacona, Chichubamba and Ccatán Pino. The information was collected through semi-structured interviews and participant observations. In order to interpret the collected data, a set of codes and categories were developed (Marying, 2014) to identify discourses from the narration of events, as well as the emotions and concerns that have resulted from the changes in the landscape.

I argue that to understand the current organization and practices around water is essential to identify the construction of the different meanings and relationships around the water sources. In this regard, it will be possible to understand how the localities that share the same water management face the changes in the water flows and the increasing sensation of water scarcity in the Chicón sub-basin. Moreover, the results show that the different representations of water and the ongoing changes in the landscapes are evidenced, and even contested in decision-making spaces. Indeed, the increasing sensation of water scarcity is reframing water rights, the relationship with State institutions, and the uses and distribution of water within the Chicón sub-basin.

RESUMEN

Los glaciares en Perú han ido retrocediendo en más de un 40% entre 1970 y el 2010 (Colonia *et al*., 2017: 2) generando preocupación sobre las posibles carencias en la disponibilidad de agua y sobre sus consecuencias, tales como los conflictos y tensiones por la competencia sobre este recurso. Además, investigaciones sobre escenarios futuros aseguran que el número e intensidad de los eventos extremos de origen glaciar, tales como aluviones (Salzmann *et a*l., 2009; Bury *et al*., 2013; Carey *et al*., 2012; Haeberli *et al*., 2016), se incrementarán conforme los glaciares continúen retrocediendo.

La sub-cuenca Chicón es un ejemplo de este escenario. Ubicada en los Andes Sur Peruanos, la sub-cuenca Chicón está encabezada por el Nevado Chicón (5,530 msnm) Carlotto *et al*., 2012; INDECI, 2005), el cual ha retrocedido de 20 a 25 metros hacia el año 2000 (Cruz Rivera, 2017; Miranda and Valer, 2018; Zegarra and Jiménez, 2018; Cárdenas *et al*., 2013), y 50 metros hacia el año 2010 (Cárdenas *et al*., 2013). Por otro lado, en el año 2010, un aluvión generado en la laguna Rit'icocha causó inundaciones y pérdidas materiales en la sub-cuenca. El evento dio lugar a acciones de manejo de riesgo en la pampa de Ocoruruyoq (ubicado en las faldas del nevado Chicón) y a los esfuerzos para continuar estas acciones en la laguna Rit'icocha. Sin embargo, esta última acción creó una fuerte desconfianza entre los residentes, causando la paralización de estas medidas en el año 2013.

En este escenario, las principales preocupaciones de los residentes de la sub-cuenca Chicón están indudablemente vinculadas al presente y futuro del agua del nevado, que es la principal fuente de agricultura y consumo humano de la sub-cuenca Chicón. Por otro lado, se trata de un recurso que se maneja colectivamente a nivel de subcuenca; de manera que las cuatro localidades que comprenden la subcuenca del Chicón: San Isidro de Chicón, Yanacona, Chichubamba y Ccatán Pino son los responsables de la distribución

del agua en la subcuenca, a pesar de los diferentes usos, representaciones y significados alrededor del agua.

En este sentido, mi tesis de maestría aborda la gestión actual del agua en la subcuenca de Chicón explorando los diferentes significados del agua, y cómo estos están cambiando después de los rápidos cambios en el paisaje. Y en segundo lugar, cómo estas diferentes representaciones del agua se reflejan en el proceso de toma de decisiones sobre la gestión del agua en la sub-cuenca.

El trabajo de campo para esta tesis se realizó entre noviembre de 2017 y marzo de 2018, y se realizó en las cuatro localidades que forman parte de la subcuenca del Chicón: San Isidro de Chicón, Yanacona, Chichubamba y Ccatán Pino. La información se recopiló mediante entrevistas semi-estructuradas y observación participante. Para interpretar los datos recogidos, se desarrollaron una serie de códigos y categorías (Marying, 2014) para identificar los discursos a partir de la narración de los acontecimientos, así como las emociones y preocupaciones que han resultado de los cambios en el paisaje.

Argumento que para entender la organización y las prácticas actuales en torno al agua es esencial identificar la construcción de los diferentes significados y relaciones en torno a las fuentes de agua. En este sentido se podrá entender cómo las localidades que comparten un mismo manejo del agua enfrentan los cambios en los caudales y la creciente sensación de escasez de agua en la subcuenca de Chicón. Asimismo, los resultados muestran que las diferentes representaciones del agua y los cambios en curso en los paisajes se hacen más claros e incluso se cuestionan en los espacios de toma de decisiones. En efecto, la creciente sensación de escasez de agua van replanteando los derechos de agua, la relación con las instituciones del Estado, y los usos y la distribución del agua dentro de la subcuenca Chicón.

LIST OF FIGURES, TABLES, AND PHOTOS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS

GLOSSARY

Acronyms

AAA: Administrative Authorities of Water (Autoridad Administrativa del Agua)

ALA: Local Water Authority (Autoridad Local del Agua)

ANA: National Water Authority (Autoridad Nacional del Agua)

FONCODES: Cooperation Fund for the Social Development (Fondo de Cooperación para el Desarrollo Social)

JASS: Sanitation Services Administrative Committees (Junta Administradora de Servicios de Saneamiento)

JNUDRP: National Board of Users of the Irrigation Districts of Perú (*Junta Nacional de Usuarios de los Distritos de Riego del Perú)*

PSI: Sub-sector Program of Irrigation (Programa Sub-sectorial de Irrigaciones)

OMSABA: Municipal Office of Basic Environmental Sanitation

Words in Quechua

Apu: It is the name that is given to the spirts that live in the mountains of the communities in the Southern Peruvian Andes (Sánchez Garrafa, 2014).

Ch'allado: Referred to the first zip or bite that is sprayed to the ground to feed the *Pachamama* and the *Apus* as they can be thirsty or hungry.

Cocha: Lake

Haywarisqa: Also referred as *pago.* It a ritual that is widely practiced in the Peruvian Andes during August, and it expresses a relation of reciprocity and obligation towards the *Apus.*

Rit'i: Ice or snow

Wayqu: Basin

TABLE OF CONTENTS

I. INTRODUCTION

a) Problem statement and aims

Peru concentrates the 70% of the tropical glaciers of the world. According to the national glacier inventories (UGRH, 2014), glaciers in Peru have been retreating in more than 40% between 1970 and 2010 (Colonia *et al*., 2017: 2) raising concerns regarding the possible shortages in water availability and their consequences, such as conflicts and tensions for the competence of this resource. Moreover, further scenarios state that the number and intensity of extreme events (specifically Glacier Lakes Outburst Floods (GLOF's) will increase (Salzmann *et al*., 2009; Bury *et al*., 2013; Carey *et al*. 2012; Haeberli *et al*., 2016) as glaciers continue receding.

The Chicón sub-basin is one example of this scenario. Located in the Peruvian Southern Andes, the Chicón sub-basin is crowned by the Nevado Chicón (5,530 m.a.s.l) (Carlotto et at., 2012; INDECI, 2005), a glaciated mountain that has retreated from 20 to 25 meters by the year 2000 (Cruz Rivera, 2017; Miranda and Valer, 2018; Zegarra and Jiménez, 2018; Cárdenas *et al*., 2013) and 50 meters by the year 2010 (Cárdenas *et al*., 2013).

Another significant change in the Nevado Chicón was caused by a glacier lake outburst flood (GLOF) in the lake Rit'icocha on October 12th of 2010. The event caused floods and material losses in the sub-basin, and it led to risk management actions in the foothills of the Nevado Chicón. These works were planned to be extended to the lake Rit'icocha; however, this last initiative created a strong distrust among the residents of the sub-basin, causing the stop of such measures in 2013.

Undoubtedly, this raises the questions about which are the main concerns among the Chicón residents concerning the present and future of the water that comes from the Nevado Chicón; moreover, considering that this is a resource that is managed collectively at the sub-basin level. In this regard, the four localities that comprehend the Chicón sub-basin: San Isidro de Chicón, Yanacona, Chichubamba, and Ccatán Pino are responsible for the distribution of water in the sub-basin; despite the different uses, representations and meanings around water.

In this direction, this thesis aims to address how water management is conducted in the sub-basin, considering the current context of the Nevado Chicón and the increasing sensation of water scarcity. To address this, the core of this work is the understanding of the conceptualization of the Chicón sub-basin. In other words, how people in the sub-basin relate to the different water sources (glacier, lakes, river, hydraulic infrastructure)

and their implications on the cultural life and cosmologies (Bolin, 2009; Rhodes *et al.*, 2002; Cruikshank,2009; Gagné *et al.*, 2014).

Consequently, the process of glacial loss has an impact on the emotions, moral values and emotional attachment (Brugger *et al.*, 2013; Gagné *et al.*, 2014; Jurt *et al.*, 2015). In this regard, the second aim of this thesis is to explore how the changes in the landscape are reflected in the relationship with the water sources; and if this is reflected in decision-making processes within the sub-basin. Thus, this work seeks to highlight the importance of the water meanings to analyze the current water management in Chicón.

b) Research questions

As stated previously, this thesis aims to address the current water management in the Chicón sub-basin by 1) exploring the meanings of water and by 2) addressing the relationship with the water sources that come from the Nevado Chicón, which has gone through important physical changes lately.

The focus of this work is centered in the four localities of the Chicón sub-basin: San Isidro, Yanacona, Ccatán Pino and Chichubamba, situated in the Chicón sub-basin. All of them work together for the water management in the sub-basin; however, the sensation of water scarcity varies among them, which is also crucial to understand the relationship, decision-making processes and tensions between them.

In order to support the evidence and address the aim of my research, my other sub-questions are the following ones:

1) How is the characterization of the Chicón sub-basin?
2) Which are the meanings and roles that are given to the water sources in the Chicón sub-basin?
3) How is the current relationship between the Chicón (sub-basin) residents and the Nevado Chicón and *Apus?*
4) Which are the current and future concerns in relation to the Nevado Chicón and water?
5) How is water management organized in the Chicón sub-basin?

c) Outline of the master thesis

The structure of the thesis starts with the methodology section. Here I describe the methods I used, the sampling, the data analysis and my experience in site. This section is followed by the state of the art, in which I recapitulate the studies made in regard of the narratives on glaciers in a context of glacier retreat; the water and glacier representations

and their implications in Andean irrigation systems; and the researches made in the study site.

The findings of my work will be divided into three parts. The first one is centered on the characterization of the Chicón sub-basin. In order to understand the current water management and relations in the Chicón sub-basin, it is essential to comprehend how water is conceived and structured. In this regard, this part explores the meanings and roles that are given to the water sources, such as the Nevado (snow-capped mountain) Chicón, lakes and the river; which are also called *Apus*, a sacred name that is given to the mountains, glaciers, and to the primary water sources in the Chicón sub-basin.

The second part explores the current relationship with the *Apus*. First, by approaching the symbolic relations to understand the daily and ritual connection with them. Secondly, by analyzing the 2010 GLOF and the risk management works that occurred after, which not only resulted in a radical change of the landscape, but in a social mobilizer as the sentiment of protection towards the Nevado Chicón intensified, and as the construction of danger denoted a new knowledge of the landscape.

The third part describes the current water organization system in the Chicón sub-basin: the organizations and actors in charge of the water distribution, the decision-making processes in a context of increasing water scarcity, the normativity and daily practices and irrigation knowledges, as well as the agreements and tensions that result of how water is managed in the sub-basin.

Finally, the discussion section describes the primary findings per chapter to answer the main objective of this thesis: understanding the current water management in the Chicon sub-basin, considering the context of glacier retreat and the changes in the landscape.

II. METHODOLOGY

In order to answer the research questions, an ethnographic approach was addressed during my fieldwork. The use of this method responds to the deeper understanding of the ways of living, meanings, and behavior that are revealed through the examination of what people *say* and *do* (Herbert, 2000). On the other hand, as ethnography is strongly bounded in the context, it also allows flexibility regarding the specific techniques that will be conducted during the research.

My fieldwork was centered in the four localities that are part of the Chicón sub-basin: San Isidro de Chicón, Yanacona, Chichubamba, and Ccatán Pino. Initially, I got the intention to focus my research in San Isidro de Chicón given its location at the headwaters. However, during my time in the field, it became important to understand the

connections and interrelations between the localities across the sub-basin; as well as to comprehend how the particularities of each locality determine the dynamics of water within and outside the Chicón sub-basin.

I got the opportunity to live in San Isidro de Chicón with a family for four months (from November 2017 to March 2018). Although this facilitated my entrance into the community, and it was a starting point to enhance my networks with residents of the other three localities (Yanacona, Chichubamba, and Ccatán Pino), it became more difficult to participate in the daily and social life of Yanacona, Chichubamba, and Ccatán Pino in contrast to my stay in Chicón. For that reason, besides the participant observations, I could conduct in meetings, assemblies and other decision-making spaces, the utilization of semi-structured interviews was of great importance for my research.

The semi-structured interviews gave me the advantage of having a general and flexible script that allows the collection of new topics (Bernard, 2006) that appear during fieldwork. Also, semi-structured interviews gave me the possibility to explore the link between concrete events with general answers and narratives about the water, the climate, the landscape, etc. (see: Episodic interview by Flick, 2000); and find narratives that establish a relation between the past, present and future (Scoville-Simonds, 2018).

In this respect, my interview questions and observations were oriented to deepen into four main topics that aim to answer my research questions: first, the relation with the Nevado Chicón, lakes, river/ Apus (sacred entities) and the conceptualization of water sources (meanings, where does the water starts, roles, etc.). Secondly, the link of concrete circumstances (mainly the 2010 GLOF and the risk management works afterward) with the increasing sensation of protection towards the glacier and landscape, and the perception of water availability. Third, water organization and daily practices. And lastly, the identification of current water problematics, possible solutions, and expectations for the future.

a) Sampling

Under the topics explained, I addressed different types of interviews that varied according to the kind of interlocutor: residents who mainly work in agriculture, water authorities, people in charge for water distribution, representatives of the Municipality and representatives of water organizations at the regional level. These actors were selected to gain a deeper understanding of water management, organization, and practices not only within each locality but at the sub-basin level.

For that reason, it can be stated that the approach at the sub-basin level evidenced the differences and tensions regarding water uses and access throughout interviews full of personal experiences and from positionalities of key actors that provided rich information

about the water and glacier retreat phenomenon. Moreover, the sampling was chosen with the help of other informants, so that key actors in the water dynamics (authorities, leaders, decision makers, etc.) were identified, as well as residents who do not necessarily have such roles but that have an active role respecting the use of water on a daily basis.

In total, 50 semi-structured interviews and nine non-scripted interviews were conducted to 48 persons (14 women and 34 men[1]). Some of the interviews were conducted in two or three parts to the same interviewee to deepen specific topics with key actors. All the interviews were recorded with a recording device with previous consent. On the other hand, most of the interviews were conducted in Spanish. Only in a few cases, especially with elders and when I noticed that Spanish was not a language some interviewees felt comfortable at all with, Quechua was used with the help of a translator.

As a guide for this thesis, the quotations that will be included in this work will not cosign the names of the interviewees and approximate ages will be given, to protect the confidentiality of my interviewees. However, I will indicate the gender, (estimated) age, and position of the interviewees in the quotes to distinguish which is the positionality of the interlocutor in regard to the topics addressed in this thesis.

b) Data analysis

In order to interpret the collected data, a set of codes and categories were developed. My interview structure has been based on my research questions and in the theoretical frame. Subsequently, the codes were mainly based on my interview structure. But also, many of the codes came up after my fieldwork, as new topics emerged.

Indeed, as a first step, my codes were grouped into three main categories: the characterization of the elements of the sub-basin, the current relationship with the water sources/*Apus* and the water organization system. During my fieldwork, new codes emerged. Some of them were more precise and linked to concrete practices that I did not consider beforehand; while others helped me to address more abstract categories, especially regarding perceptions, representations, and relationships.

In the analysis, I used my data in different manners. For topics that involved aspects such as emotional attachment, perceptions and representations, I followed the interpretation based in a broad context analysis (Marying, 2014); this is the analysis of the personal meanings in the context of Chicón, but also concerning other studies conducted in the Southern Peruvian Andes. In other aspects, such as the narration of events, passages and the sequence of projects, rules, daily practices, etc. the analysis privileged the summarization (Marying, 2014), in which I collected the main aspects per category, but

[1] I found that positions of authority were mainly occupied by men than women, which resulted in a bigger amount of male interviewees.

also considering the particularities that I could find in my data. The summarization also responded to the considerable volume of data from the four localities in this regard.

c) My experience in site, challenges, and limitations

Before I started my fieldwork in Chicón, I had some contacts from the field site after previous researches conducted by students of Anthropology from the UNSAAC (University San Antonio Abad of Cusco). In this regard, my entrance in San Isidro de Chicón was not complicated. On the contrary, having colleagues who worked in site facilitated the first logistical aspects such as accommodation and, especially, the possibility to live with a family from San Isidro.

Living with a family from the community gave me some advantages, especially regarding the possibility to meet new people. My family in Chicón owned a store, so that there were many interactions with different people on a daily basis. Thus, my presence generated curiosity and some questions, which did not create greater suspicions after I could explain that I was a student who was conducting a thesis. But mainly, having references from my previous colleagues, also helped me to enhance new relationships in San Isidro.

However, my entrance in the community was not completed until I talked to the principal authorities: the president of the community, the president of the irrigation committee and the president of the Sanitation Services Administrative Committee of San Isidro. In order to have their approval, it was necessary to present me in meetings and assemblies to be known and clarify any doubts. Moreover, with these authorities, I engaged in more extended conversations regarding my thesis, and they expressed that I should share my results once my research is done. Similarly, once I started to go to the other three localities, the conversations with the respective authorities also revolved around the contributions of my work for the localities.

Regarding my limitations, a first one is language. Despite that Spanish (my mother tongue) is spoken without problems in the province of Urubamba, I noted that during my fieldwork some meetings and conversations were in both Spanish and Quechua. In these occasions, I could not understand everything that was said due to my basic command of Quechua. On the other hand, it was more challenging to communicate with elders, and on some occasions, I noted that Quechua is a language that expresses different things about the relationship with the landscape in comparison to Spanish. To overcome this, I asked some of my interviewees to answer me in Quechua if they did not feel comfortable. Since I could understand only a little, I needed to contact Quechua speakers who could help me with the translations.

A second limitation was the limited time I could spend in the field. My work focuses on water management and practices, which have considerable variations throughout the year. Especially, I was interested to see such dynamics during the dry season, which starts in May and finishes in August-September. Thus, there are more concerns, regulations, and tensions in the dry season due to the water scarcity. On the contrary, during the rainy season (which coincided with my fieldwork), water availability is less a concern. In this regard, I tried to address such changes with interviews and conversations about the daily life in the dry season but without the possibility to participate in them.

Regarding challenges, the biggest one for me was to comprehend that to study water practices on a particular site, it cannot be neglected the role of actors at different levels. As it was mentioned before, water management in Chicón cannot be analyzed by the practices and decisions that are taken within one locality solely; but it requires the understanding of the interactions at the sub-basin and even regional level. In this respect, one important decision in my research was to include other three localities, although that meant that I was not going to spend the same amount of time as in San Isidro due to time constraints. On the other hand, when I decided to interview regional authorities as well, I noted that our conversations required a specific knowledge of laws and a more technical language that were more challenging for me.

III. STATE OF THE ART

The following literature background will be divided into three parts. The first part addresses the researches focused on narratives on glaciers in a context of glacier retreat in mountainous areas; and how certain narratives regarding retreating glaciers have more preponderance on politics and agendas on climate change. The second part reviews examples of how different irrigation systems in the Peruvian Andes interact and overlap; but also, which are their implications on who water is managed and conceived for the future. Finally, the last part covers the researches that have been addressed in the Chicón sub-basin, specifically in the community of San Isidro de Chicón.

Narratives on glaciers in a context of glacier retreat

In this section, I will address the relationship between people and glaciers in the Andes from a Social Science perspective. Even more, in a context of glacier retreat, different studies have highlighted the biophysical, economic and political aspects of this

phenomenon (Allison, 2015); but also, they have deepened into the relationship between social and cultural life with the movement of ice; and how perceptions and narratives change as a consequence of receding or moving glaciers (Cruikshank, 2005), which have implications at the emotional, spiritual and moral level (Allison, 2015; Brugger *et al.*, 2013; Gagné *et al*., 2014; Jurt *et al*., 2015).

In the Andes, glaciers are portrayed in multiple ways beyond their physical characteristics. They can be powerful deities (Bolin, 2009), a female entity that behaves as a mother (Rhoades *et al.*, 2002), or a lawyer that intercedes to God on behalf of the petitioners that make *pagos*[2] (De la Cadena, 2015; Scoville-Simonds, 2018). In any case, in this region, glaciers are seen as superior entities whose behavior has a significant impact on peoples' lives.

Consequently, with the process of glacier retreat, there are not only physical changes that are perceived and felt, but there are also changes in the attributions and meanings that are given to glaciers (Gagné *et al.*, 2014). In the Ecuadorian Andes, Rhodes *et al* (2002) explore how "Mamá" (mother) Cotacachi glacier is conceived as a feminine entity and provider of abundant water; but also it expresses anger and disappointment, especially regarding glacier retreat. Indeed, the narratives, among elders, relate these changes as a punishment from Mama Cotacachi, while among younger people these changes are more attributed to climate change (Rhodes *et al.*, 2002).

In the Peruvian Southern Andes, the conceptualization of glaciers also goes beyond its physical characterization. Indeed, the relationship between people in the mountainous areas in the Southern Andes and the glaciers is quite close. Thus, *Apus* (a sacred name given to the mountains and glaciers in this region) are consensually powerful (Bolin, 2009; Allison, 2015; De la Cadena, 2015; Scoville-Simonds, 2018; Mujica, 2016; Sánchez Garrafa, 2014) but they might be losing their powers, especially in regards to water provision. In the literature reviewed, the narratives about the possible causes of deglaciation are mainly linked to human actions. However, in all of these studies, narratives are quite diverse, and therefore they can differ significantly within each study site (Jurt, 2015; Scoville-simonds, 2018).

In this regard, Bolin (2009) finds how glacier retreat is not only affecting the natural environment and livelihoods in a community of Cusco (Peru), but also the cultural and religious beliefs. Thus, glacier retreat also means that the powerful *Apus* are losing their

[2] *Pagos* or *Haywarisqa* (Quechua) are rituals that are performed in the Peruvian Southern Andes in which there is an offering to the Mother Earth and *Apus* (sacred mountains) in order to ask for a good year in agriculture and livestock, as well as to prevent climate-related problems. These rituals are done mainly during August within communities, institutions, and households; but they can also be conducted in other moments of the year to ask for personal wishes.

powers, especially as the main provider of abundant water. These changes are possibly attributed to wrong actions or certain behaviors in the society.

Similarly, Scoville- Simonds (2018) explores how different religious affiliations come into play when interpreting the changes in the environment in an agro-pastoral community of Cusco. Here he identifies two narratives: the first one that associates climate-related problems with failures at performing *pagos* as they express a bad relation with the environment. The second narrative is based on Evangelical beliefs, which links climate changes with the end of the world, as written in the Bible.

In third place, Allison (2015) highlights the implications of glacier decline in the way people understand themselves and how their meanings change in relation to the surroundings (Allison, 2015: 1). In this text, among other examples, she addresses the pilgrimage of the Señor de Qoyllur Rit'i (Lord of the Snow Star), a ritual that congregates around 70,000 people in the Sinankara glacier (Cusco). Here, the rapid deglaciation of the Sinankara is mainly attributed to the burning of fossil fuels from far away. Its rapid retreat increases the perception that the end of the world will come as soon as the glacier retreats completely. To face this scenario, the villagers have taken a more active role apart from being supplicants to this powerful deity; so that they seek to protect the integrity of the glacial area by restricting their access during the pilgrimage.

The studies conducted in Cusco have been systematic in the conceptualization of the *Apu* as a powerful entity that is the main provider of water. However, the causes of deglaciation are attributed to a set of different representations and beliefs, setting particular visions of the future, even within the same locality or community. Indeed, these new meanings and concerns have implications on emotions and the moral values (Gagné *et al.*, 2014; Cruikshank, 2009). For instance, the different perceptions of glacier retreat issues can also draw boundaries and identifications within each study site, in terms of loss and harm; as different groups associate different responsibilities and damages from the process of climate change (Jurt *et al*., 2015: 520).

Another aspect of the implications of the different representations on glaciers is the influence of narratives that are related with science and politics of climate change, in which political actors and authorities (regional, national), scientists and NGO representatives have an important role in the construction of new meanings in site. Thus, it has been discussed that the idea of local knowledges is constructed after all the interactions that occur in a particular context, so that it is difficult to differentiate local knowledge from external interventions and the introduction of new knowledge (Agrawal, 1995; Dekens, 2007); such as the scientific observation, which has become a new form of how to perceive glaciers in high mountainous areas (Orlove, Wiegandt, & Luckman, 2008; Carey, 2005, 2016; Jackson, 2015; Cruikshank, 2009; Nüsser & Baghel, 2016).

These interactions can result in asymmetries of power and knowledge, as certain knowledges are given credence as dominant discourses, while others are devaluated (Nüsser and Baghel, 2016) nor considered as contributions to academic questions (Cruikshank, 2001). For instance, Carey *et al.* (2016) have criticized that glacier retreat has been addressed mainly as a masculine, western and scientific way, neglecting other knowledges and groups when it comes to decision-making processes regarding climate change agendas at the national and international level. Likewise, Carey (2016) explains how narratives of endangered glaciers (see also Cruikshank, 2009) raise issues about the relationship between discourse, power, and environment as these narratives promote normative agendas about how to save the glaciers and from whom. Finally, Jackson (2016) addresses how narratives of ruined glaciers (future landscapes with no glaciers) lead to an imaginative state of loss that can be influential as part of the climate change discourse.

In summary, these researches highlight the different narratives and world visions regarding glaciers and water that can be found within one site, which are also constructed constantly with other knowledges, values, and conceptualizations of water and glaciers. It has also been illustrated how these different narratives do not find the same influence regarding policies and decision-making processes. In this regard, the next part of the literature review will address how such differences have implications in the irrigation systems that can be found in the Peruvian Andes.

Water and glacier representations and their implications in Andean irrigation systems

The different representations and the attributions that are given to glaciers and water in the Peruvian Andes are a starting point to understand the various notions that sustain how these resources should be used. Thus, as Boelens (2008) states, the irrigation systems and their control are founded on different notions of justice and processes of identity that support the right to culturally define and politically organize such systems. As a result, in the Peruvian Andes, multiple models of irrigation with rights of different origin can coexist but also overlap between them (Boelens and Gelles, 2005; Boelens and Zwarteveen, 2005; Boelens, 2008; Stensrud, 2014; Paerregaard, 1994).

For instance, Boelens and Gelles (2005) state how different social groups with different water management systems confront each other to establish rules and legitimate their model of irrigation in a community of Cabanoconde (Arequipa, Peru). Here the authors find two models that have entirely opposing conceptualizations of water, which are reflected in different water management schemes. On the one hand, among locals, the

social and symbolic order is materialized through the cult of the Huaca-Huaca mountain, the source of irrigation water. This cult has a crucial role in the notions of identity that link people, place, and production (Boelens and Gellens, 2005: 321). The other model of irrigation is more technical and "rational", and it comes from technicians, state officials and local elites who have been seeking for an inclusion policy and uniformity in how water should be managed. However, the authors state that this approach could enforce the power of local elites and the private and state sectors.

In the same line, in her study in the Colca Valley (Arequipa, Peru), Stenrud (2014) analyzes the interactions between people and their multiple versions of water. Thus, on the one hand, locals relate respectfully with the entities of their surroundings (mountains, soil, and water) (see also Paerregaard, 2013), while in the other all water users have to navigate in an institutional plurality to negotiate their rights and duties. Moreover, with climate change scenarios, the conceptualization of water as finite and measurable is being reinforced, which strengths the need for singular measures and implementations that could ensure water for the future. Therefore, the need for singularizing practices when there is a multiplicity of practices can create conflicts and constant negotiation in the field of water management.

In this respect, water management in the Andes cannot be understood without the role of the Peruvian state. That role has been marked in the last years by the aim of modernity and uniformity of water practices through the promotion of irrigation techniques, knowledge and norms (Boelens and Gelles, 2005; Stensrud, 2014; French, 2016); an increasing interest for big hydraulic projects (French, 2016); and the promotion of a new water culture that aims for a more mindful use of water through the increment of regulations between water authorities and users, through license payments, and controlled uses of water (Paerregaard et al., 2016). These new forms of governmental presence have been gaining preponderance with the process of climate change, water scarcity and other factors as urban population growth or the increasing dominance of mining, which repercusses in the ways people engage with water (Paerregaard, 2013; Lynch, 2012).

Climate change scenarios are more likely to reinforce tensions and power inequalities due to water scarcity as that might determine to whom the water flows (Lamadrid, 2014:1). In this regard, in her research in the Cordillera Blanca (Ancash, Peru), the author highlights that due to the hydric stress, power relations are more likely to emphasize an unequal distribution of resources. In the same line, Mathias Vuille (2013) addresses how water scarcity can deteriorate the already tense relations between local peasants and mining companies in Ancash (Peru) not only because mining activities are seen as highly polluting activities and as a risk for water quality (especially if they are located at the headwater); but also because the unequal power relationships are reflected in government policies that determine who has more control over and access to water.

To sum up, the different irrigation systems in the Andes are rooted in the relation and identification with glaciers, mountains, water, and soil, which cannot be separated from other social, cultural, and political processes. In this regard, the role of the State was presented to comprehend how different systems can overlap and coexist; but also how the institutional presence can create tensions due to their increasing control and unequal distribution of water.

Following this perspective, my research wants to find out how deglaciation and the increasing sensation of water scarcity are reconfiguring the relations with the Nevado Chicón, taking as a starting point the representations and attributions given to the water sources (nevado Chicón, lakes, river, etc.). And on the other hand, how the process of glacier retreat dynamize the confluence and tensions of the different water irrigation systems in Chicón in their way to ensure the access to water and other resources for the future.

Researches made in the Chicón sub-basin

In this section, I will present four theses that have been conducted in the study area by Peruvian students. All of them address the concern regarding glacier retreat from different perspectives: first, from Anthropology these works have focused on narratives regarding glacier retreat (Tecsi and Tupa, 2016; Miranda and Valer; 2018) and water management in the same context (Zegarra and Jimenez, 2018). And secondly, from the natural resources management and development perspective (Cruz Rivera, 2017).

Regarding narratives, Tecsi and Tupa (2016) analyze the interpretations that were given to the causes that originated the 2010 GLOF in Chicón. Their findings show two types of narratives: ones related to glacier retreat and the others related to an explosion in the Nevado Chicón. The authors highlight how these narratives have been constructed socially and how these do not necessarily coincide with the technical versions or studies which were made after the GLOFs.

On the other hand, Miranda and Valer (2018) focus their work on the perceptions and actions towards deglaciation taking into account the mythical-religious knowledge in San Isidro de Chicón. For this reason, they center their research in the conceptualization of the Nevado Chicón to later describe the actions that the Chicón residents are conducting to face the process of glacier retreat. Thus, the authors find that the Nevado Chicón is conceived as an *Apu* that is protective of their fields and which owns the animals and resources of the landscape. In this regard, people are in charge of ensuring the ecological system to show their respect and to not to lose access to the resources the *Apu* owns. Especially, with the process of glacier retreat residents are increasing their participation in rituals towards the *Apus* or water resources; but also, they are enhancing the monitoring

of the glacier and seeking for initiatives together with external institutions to reforest the area of Ocoruruyoq and other activities to reserve water for the future.

Similarly, Zegarra and Jimenez (2018) address the strategies to cope with climate change focusing on water organization within San Isidro de Chicón. One first finding is the conception of *time* to explain climate-related changes, while *climate change* is often an expression that is mostly used external institutions out of the Chicón sub-basin. In any case, given the increasing perception of water scarcity, the authors find that the local water organization is becoming more crucial to ensure the distribution in the community, so that they have an increasing influence on daily practices, schedules, and uses.

Finally, Cruz Rivera (2017) analyzes the perception of people living in the community of San Isidro de Chicón in regard of climate change, disaster risk and ecosystem-based solutions in order to identify hazards and vulnerabilities that could be potentially suitable for Ecosystem-Based Adaptation and Ecosystem-Based Disaster Risk Reduction.

Her results show that residents are aware of the climate-related changes, such as the increment of the temperature and the changes in the raining seasons. Drought is especially identified as one of the main concerns, mainly because with climate change the lower parts of the sub-basin are receiving less amount of water. About the GLOF, although this is also considered a hazard that also can be worsened by climate changes, it is not perceived that this event will happen soon because of the previous experience with GLOFs. Precisely, the causes associated to the GLOF in 2010 are that this was a provoked event to get minerals from the glacier (see also Tecsi and Tupa, 2016; and Miranda and Valer, 2018).

1. BRIEF CHARACTERIZATION OF THE STUDY AREA

1.1. Location, communities and main activities of the study area

Figure 1: Location of the Cusco province. Source: Google Maps

The Chicón sub-basin is located in the district and province of Urubamba, in the Sacred Valley[3], in the region of Cusco, Peru. It has an extension of 37.38 km^2 (Cruz Rivera, 2017: 20; INDECI, 2005: 19) and its altitude varies from 2,900 m.a.sl, in the city of Urubamba and 5,530 m.a.s.l which represents the elevation of the Nevado Chicón (Carlotto et at., 2012; INDECI, 2005).

The sub-basin starts in the Nevado Chicón, which in turn is the primary water source of the Chicón (or Tullumayo) river. The end of the Chicón river is located in the water mouth of the Vilcanota river, one of the main rivers in the region, in the city of Urubamba.

Throughout the sub-basin and alongside the Chicón river four localities can be found: San Isidro de Chicón, Yanacona, Ccatán Pino and Chichubamba. San Isidro de Chicón is the most extensive locality of the four with a total of 2084 hectares, which include the central part of the community where the housing area is located (46 hectares); the agricultural fields in the high area (without irrigation system) and in the lower part of the community (irrigation fields); an extensive forest area (325 hectares) with eucalyptus and diverse native species; pasturelands (317 hectares); and the area in which the water for the sub-basin is born: the Nevado Chicón, the glacier lakes, the pampa of Ocoruruyoq and small creeks (738 hectares). The community manages all of these areas and its resources, so every decision that compromises the access and use of these resources has to be agreed by the members of the community.

Yanacona is the second locality of the study site, and its extension is mainly oriented for agriculture and housing. Unlike Chicón, Yanacona has two types of property: the private and the communal one together. The private part comprehends the housing area, which has been experiencing a considerable urban growth as a result of construction projects that are attracting new residents to the community; and on the other hand, the agricultural fields that are located close to the river (57 hectares). The communal area comprehends

[3] [3] The Sacred Valley is the name given to the area located next to the Vilcanota river. It comprehends the towns of Pisac, Yucay, Calca, Urubamba, Chinchero, Maras, Moray and Ollantaytambo

the higher parts of the community where the agricultural fields that are irrigated with rainfalls. Similarly to Chicón, the use of these lands are only accessed under the approval of the community.

Chichubamba and Ccatán Pino are located in the lower part of the Chicón sub-basin, and both are annexes within the city of Urubamba, the capital of the province. Consequently, both Ccatán Pino and Chichubamba are situated in an urban context with more diversification of economic activities such as commerce, education, tourism, construction, etc. Moreover, because of their location, unlike Yanacona and San Isidro de Chicón, the political organization in these localities depends mostly on the Municipality of Urubamba. It is only in regard to water management for human consumption and agriculture that the authorities are chosen within Chichubamba and Ccatán Pino.

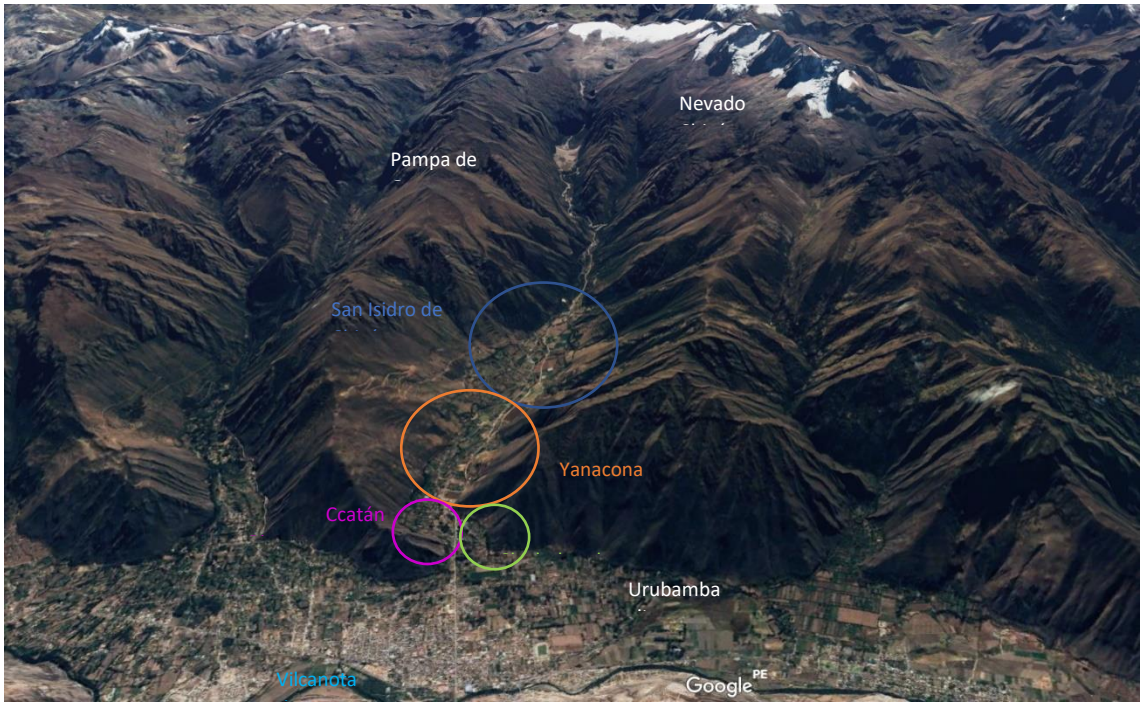


Figure 2: Location of the Chicón sub-basin and of the four localities in the study area. Source: Google Maps

Table 1: General information about the localities of the Chicón sub-basin

Locality	Type of locality	Main authorities	Number of inhabitants (2016)[4]	Languages	Distance from Urubamba city
San Isidro de Chicón	*Comunidad campesina* (peasant community)	Communal president (elected by the assembly of the community),	640	Spanish, Quechua	15 minutes by car

[4] See Tecsi and Tupa (2016) p.60

		presidents of the irrigation committee and JASS[5]			
Yanacona	Community /Association of small and medium owners	Communal president (elected by the assembly of the community), president of the association of small and medium owners, presidents of the irrigation committee and JASS	356	Spanish, Quechua	10 minutes by car
Ccatan el Pino	Annex of Urubamba	Major of Urubamba, presidents of the irrigation committee and JASS	300	Spanish, Quechua	Within the city
Chichubamba	Annex of Urubamba	Major of Urubamba, presidents of the irrigation committee and JASS	736	Spanish, Quechua	Within the city

Sources: Retrieved from the interviews to the authorities in the sub-basin, and Tecsi and Tupa (2016)

However, throughout all the sub-basin, agriculture is the most important economic activity. The main products that are found throughout Chicón are corn, potatoes, vegetables, alfalfa, fodder oats and barley; and in smaller scale quinoa, olluco *(Ullucus tuberosus)*, oca *(Oxalis tuberosa)* and fruits like apples, capulí *(Prunus salicifolia)*, peaches, among others. Products like potato, olluco and oca are mostly irrigated with rainfalls (*secano*) in farms located in the higher parts of Yanacona and Chicón, while the rest of the products are cultivated in farms watered with water from the Chicón river, especially corn and vegetables, so they are more available throughout the year.

Mostly in the case of San Isidro de Chicón, another economic activity that is gaining increasing importance is floriculture. This is an activity that is becoming popular after one resident from Junín (a province in the central Peruvian highlands) established in San Isidro to grow flowers, which generated him substantial profits that gained attention among Chicón residents. Thus, few families started to cultivate roses, gladiolus, and carnations along with their crops. However, its expansion is difficult as it is an activity that requires considerable investment and whose profits are only seen in the long term.

[5] Sanitation Services Administrative Committees (Junta Administradora de Servicios de Saneamiento)

Finally, other important activities are livestock, especially in San Isidro de Chicón that possesses pasturelands in the highest areas of the community. In this regard, few families from San Isidro de Chicón are dedicated to raising their cattle in the communal pastures or nearby their fields, or from other residents who do not have access to such spaces in their localities. Besides, in the four localities is quite common to raise small animals like chickens, ducks and guinea pigs for self-consumption and sales.

1.2. A brief history of land tenure in Chicón: from the *hacendados* to the end of the Agrarian Reform

The recent history of the Chicón sub-basin is highlighted by the radical transformation of land tenure after the Agrarian Reform of 1969, which had significant implications in the construction of different relationships with the territory along the sub-basin. On the one hand, the Agrarian Reform is a breaking point that is present in the collective memory of the Chicón inhabitants, especially among the residents of San Isidro de Chicón who experienced life in the *haciendas.* On the other hand, the changes in land tenure and the different configuration across the sub-basin are essential to consider to understand the current relations and rights over resources, including water.

The *hacendados*

Until the Agrarian Reform of 1969, San Isidro de Chicón, Ccatán Pino and some parts of Yanacona were under the control of the *hacendados* (landowners). The *haciendas* were one of most representative manifestations of the Spanish colonization during the twentieth century (Zans Candia, 2007) in the rural areas of the Peruvian coast and highlands as it perpetuated the traditional power and the paternalistic relations towards the peasantry (Boelens, 2008). Thus, local elites were not only owners of significant extensions of agricultural lands throughout Peru, but they were also in control of the means of production, labor force and the resource bases of the dominated groups (Boelens, 2008: 204). In few words, until the 60s the *haciendas* lead the economy and society in most of the country (Eguren, 2006).

In the Sacred Valley, the number of *haciendas* ascended to 66 (Gade, 2015: 165). During the 50s and the 60s, Urubamba became an important commercial corridor between the cities of Cusco and La Convención (a rainforest province of Cusco), especially regarding the production of different types of corn for different ways of consumption.[6] Besides the production of corn and other crops, in Chicón the *hacendados* had a considerable amount

[6] *mote* (from dried corn), *choclo* (fresh corn) and *chicha* (fermented corn beverage that is widely consumed in the region).

of livestock that served for the production of milk and cheese; and also, they involved in the cultivation of great extensions of eucalyptus. These products were not only market-oriented, but they also served as a way of payment to the *hacienda* workers for their work, which was well known as *condiciones.*

Moreover, the *hacendados* had absolute control over the resources, including water, pasturelands and even the glacial area of San Isidro de Chicón, so that the hacienda workers could only access them through their work or by paying for it. For *instance*, the *hacendados* allowed the use of *their* pasturelands for livestock in exchange for work, the access to the glacial area for harvesting ice in exchange for a tax, or the acquisition of water by working or purchasing it from the *hacendado* (Trawick, 2003). Such control over resources allowed the *hacendados* to keep relations of dependency with their workers.

"(El hacendado) era dueño del agua, dueño del terreno (...) Habiendo tanta leña en el cerro qué ibas a hacer pasar leña, te quitaba. Había tanto capulí, llevabas en tu canastita y te quitaba, no podías pasar. Así era el hacendado"

"(The hacendado) was the owner of water, the owner of the land. (...) Having so much firewood in the hills, there was no way you could bring it, the hacendado could take it away from you. There was so much capulí, (but) if you brought it in your basket, he took it away from you, you could not pass. That is the way the hacendado was.

Authority of San Isidro de Chicón, male, 67 years

The *hacienda* Chicón (2084 hectares) was initially under the control of four families: Santiesteban, Castañeda, Aedo, and Salas. Later, and as a result of transfer processes, only Jose Santiesteban became the owner of the *hacienda* Chicón until the 50s, in which he leased his property to Santos Lopez, who was well known as the last *hacendado* in Chicón (Miranda and Valer, 2018) before the Agrarian Reform. During that time, most of the workers of the Hacienda Chicón came from the town of Chinchero (Urubamba province). Thus, the Sayllo, Cusihuamán, Inquiltupa, Quillahuamán, Callañaupa, Huamán and Mañaccasa families were some of the first 15 families who established in the *hacienda* Chicón and who later founded the community of San Isidro de Chicón.

The situation in Ccatán Pino and Yanacona were distinct as the *haciendas* were much smaller and with few workers who were originally from the same area. In Ccatán Pino, for instance, the only hacendado (the Guevara family) worked with (approximately) 20 persons, while in Yanacona the small properties prevailed rather than the presence of a powerful *hacendado.* In this regard, these owners founded the community of Yanacona on July, 18th of 1966, before the Agrarian Reform was promulgated.

Changes after the Agrarian Reform of 1969 in the Chicón sub-basin

The Agrarian Reform of 1969 originated the most important transformation over land tenure in Peru as the *haciendas* were expropriated to be redistributed throughout the country (De la Cadena, 2015). Nevertheless, the Agrarian Reform in Cusco cannot be understood without the influence of the peasant movements that started in the provinces of Lares and La Convención (Cusco) during the 60s. Led by Hugo Blanco, these movements demanded to stop the tyranny of the *hacendados* by reconverting the peasant society (Gade, 2016; Concha Tupayachi, 2008). In this regard, their actions included the invasion of the *haciendas;* for instance, only in La Convención a total of 70 *hacienda*s were taken by the peasant movements (Encinas *et al*., 2007: 121). Despite the resistance these movements faced, their actions had such repercussion that on 1962 a first Agrarian Reform was declared, but only limited to Lares and La Convención (Bebbington, Scurrah, and Bielich, 2011).

However, the influence of the peasant movements had a great repercussion in the rest of the country. In Urubamba, the *hacienda* workers were organizing themselves into *grupos campesinos* (peasant groups) to force the transformation of the land tenure system. According to some interviewees who participated in this process, in Chicón a total of 60 workers formed the *Sindicato de Chicón* (Union of Chicón). When the *haciendas* yet existed their meetings had to be clandestine for fear of reprisals; but once the president Juan Velasco Alvarado promulgated the Agrarian Reform on June 24th of 1969[7], these groups were in charge of the transfer process from the *hacienda* to a *comunidad campesina* (peasant community) or *cooperativa* (cooperative) in their localities.

In fact, although the Agrarian Reform disposed the expropriation of lands and its redistribution among the people who worked on them, this was a slow process that culminated during the 80s when the haciendas became *comunidades campesinas* (peasant communities) like in San Isidro de Chicón or a *cooperativa agraria de producción* (agrarian cooperatives of production) like in Ccatán Pino. In Urubamba, a total of 12 communities have benefited from the Agrarian Reform.

In this regard, Ccatán Pino, first as a *cooperativa* was founded by 23 ex-workers on 1985; and San Isidro de Chicón was founded as a *comunidad campesina* on November, 4th of 1981. Here, although the expropriated land was of 2048 hectares, only 20 hectares[8] were able to be divided into family plots among the 42 families that founded the community. In both cases, *comunidades* and *cooperativas* are based on the idea of the collective management of land (Diez, 2003). However, the main difference between them is that only the *comunidades campesinas* are recognized by the Peruvian constitution[9] as an organization that is autonomous in its organization, in its communal work and in the use of their lands; while the *cooperativas* was another associative model that emerged from

[7] Ley de Reforma Agraria N° 17716 (Law of Agrarian Reform).
[8] Information retrieved from the interviews
[9] Art 89° of the Political Constitution of Peru

the Agrarian Reform that was conceived as a business, which had a considerable intervention from the State. (Martinez, 1981).

The communal tenure over land in Ccatán Pino and San Isidro went through several changes during the 90's which transformed their uses to the present.

"En 1981 formamos la comunidad campesina y los demás terrenos que estaban sin dueño pasan a manos de la comunidad, pasan a manos del grupo campesino y eso se trabajaba en sociedad, toditos trabajábamos habas, maíz, trigo, cebada y la cosecha (...) lo guardábamos. Y los directivos cuando necesitaban dinero lo vendían para algunos gastos. Pero resulta que cada año, cada año y no se hacía nada bueno; "y tanto trabajamos y no hay provecho. Y mi esposa era tesorera...le digo a mi esposa "¿Sabes qué? tanto trabajamos, almacenamos tanto trigo, tanta haba, tanta cebada, maíz y después desaparece. No puede ser. Entonces estamos trabajando por gusto para "engordar" a los directivos. Mejor hablaremos con tu presidente y mejor le "lavaremos la cabeza" y como no tenemos ni terreno, mejor nos repartiremos este terreno". Entonces hablé con el presidente, le expliqué y en la Asamblea decidimos ya mejor nos repartimos, ya nos repartiremos y nos hemos repartido."

"In 1981 we formed the comunidad campesina and the lands that had no owners passed into the hands of the community and the grupo campesino, and that was labored in society. We all worked broad beans, corn, wheat, barley and we stored the products. And whenever the directives needed money they used to sell the products for some expenses. But year after year nothing good came from it. We worked so much and there were no profits. My wife was the treasurer (of the board of directors) and I told her "Do you know what? This is not possible. We are working just to please the directives. Better if we talk to your president, we "wash his brain" and as we do not own any land, better if we redistribute these lands". So I talked to the president and explained to him and in an assembly we decided that it was better to distribute the lands among us, so we did."

Authority of San Isidro de Chicón, male, 67 years

Although San Isidro remains as a *comunidad campesina,* during the 90s it went through a process of redistribution of land, in which the plots that were located in the lowest areas of the community passed from the communal possession to the exclusive use of the Chicón families, who could then decide their uses and transfer their lands to their descendants. However, no process of privation has occurred within these lands until these days, so that these lands remain under the property of the community. On the contrary, Ccatán Pino initially formed as a *cooperativa,* but after 20 years their members decided to individualize and privatize their properties. In consequence, Ccatán Pino is no longer a *cooperativa,* but an annex within the city of Urubamba.

In this regard, the historical changes, especially regarding land tenure over the second half of the twentieth century, are important in order to comprehend the different political organizations that are present in the Chicón sub-basin; but also how these changes have resulted in the coexistence of different types of land tenure, such as the coexistence of private and communal plots within a specific locality. Thus, the varying degrees of appropriation regarding the territory are defined by a combination of rights that have been cultural, historical and locally determined (Diez, 2003: 74). Hence, the political organization that has resulted from the history of the territory is crucial to understand water rights as the relation between water and land in Chicón cannot be separated from each other.

II. THE STRUCTURE OF THE CHICÓN *WAYQU*

Water places are symbolically dense sites of meaning (Gagné & Rasmussen, 2016: 145). On the one hand, water can be conceived as a sacred entity, but it also might contain large-scale infrastructures; or water can be an element that attaches people to a place or a resource that causes conflicts. In any form, it is undeniable that water has a great interconnection with people (Toussaint, 2008) and it dynamizes social relations, as water emerges and enables practices (Stensrud, 2014: 86). Thus, water structures the space that delimits the Chicón sub-basin, and it influences in how relationships between localities sharing the same water are configured.

In Chicón, the area of the sub-basin is also known as *wayqu* (in Quechua language) or sub-cuenca (in Spanish).[10] According to Mujica, a *wayqu* in the Andes is the place where the population lives and interacts with different elements of nature, in which water is the ordering shaft of the social and cultural life (Mujica, 2016: 119). Even more, the basin is the space where soil and water meet, a confluence that shapes peoples' daily experience and their perception of a place (Gagné and Rasmussen, 2016). Indeed, particularly in this region, it is impossible to conceive life and *Pachamama* (Mother Earth) without water *(*Mujica, 2016: 119), which is the other element that structures life in the *wayqu.*

"(Un wayqu) Es un valle pequeño en dos cerros (por el) que pasa un riachuelo (...) El wayqu, así se dice en quechua también eso porque los ancestros lo han determinado así o lo han definido así. (...) En quechua wayqu es un lugar donde vive un grupo de personas que se dedica a una actividad, agrícola, diversas actividades."

(A wayqu) is a small valley between two hills through which a creek passes (...) The wayqu, that is said in Quechua too because our ancestors have defined it that way. (...) In Quechua, wayqu is a place where a group of people lives and who work in an activity, agriculture, different activities."

Water authority from San Isidro de Chicón, male, 30 years old

"Entonces, para nosotros, como cuenca o como wayqu, (la sub-cuenca) es importante porque nosotros nacemos de ahí, vivimos en ahí, pertenecemos ahí y trabajamos en ahí."

"So for us, as a cuenca or as a wayqu, (the sub-basin) is important because we are from there, we live there, we belong there, and we work there.

Water authority from Chichubamba, male, 62 years old

En Quechua más que nada kanmancha riki llapan chay maykunatan hamushan unu, chay huñunakuspa riki, namanta rit'imanta ris, wakin, wakin unuqa lloqsemushan naq orqoqkuna pachantan, orqoqkuna, chay huñunakuspa, huñunakuspa,

In Quechua, most of all, (Wayqu) will be all that the water is coming from; that is joining from what comes out from the glacier. Some of its waters are coming out from the hills, from below the hills. All that is gathering until it is a lot and

[10] In Spanish the space of the Chicón sub-basin is referred as both cuenca (basin) or sub-cuenca (sub-basin) in everyday conversations; although the terms *sub-cuenca* or *micro-cuenca* are recognized as the most accurate ones.

ashkachaman rikurimushan urayman, mana simple, ya no mana lloqsemushan nevadomantachu, rit'illamantachu, si no por partes uraykunapiña rihurimushan pachanmanta pachaq mama pachanmanta. chaykunata huñunakuspa, askanmañan tukuq, astawan parastinqan asqachañа hamun kay tullumayu nisqata ashkachamaña rihurin unu chayqa noqapaqa rimayniytaq cuenca llapanchataq huñumushan nisqayhina, pachaman pachanmanta, tanto rit'imanta, parapas, (...) cuencaqa solamente masqamushan llapan caminuta hasta nama chayankunaqanma, vilcanotaman chayapushan riki naman mayuman tiempo para tiempollapi chaypas (...) mana para qan chayqa chakiypiqa chakiriy ninku manan para kanchu pisi kan para manan unu chayanñachu nama vilcanotamanqa mayuman chayllapi tukuqapun, consumo humano, chakra qharpay, tanto animalkuna chayllapaq manaña usunñachu namanta mayumanta, anchaychakaman parte cuenca niskaykimanta (...) porque la cuenca nacimun riki cuenca del ritiq, ritipas pisiamushanña, tanto subterraneo chay manante nisqanku pachaq mamanta lloqsimun unu anchaychakunaya huñunakuq, huñunakuq chakiriypiqa tomanapaq plantapaq, animalpaq, chayllapaqya, tanto wasi ruanapaqpas qanllantaqya, riki unullamantaqya wasipas imapas, adobepas, imapas unu, agua unu.

it appears down the basin, right? Simple, not anymore, (water) is not coming out from the glacier, only from the glacier; it is coming out in parts, it appears below the sub-basin, underneath the Mother Earth. Those waters are coming together underneath our Mother Earth, and there is a lot that comes out. When it rains a lot, a lot of water comes out, a lot appears in this Tullumayo (Chicón) river. That is for me what I mean for cuenca. It is everything that is coming together from below the soil, from the glacier, from the rains (...) So a cuenca is only searching all the path to the Vilcanota river. That just happens during the raining season (...) When there is no rain, we are in a drought; where there is no rain o there is a little rain, the water cannot reach the Vilcanota river. (Water) Is for human consumption, for watering the fields, for animals; but it does not reach the river. Only until that part it will be what someone would call as "cuenca"(...) because the cuenca is a source from the glacier, although it is becoming smaller; also that spring that is coming out from beneath our Mother Earth; so (these waters) knew how to get together so we could drink when we are thirst, for the plants, for the animals, to build our houses, only for that, from water houses are made; for anything else, water.

Water authority from Ccatán Pino, male, 56 years old

These quotes explain what a *wayqu* or *cuenca* means to the interviewees.[11] In all of them, water is the element that defines the *wayqu* and in its multiple forms. Thus, the basin is formed by the water from the Nevado, from the rains, from creeks and from beneath the soil or *Mother Earth*; and it can be abundant or scarce. Although all of the waters constitute part of the same system, it is also noted among most of my interviewees that the main water contributor is the Nevado Chicón.

On the other hand, it is important the emphasis that the interviewees made about the multiple uses of water; especially regarding work, agriculture, and water for human consumption. Precisely, those are the waters that are located the closest to the residents through irrigation channels and pipelines; while the places where the water is born do not necessarily take part of the daily life of the inhabitants. However, all of them are identified as one system and as a place of belonging and identity. In the following lines, I will detail the conceptualization of the elements that comprehend the Chicón sub-basin.

[11] These quotes correspond to my question of what a *wayqu* means and if there are differences in the meaning between Spanish and Quechua. Despite that some interviewees felt more comfortable explaining certain things in Quechua, there are common elements in all the definitions I could collect in both languages.

2.1. The Nevado Chicón[12]

Photo 1: The nevado Chicón from the community of San Isidro

The Nevado Chicón is one of the 37 snow-capped mountains that comprehend the Urubamba mountain range, and it is the third highest among these. The Nevado Chicón is the starting point of the Chicón sub-basin, and it constitutes the primary source for fresh water for all the activities, as their waters run through all the sub-basin until they drain in the Vilcanota river. The glacier divides into three sectors: Sabanayoq, Wisq'ana, and Padreyoq. According to Miranda and Valer (2018), the toponym of each represents a distinctive physical characteristic, hierarchy, and size.

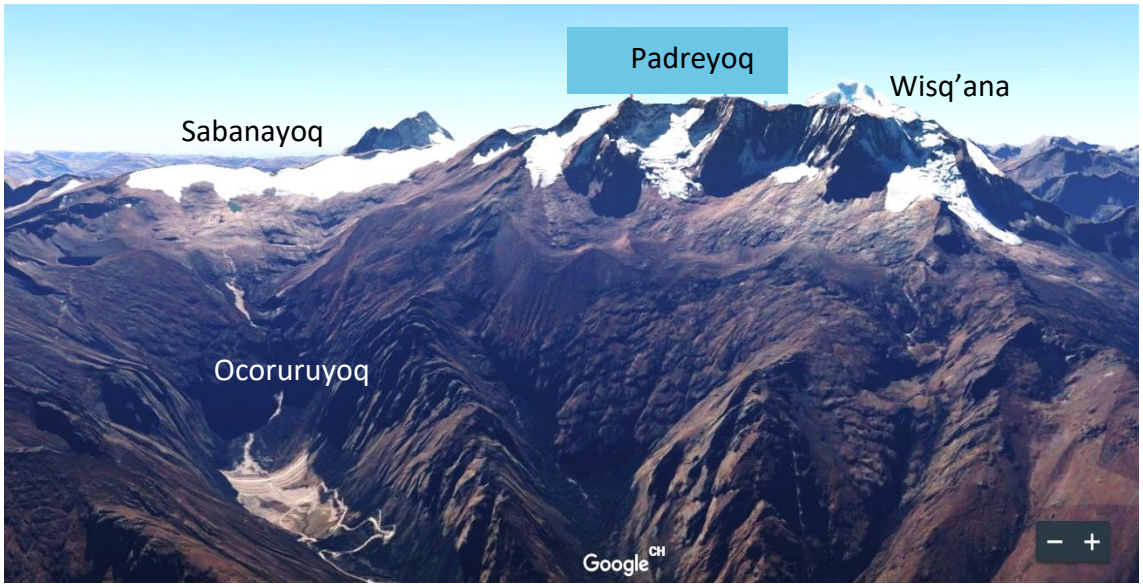


Figure 3: Sectors of the Nevado Chicón. Source: Google Earth

Indeed, the sector of Padreyoq is the biggest in height, and its name also represents the figure of a priest[13] that formed with the ice thaws. On the other hand, the sector of Sabanayoq or Mamá Sabana represents the figure of a bed sheet, and it is as well the

[12] I would like to note that throughout this thesis I will use the term "nevado" to refer to the glaciated mountains. I also would like to highlight that during my interviews in Spanish, the terms nevado (glaciated mountains) and glaciares (glaciers) were used indistinctly among my intervieweesto make reference to the Nevado Chicón as a whole. In a lesser extent, when the interviews were conducted in Quechua, the term Rit'i (ice, snow) was used among my interviewees.

[13] Padre – priest or father in Spanish/ yoq – suffix of possession in Quechua.

smallest peak and where all the glacier lakes locate. Finally, the sector of Wisq'ana is located next to the sector of Padreyoq, and following Miranda and Valer (2018) this sector is distinguished by its form of a "corral" and great extension, which allowed the residents of San Isidro to bring their cattle and horses to this area.

Besides the physical features of the Nevado Chicón and the lakes, the characterization of these water sources also comprehends the emotional and spiritual attachment. According to Sánchez Garrafa (2014), in the Southern Andes, there is a mythical relationship between people and the places where the water born, as they influence the watercourse for the diverse activities, especially agriculture (Sánchez Garrafa, 2014: 66). In this regard, in the Chicón sub-basin, the nevado and lakes are also represented as *Apus,* which is the sacred name given to the mountains as it expresses their powerful character as deities and their prominent role as water providers.

2.2. The lakes of the Nevado Chicón

The Nevado Chicón contains different glacier lakes. The most known by the locals are Rit'icocha, Yanacocha and Azulcocha, whose waters run through the Chicón river, the Pumahuanca river (Pumahuanca sub-basin) and small creeks like Lambranpuquio, Queuñayoq, Ninaspuquio, and Willkamayucha. Besides these lakes, there are also smaller lakes such as Qomerococha, Quellococha, Chakicocha, and others, which are located in the Sabanayoq and Wisq'ana sector of the Nevado Chicón; however, these are less known, and their identification is not consensual among the residents of the sub-basin.

The emergence of various lakes of small dimension is a consequence of the glacier retreat (Cárdenas *et al*., 2013). Indeed, the Nevado Chicón has retreated from 20 to 25 meters by the year 2000 (Cruz Rivera, 2017; Miranda and Valer, 2018; Zegarra and Jiménez, 2018; Cárdenas *et al*., 2013) and 50 meters by the year 2010 (Cárdenas *et al*., 2013). As the lakes are recognized as great contributors to the Chicón river, this scenario has brought concerns about the less amount of water, but also it has raised questions regarding the *path of the water*.

"(El nevado) Ha cambiado bastante, antes había bastante agua (…) Pero ahora no hay pues agua, no hay río ¿Para dónde se ha ido el agua? ¿En qué lugar está escapando el agua? Entonces ahora como dicen, el agua está escapando por todo sitio, por debajo. (…) Está filtrando el agua por otro lado. Hay hoyos que está filtrando y agua está apareciendo allí en el (ininteligible) en donde no debería aparecer todavía. (…) Acá en Chicón en medio está apareciendo el agua y nunca ha aparecido esa agua. Entonces la gente de Chicón está avisado que el agua está corriendo por todos lados. (…) Está como un colador. Y el agua (…) en los cerros está apareciendo."

"(The nevado) has changed a lot. Before there was a lot of water (…),but now, there is not so much water, there is no river. Where does the water go? Where is the water escaping? So now, as people say, water is escaping everywhere, underneath (…) The water is filtering somewhere else. There are holes from where the water is leaking (…) in which it should not yet appear. Here in Chicón water is appearing in the middle and that water has never showed up before. So the people of Chicón are saying that water is running through everywhere. (…) It is like a strainer (…) and the water is appearing in the hills."

Resident of San Isidro de Chicón, female, 30 years old

"He ido a la laguna (Azulcocha) y hay unas filtraciones. Hay que saber dónde están filtrando y se dice que filtra a Pumahuanca ¿De qué sirve una represa si no nos va a beneficiar a nosotros? Por eso Pumahuanca tiene más agua. (…) De haber una represa mediana se tiene que monitorear porque Azulcocha ¿Adónde se filtra? Porque en tiempo de lluvia poca cantidad sale de ahí."

"I went to the lake (Azulcocha), and there are filtrations. We have to know where these filtrations are going to, and it is said that they filter to Pumahuanca (the other sub-basin). What is the purpose of a dam if that is not going to benefit us? That is the reason why Pumahuanca has more water. (…) If there is a medium-size dam, we have to monitor the lake because Azulcocha, where does it filter? Because during the raining season there is not much amount that comes out from there."

Water authority from San Isidro de Chicón during assembly, male, 30 years old

Indeed, there is a broad common sense on site that the water from the lakes is more scarce than before, especially during the dry season (May-October); on the contrary, during the raining season, the lakes act as rainwater deposits. In this regard, some residents have observed how the water filtrations from the lakes are taking different directions that might not be beneficial for the sub-basin. In fact, the question of "*where does the water go?"* has gained importance during discussions and assemblies, especially regarding the possibilities of future dams and reservoirs in Azulcocha and Rit'icocha.

2.2.1. Rit'icocha

Rit'itocha, or snow lake in Quechua language, is located in the Sabanayoq sector at 4670 m.a.s.l (Cárdenas *et al.*, 2013). Its formation is a result of the deglaciation of the glacial mass, and its extension has increased after a glacial lake outburst flood on October 17th of 2010. In fact, before that event, few residents recall that this lake was known as Pukacocha (Red Lake) and it had a smaller size than nowadays; while other residents state that no lake existed before this event. In any case, once risk management measures started to be implemented to prevent similar events, the lake started to be known as Rit'icocha, a name that prevails until nowadays.

"Presumo yo por la aceleración del calentamiento global aparece esa laguna recién."

"I presume that because of global warming, this lake (Rit'icocha) just emerged."

Water authority of San Isidro de Chicón, male, 30 years old

"Hay un compañero que primera vez llegó (a la laguna) con unos profesionales, entonces ellos le pusieron ese nombre (Rit'icocha)."

"There is a peer that when he first arrived (to the lake) with some professionals, they gave the lake that name (Rit'icocha)."

Authority of San Isidro de Chicón, male, 27 years old

"Mal han pronunciado de lo que se llama Pukacocha. Rojito es, eso se llama Pukacocha. Ahora, habían cambiado a Rit'icocha (…) Es lo

"Badly it has been pronounced from what was called Pukacocha. It is red. Now, they have changed to Rit'icocha (…) It is a bad thing that

malo lo que han cambiado porque a mí no me han dicho que le han cambiado a Pukacocha (…) Rit'icocha han cambiado, si era un nombre natural de Pukacocha..”

they have changed (the name) because nobody told me that (the name) Pukacocha was changed (…) To Rit'icocha has been changed, when Pukacocha was the original name.”

Resident of San Isidro de Chicón, male, 54 years old

“Cuando ha venido ese a 2010 aluvión, ahí escuche ese Rit'icocha (…) antes no existía.”

“When the 2010 alluvium came, I heard about that Rit'icocha (…) before it did not exist.”

Resident of Yanacona, male, 52 years old

The quotes show that despite the different experiences regarding the origin of the name Rit'icocha, the recognition of this lake is more evident after the 2010 GLOF and the use of this toponym now extends throughout all the sub-basin. Nowadays, it is also identified that the waters of Rit'icocha are an essential source for the Chicón sub-basin, especially during the raining season. In fact, the lake is surrounded by rock, maintaining the waters and forming a natural reservoir (Zegarra and Jiménez, 2018).

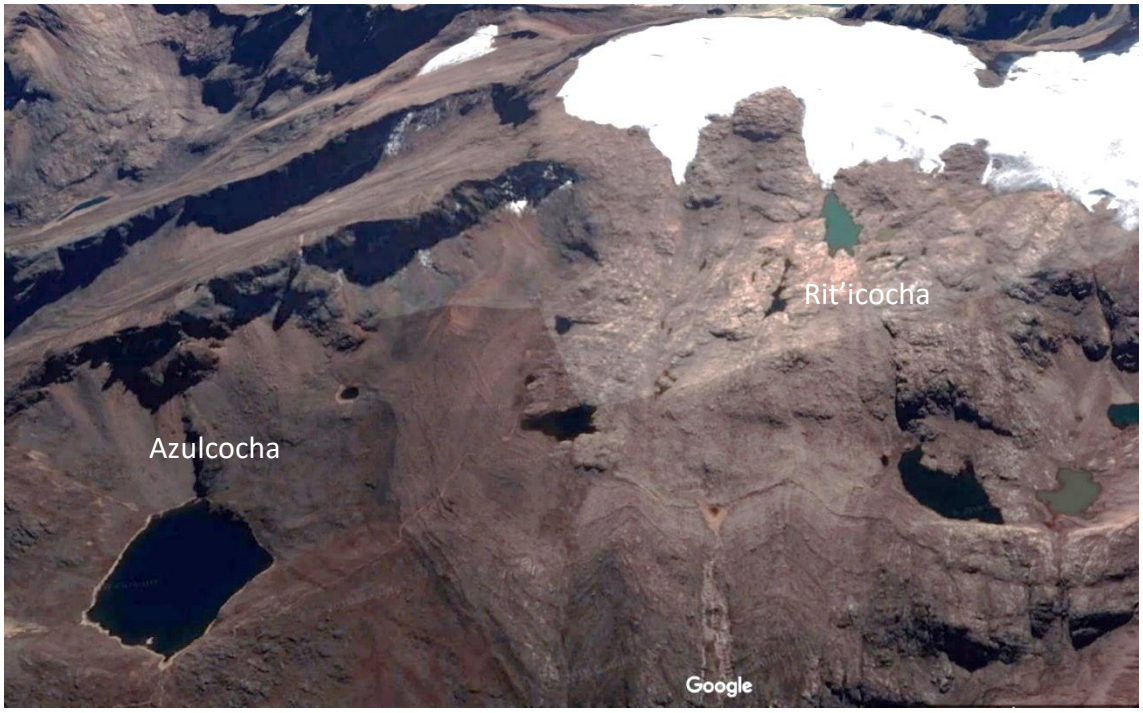


Figure 4: Azulcocha and Rit'icocha. Source: Google Earth

2.2.2. Azulcocha

Azulcocha, or blue lake in Quechua language, is other of the oldest and biggest lakes of the Nevado Chicón. It is located in the Sabanayoq sector, and its location is the closest to the Chicón community. Together with the Rit'icocha lake, they form the course of the Ocoruruyoq creek (Cárdenas *et al*., 2013: 8), which is the starting point of the Chicón

river. Likewise, some residents also observe that the waters of Azulcocha also filter the Pumahuanca sub-basin. Finally, another crucial aspect is that in 1942 the Azulcocha lake overflowed by the fall of an edge of the glacier (Cárdenas *et al*., 2013: 14) which resulted in a GLOF of a more significant magnitude than the flood occurred on 2010[14].

2.2.3. Yanacocha

The references about the Yanacocha lake, or black lake in Quechua language, are less in comparison to Azulcocha and Rit'icocha. On the one hand, this lake is not identified by many residents, while others use the name "Yanacocha" to refer to Azulcocha or Rit'icocha. Precisely, in prior studies conducted in Chicón (Zegarra and Jiménez, 2018; Miranda and Valer, 2018), it is stated that the use of the name Yanacocha is used to indicate that the lake is taking the color "black" when it is angry or nervous, so that it can have more than one place. However, as well as the other lakes, Yanacocha it is considered a sacred entity that has to be respected by not "bothering" it (by going to the lake without a purpose or by throwing stones in the lake, for instance) or by doing a *pago* to ask for permission.

2.3. The place where the river starts: Ocoruruyoq

The plain of Ocoruruyoq is located below the Nevado Chicón at 4km from the community of San Isidro de Chicón at 4000 m.a.s.l approximately. Ocoruruyoq is the encounter site of different creeks that form the start of the Chicón river. As the place where the river starts, Ocoruruyoq is a place of multiple significances for the population of the sub-basin; but also, the radical changes in the landscape have had an impact on the relationship and emotional attachment towards Ocoruruyoq.

On the one hand, according to some residents, especially elders, it is said that Ocoruruyoq was a place where different waters from the Nevado Chicón encountered. However, these waters were not the same, as the waters that ran in Ocoruruyoq were red or "*turbio*" (turbid) symbolizing the feminine side of this part of the Nevado; especially during raining seasons in the past. On the contrary, the waters that flowed from the sector of Padreyoq (which is seen as masculine after the figure of a priest that is formed with the thaws) were portrayed as transparent and clean. In this regard, the born of the Chicón river is explained by the encounter of the feminine and masculine entities of the Nevado Chicón[15].

[14] See chapter four on the 1942 GLOF
[15] See also Miranda and Valer (2018) p. 79

Entrevistadora: ¿Por qué (el agua) venía rojo?
Entrevistada: De Ocoruruyoq ¡De qué parte habrá salido eso! De este lado venía líquido nomás, limpio, sanito. De otro lado de Ocoruruyoq venía turbio. Juntaban con esa agua y ya rojo nomás venía (...) De Ocoruruyoq había sido mujer.

Entrevistadora: ¿Cómo se dio cuenta que era mujer?
Entrevistada: No sé, no sé ¡Quien habrá dicho pues eso! Después de este lado habría sido Padreyoq y en ahí varón ya también y dice lo enfermaba. Por eso dice que había venido así ese color. (…) Era como ha venido el agua turbio, por eso le decían que estaba enfermando. Y este tiempo ya no viene así. No sé si ha desaparecido.

Interviewer: Why was water red?
Interviewee: From Ocoruruyoq, who knows where this came from! From this side (the water) came liquid, clean, healthy. From this other side of Ocoruruyoq (the water) came cloudy. It joined that other water, and it came red. (…) Ocoruruyoq was a woman.

Interviewer: How did you realize that it was a woman?
Interviewee: I don't know, I don't know. Oh, who would have said that! Then, from this side was Padreyoq and it was a male too, and it is said that their waters were sickened. Reason why it came with that color. (…) Because the water was cloudy, people said that it was getting sick. At this time it does not come out this way anymore. I do not know if that has disappeared.

Resident of San Isidro de Chicón, female, 65 years old

Entrevistado: "Agua roja, dice que, se está menstruándose (..) ¿Para qué? Para que llueva, ese es temporal. (...) Hasta acá llega, como si viera que has echado ocre. Igualito".

Entrevistadora: ¿Qué Apu es el que menstrúa?
Entrevistado: De ese es Chicón nomás. Por eso...agua hembra que ha salido roja y agua macho sale de la mano derecha."

Interviewee "Red waters, it is said, they are menstruating. (…) For what? So there is rain, that is temporary. (…) It comes up to here (down in the sub-basin) as if you throw ochre (in the water). The same"

Interviewer: Which is the Apu that menstruates?
Interviewee: Only from Chicón. That is why…the female water that came out red, and the male water comes out from the right side (of the nevado).

Resident of Ccatán Pino, male, 67 years old

It is important to emphasize that is a characterization of Ocoruruyoq that I found mainly among elders, as a recall from what they have heard from their parents and neighbors; and as a phenomenon that they do not longer see nowadays. On the contrary, when I asked some younger residents, these stories were less known or assigned to what *grandparents* believe. However, this does not take away the representation of Ocoruruyoq as a place where the river born. Furthermore, despite its physical characteristics as flat terrain, Ocoruruyoq is considered part of the space of the Nevado, and consequently, it is regarded as an *Apu*.

Thus, Ocoruruyoq is a place of great importance and full of multiple meanings for Chicón. On the one hand, its symbolism leads to rituals such as the *pago a la Pachamama* or *haywarisqa* (payment to the Mother Earth), which are performed every August in the plain of Ocoruruyoq, and which is organized by the four irrigation committees of the Chicón sub-basin. Thus, they are in charge to hire a shaman to conduct the ritual and to provide all the elements that make a good *haywarisqa*[16] to ask for a year without water scarcity. The importance of Ocoruruyoq is also reflected in the Holy Cross that was put in the plain after the GLOF of 1942 by the community of San Isidro to ask for protection.

[16] See chapter 3.1 (symbolic relations with the Apus)

Nevertheless, later on, the Holy Cross had to be removed to a higher place after the last GLOF because the floods and the risk management works caused a considerable impact on Ocoruruyoq.

"Cuando viene el aluvión que vino, todo barrio. Pero el cruz sí se quedó ahí, no lo ha afectado pero sí se quedó ahí. Pero ahora lo han sacado ¿Por qué? Porque toda esa pampa se ha hecho feo y lo han llevado, lo han buscado un lugar. Pero está aquí nomás, no está tan lejos. (...) pero ahora no hay ni una planta acá, yo no veo ni una planta. Cuando yo fui ¿Dónde está la planta? dije ¿Y dónde está el cruz? dije. "No, se lo han llevado?" "Pero donde? ¿Su casita dónde está?" (...) Y todo de aquí, toda esa pampa era llena de árboles, pero al venir este...el agua, todo ha barrido y así ha quedado feo. (...) Los mayores creo que habían decidido de moverlo porque estaba en riesgo todavía de que iba a venir de vuelta el agua. Eso quisieron sacarlo más aparte seguro (...) Porque estaba en riesgo todavía estaba."

"When the flood came, everything was taken away. But the Holy Cross stayed there, and it was not affected, it stayed there. But now it was taken away, why? Because all this plain became ugly and the Holy Cross was taken away, then another place was found. So now is here, not so far. (...) But now there are no plants; I do not see plants. When I went there, I asked "Where are the plants? Where is the Holy Cross". "No, it was taken away" "But where? Where is its "home"?[17] (...) And everything from here, all this plain was full of trees, but when the flood came, it took everything away and now it is ugly. (...) I think that the elders decided to move the Holy Cross because there was a risk that the water could come again. (...) They wanted to take it away, it was safer (...) because it was still at risk.

Resident of San Isidro de Chicón, female, 30 years

Despite these events, Ocoruruyoq did not stop being a place destined for spiritual and religious activities. According to Miranda and Valer (2018), the festivity of the *Señor de Ocoruruyoq* (Lord of Ocoruruyoq) or *Cruz de Ocoruruyoq* (Holy Cross of Ocoruruyoq), which take place every May 3rd, remains as one of the most important religious dates in San Isidro, increasing the attitude of respect towards Ocoruruyoq. In this regard, it is important to mention that this religious date it is more significant for the inhabitants of San Isidro; for instance, in Yanacona the *Cruz de Tantanmarca* (Holy Cross of Tantanmarca) is celebrated in a small hill of the community and is one of the most important dates for this community.

Another aspect that is relevant in regards to the relationship with Ocoruruyoq is the risk management works after the 2010 GLOF. The constructions included a contention dam in Ocoruruyoq, a road that connected San Isidro and Ocoruruyoq, the implementation of an Early Warning System in Ocoruruyoq and Rit'icocha, and the attempt to drain the Rit'icocha lake[18] to prevent possible future GLOF's. Besides the importance that these works have had concerning the safety for the residents, these constructions also caused a radical change in the landscape and on the collective memory of the residents, as various narratives of melancholy have resulted from the emotional attachment to Ocoruruyoq.

[17] A small construction that covers the Holy Cross

[18] See chapter 3.2.1 about the description of the risk management works in the lake Rit'icocha and the later strikes.

Photos 2 and 3: The plain of Ocoruruyoq after the risk management project, 2017.

"O sea, lo que es la naturalidad de ese río, la originalidad de eso lo han vulnerado poniendo cemento, piedras, cemento y han matado las plantas nativas por diestra y siniestra por toda la rivera. (...) No era así antes, era hermosísimo, cubierto con alizos, chachacomos, queuñas, era así. Pero lamentablemente hoy en día eso han matado esto. Este riachuelo tenía sus peces, cantidad de trucha, trucha pero limpia de calidad. (...) Lamentablemente todo eso se ha perdido. Entonces qué pasa en la pampa de Ocoruruyoq, una pampa inmensa, hermosísima que posiblemente en aquellos años, o sea cuando vivían nuestros ancestros había todavía construcciones incas. Ahora todo ha sido vulnerado, ha sido destruido."

"So, it is the river's naturalness and originality that has been damaged by cement, rocks, cement: and they have killed the native plants left and right across the basin (...). It was not like this before; it was so beautiful, covered with alizos, chachacomos, queuñas, it was like that. But unfortunately, that has been killed. This creek had its fishes, lots of trouts, fresh and quality trouts. (...) Unfortunately, everything was lost. So what is going on in the plain of Ocoruruyoq, a large pampa, so beautiful that maybe in those years in which our ancestors lived there were Incan constructions. Now everything was vulnerated, it has been destroyed".

Water authority of the JASS of Yanacona, male, 58 years old

"Bueno, aquellos tiempos Ocoruruyoq era un sitio donde nadie iba. No llegaba la gente, no es como ahora. Ahora ya ha cambiado mucho porque cualquiera puede ir ahora con su carro. Aquellos tiempos cuando no había carretera, nadie iba. Algunas personas de ese sector (Chicón) iban por leña, a traer nieve cuando no existía la congeladora, frigider; de ahí traían acá. Entonces el Apu era bien fuerte. El que conocía nomás iba, el que no conocía no iba. Pero ahora ha cambiado mucho, Ocoruruyoq; como quien se va en un carro, llegas, te vas hacia la nevada y en un ratito llegas. Pero aquellos tiempos no dejaba el Apu que llegues a Ocoruruyoq, no había caminos como ahora. Es un sitio sagrado ¿Por qué? Ese Ocoruruyoq como es como una pampa, esa pampa era santa; como quien dice descansaba el agua ahí. Recién salía el agua abajo cuando se aumentaba, quedaba como una lagunita, así. Entonces ahora ¿Qué ha cambiado? Lo han hecho una acequia por el centro, entonces el agua ya no descansa, de frente se sale el agua. Entonces baja ahí y se viene abajo. Entonces como la pampa está,

"Well, in those times Ocoruruyoq was a place where nobody used to go. People did not reach there; it is not like that now. Now it has changed a lot because anybody can go with their car. When the road did not exist yet, nobody used to go. Some people of that sector (Chicón) used to go to get firewood, to bring ice when the fridge did not exist yet; from there they brought here. So the Apu was very powerful. Only the people who knew used to go; the people who did not know, did not go. But now it has changed a lot Ocoruruyoq; you go by car, arrive, you go to the nevado and just in a little while. But those times, the Apu did not let you reach Ocoruruyoq. It is a sacred site. Why? That Ocoruruyoq, because is like a pampa, that pampa was sacred; as one can say, the water used to rest there. The water only used to come out when the water increased; it used to result in a small lake, like that. So now, what has changed? They have made an irrigation ditch in the center, so the water cannot rest anymore, the water just goes out. So the water goes down there and then comes below.

no hay agua que descansa, entonces quiere decir, se seca. “	*So, because the pampa is there, water does no rest, so that means, it gets dry”.*

Worker from the JASS of Ccatán Pino, male, 52 years old

Thus, Ocoruruyoq is remembered as a place full of native plants such as queuña, chachacomo and alizo; and a place where the river could run *freely*. In this regard, the changes are not solely linked to the beauty of the site but on the impacts that such works could have had in the course of water, which in turn have repercussions in the relation with the *Apus*. On the other hand, before the road to Ocoruruyoq was constructed, the plain was not of easy access; in fact, mainly the residents from San Isidro de Chicón used to frequent this place to get resources such as firewood and ice to be sold for *raspadilla*[19]. Since the construction of the road (2012-2013), more events are taking place here, including the *pago a la Pachamama* and reforestation activities together with the Municipality or NGOs that also are responses to concerns and doubts about the future, based in what it has been experienced so far.

2.4. Water sources and infrastructure for irrigation and water consumption in the Chicón sub-basin

An essential aspect of the definition of *wayqu* is the link between the water sources and the population that lives here. Such relationships are materialized in the water technologies and infrastructure that transport the water resources to the inhabitants of the sub-basin, which facilitates their access to water consumption and ensures the development of the economic activities in the sub-basin.

Thus, the landscape of the Chicón *wayqu* is characterized by the increasing presence of channels, irrigation ditches, reservoirs, and pipelines. The construction and maintenance of these infrastructures require a set of regulations, investments, and politics that demand a coordinated organization throughout the sub-basin and with external institutions (Government, NGOs, private enterprises, etc.). On the other hand, the presence of these infrastructures implies an increasing control over the quantity of water that is destined for agriculture, human consumption and other users. In this regard, as Rasmussen (2017) states, the distribution and control over water are not solely based in old forms of social hierarchies, but on the bureaucratic presence from the State and the technological knowledge (Rasmussen, 2016: 221).

[19] During the hacendados time, and shortly after, it was common to go to the glacier to get ice and sell it for the preparation of raspadilla, scraped ice with flavors that were sold in the city of Urubamba. This economic activity stopped as the ice was challenging to reach.

In the following lines, I will explain the water sources for irrigation and human consumption and how the infrastructure works for the water distribution in both cases. Thus, while the irrigation system is sustained in the Chicón river; the water system for human consumption is based in creeks. However, in both cases, the use and maintenance of the water infrastructure for irrigation is a responsibility of each of the four committees (irrigation and human consumption) and of the central commissions for irrigation (Commission of Water Users of the Hydraulic Sub-Sector of the Chicón River) and for human use (Central JASS).

2.4.1. Water sources and infrastructure for irrigation in the sub-basin

The history of the water infrastructure for irrigation in the Chicón sub-basin is characterized by the presence of national and private projects during the 90s. The most important one was the Plan MERISS Inka, an initiative that was a joint effort between the cooperation of the Peruvian Government and the Federal Republic of Germany in 1975. Between 1980 and 1994, 20 irrigation projects were implemented in the Southern Peruvian highlands, including the Chicón sub-basin (Baca, 1998).

The Plan MERISS project consisted in the implementation of irrigation channels and reservoirs in Chicón to ensure the access to water throughout the year (Bolin, 2009) and to enhance the agricultural development in the sub-basin (Baca, 1998). Moreover, besides the improvements and the extension of the water networks, the construction of the irrigation infrastructure also responded to the strengthening of the water organizations.

The project concluded in 1991, and it changed the whole irrigation system in Chicón. Before the Plan Meriss, the ditches or *canales rústicos* (made with materials such as stones, pieces of soil, dry leaves, among others) predominated the irrigation system. After the project, most of the water that is transported throughout the sub-basin was made of concrete. Currently, these infrastructures are combined with smaller water irrigation systems, which carry less amount of water as they connect the irrigation channels with each of the fields.

The possibility to count with water during all the year changed the orientation of agriculture in the sub-basin, even during the months of drought. First, this allowed the farmers to cultivate their products throughout the year; and it also helped to the diversification of products in the sub-basin, especially vegetables. However, while the water infrastructure concentrates in areas close to the river, in the higher areas of the localities or far from the river, such infrastructure is not existing. Thus, in such fields agriculture is mainly sustained during the rainy season. In consequence, agriculture is prioritized in the lower areas of the sub-basin.

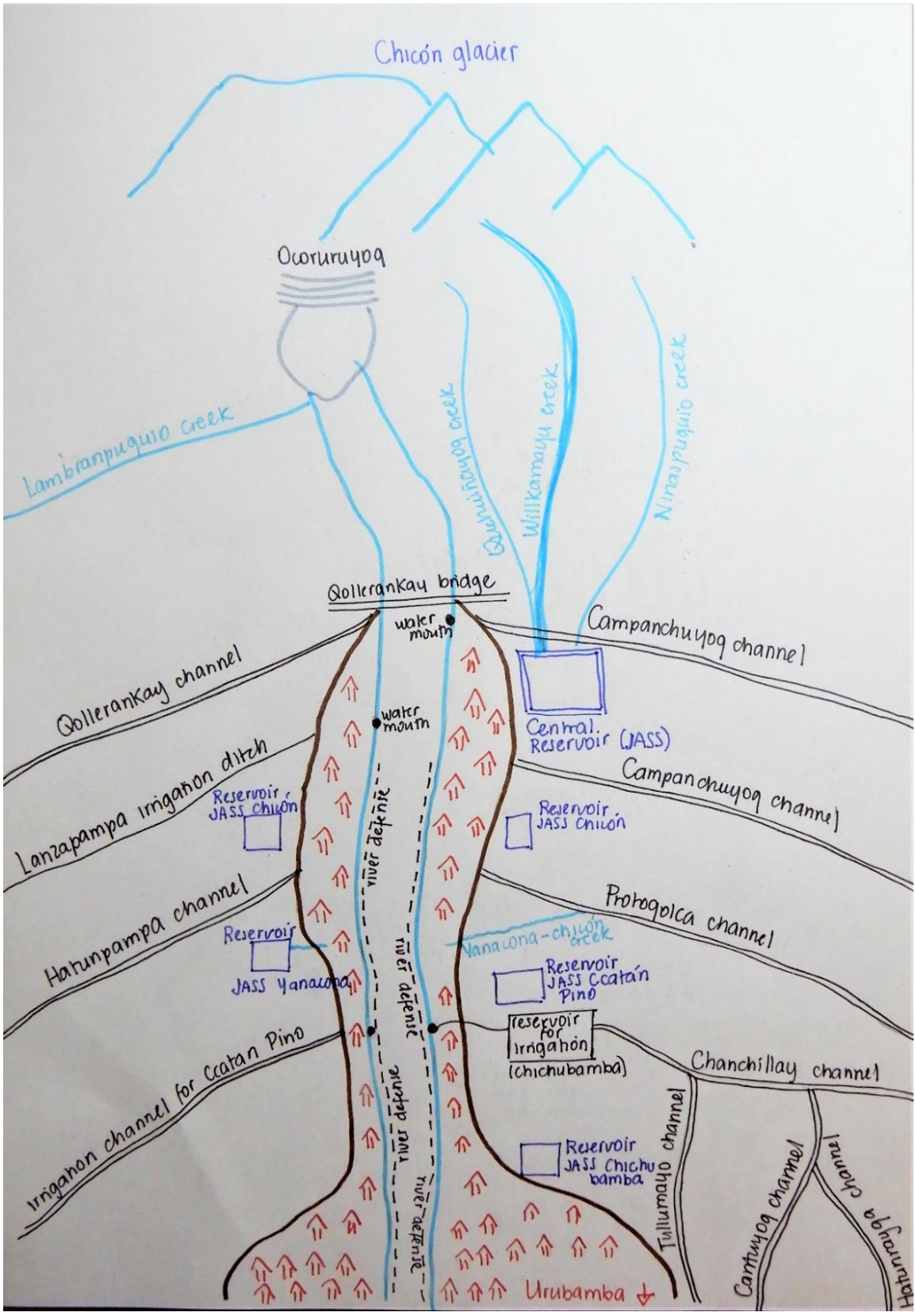


Figure 5: Map of the water sources and infrastructure in the Chicón sub-basin for irrigation and human consumption. Elaborated by the author based in different drawings and interviews.

In regard of the irrigation system in each locality, in San Isidro this is centered in two irrigation channels: Qollerankay (at the left side of the river) and Campanchuyoq (at the right side of the river); and in an irrigation ditch called Lanzapampa, which extends to Yanacona. Qollerankay and Campanchuyoq are irrigation channels that were constructed during the 90s by FONCODES[20], an institution from the Ministry of Development and Social Inclusion (MIDIS by their initials in Spanish) focused on financing infrastructure in rural areas with social, economic and productive purposes.[21]

The intake of the irrigation system for San Isidro is located in the sector of Toqaqaqa[22], situated around 40 minutes by walk from the community of San Isidro. During the rainy season, Toqoqaqa becomes the place for water distribution. Here every irrigation user has to ask for an assigned amount of water depending on the extension of their fields; also, the location of the farms is vital as each terrain belongs to Qollerankay or Campanchuyoq. Thus, every user has to follow a schedule according to the water availability in both channels.

Similarly to Chicón, in Yanacona the water infrastructure is based in two irrigation channels: Hatunpampa, at the left side of the Chicón river; and Protoqolca, at the right side of the Chicón river. Part of this infrastructure was coated with cement by the Project Meriss during the 90's; while other transects of the irrigation system in Yanacona still have the same characteristics as the agricultural ditches.

The intake for both channels is located within the jurisdiction of San Isidro, but the Irrigation Committee of Yanacona manages it. Like in Chicón, this area becomes the place for the water distribution during the rainy season among the Yanacona committee users. The intake is as well the starting point of the jurisdiction of Yanacona, which extends until the sector of Taquina, located five minutes (approximately) from the city of Urubamba.

In Chichubamba, the irrigation system differs from the ones in San Isidro and Yanacona. It comprehends four irrigation channels and one reservoir. The reservoir was constructed by the Plan MERISS to improve the water availability in Chichubamba during the dry season. In fact, despite the irrigation Committee of Chichubamba counts with the most significant number of users in the sub-basin, it is one of the committees that has been facing the most water scarcity in Chicón. In this regard, the reservoir is used exclusively by the users of the Irrigation Committee of Chichubamba.

[20] Cooperation Fund for the Social Development - Fondo de Cooperación para el Desarrollo Social
[21] Retrieved from http://www.foncodes.gob.pe/portal/index.php/nosotros. Web page from FONCODES

Photo 4: The reservoir of Chichubamba. The photo was taken during the rainy season.

Likewise, Chichubamba counts with four irrigation channels: Tullumayo, Hatunrayqa, Chanchillay, and Cantuyoq. During the dry season, the reservoir stores the water from the Chicón river and then it is distributed throughout the five irrigation channels. The *tomero*, or the person who distributes the water during this season, is in charge to open the gates of the reservoir and to distribute the water throughout the four channels; moreover, he is responsible for ensuring that every irrigation user follows their assigned schedule to irrigate their crops.

Finally, the Irrigation Committee of Ccatán Pino is the smallest one in extension and number of users of the four committees of the sub-basin. Their system comprehends one irrigation channel whose water mouth is at the entrance of the city of Urubamba. However, despite the closeness to Chichubamba and their difficulties regarding water availability, the irrigation system of Ccatán Pino depends entirely from the river Chicón.

2.4.2. Water sources and infrastructure for human consumption in the sub-basin

The water sources for human use in the Chicón sub-basin is based in few creeks located within the community of San Isidro de Chicón: Willkamayucha or Ñustayoq and Ninaspuquio[23]. The water of these sources is stored in one central reservoir located in San Isidro de Chicón and then distributed throughout each of the four reservoirs that are found in each of the four communities. The central reservoir contains the infrastructure to filter the solids and chlorinate the water, and it is continuously maintained by the users of the four JASS together. The other four reservoirs and their pipelines are cleaned, preserved,

[23] Just in the case of Yanacona, the community counts with a spring for human consumption, which is located in the lower part of San Isidro. The access to this source is a result of agreements between the two communities.

restored and replaced by the users of each committee, with the close presence of the Municipal Office of Rural Basic Sanitation from the Municipality of Urubamba (OMSABA).

The set of reservoirs and pipelines replaced the previous use of the Chicón river for human consumption during the 90's after the increasing contamination of the river. Thus, the reservoirs were implemented by FONCODES, and now they are managed by the OMSABA, the four local JASS, and the central JASS. In fact, after the construction of this infrastructure, the coordination and work at the sub-basin level are increasingly needed to request the expansion and improvement of the water distribution network, as not all the inhabitants count with the same access to water.

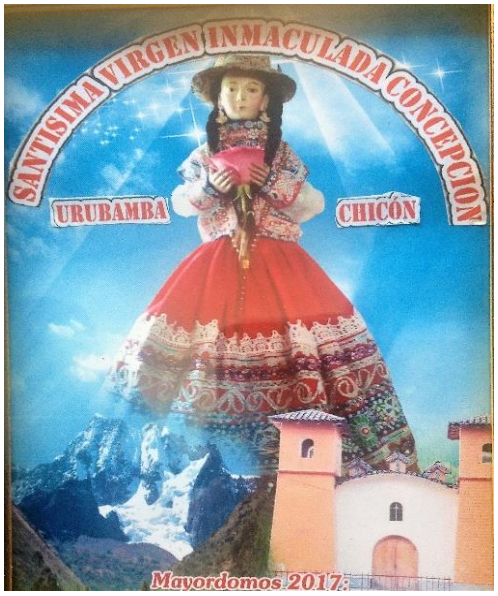
Photo 5: Reservoir in San Isidro

The water distribution for human consumption reaches most of the inhabitants of the sub-basin, but within each locality, there are still some families who access to water from the irrigation ditches (from the Chicón river) or through shared water piles. The lack of distribution usually happens in sectors that are further away from the urban area of each locality. On the other hand, another concern regarding the current water sources for human consumption is their possible availability in the long term, as the rapid urbanization, especially of the lower areas (Ccatán Pino and Chichubamba), demands a constant extension of the water distribution system and even the possibility of new water sources.

III. THE CURRENT RELATION WITH THE APUS

Following the structure of the Chicón *wayqu*, the water sources have multiple meanings, roles, and forms. Here, the *Apus* incarnates one of the most important elements of the *wayqu*. *Apu* is the name that is given to the spirits that live in the mountains of the communities in the Southern Peruvian Andes, and it also can be translated as "lord"

(Sánchez Garrafa, 2014). Also, they are the owners of the water sources, reason why the relationship with them seeks to be respectful and in harmony with the environment.



However, the glacial area of the Chicón sub-basin has experienced radical changes as a result of a glacier outburst flood in 2010 and the following risk management measures to prevent similar extreme events. Such events not only caused physical changes in the landscape but also had an impact in the relationship with the water sources, including the *Apus;* and between the water users and the institutions working on risk management measures.

Photo 6: Souvenir from the *Immaculate Conception,* a religious festivity that takes place in San Isidro on December 8th. In the illustration can be appreciated the chapel of San Isidro and the Nevado Chicón.

In this regard, this chapter explores, first, the symbolic relation with the *Apus* to understand the current representations in a context of constant retreat and in the face of extreme events. Secondly, how this relationship is altered by the physical changes in the landscape, especially after the GLOF and the risk management works in Ocoruruyoq. And third, which are the narratives that emerged to explain such events, and which were the actions taken afterward.

3.1. Symbolic relations with the Apus

Following Boelens and Gelles (2005), water is part of a social and symbolic universe in the Andes, in which rituals and practices are crucial to understanding the local model of irrigation. Consequently, in Chicón, the relation around water control and distribution cannot be understood solely by the interactions between water users, authorities and other (human) actors; but on the relationship between humans and nature (Paerregaard, 2013), manifested in the presence of the *Apus.* In this regard, water control in the Chicón sub-basin is not just explained alone by the power relations between their inhabitants or with other (human) actors, but also on the will of the *Apus.*

Being the owners of the water sources in the Chicón sub-basin, the *Apus* are considered sacred entities. Their sacrality is characterized by a relation of distance with the humans and by the mystical construction of the Apus, in which elements from the ancestral religiosity and Catholicism can be traced (Mujica, 2016). Thus, the *Apu* is an entity in which the origin of the communities is sustained (Sánchez Garrafa, 2014), and as such, it

cannot be touched or approached without a purpose, and it should remain permanent (Mujica, 2016: 233).

"Para nosotros en nuestra comunidad, el nevado es lo más sagrado. Es nuestro Apu, de ahí viene nuestra fuente de vida. Así que lo consideramos como lo más sagrado de nuestra comunidad. Tenemos esa visión de respeto, de veneración a nuestro nevado. Más que todo, nosotros tenemos una creencia a la Pacha Tierra. Por eso hacemos los pagos a nuestros Apus, que es el nevado de Chicón. Así que lo vemos muy sagrado."

"For us in our community, the nevado is what is the most sacred. It is our Apu. It is from there that our source of life comes from. So we consider it as the most sacred in our community. We have that vision of respect, of veneration to our nevado. Most of all, we have a belief in our Pacha Tierra (Earth). This is why we make the pagos to our Apus, which is the Nevado Chicón. So we see it as very sacred."

Water authority from the JASS of Yanacona, female, 39 years old

The previous quote states the way *Apus* are commonly portrayed in the sub-basin: as an entity that gives the source of life and that should be revered. But also, these are deities that are far, and they do not let people approaching them to not to be bothered. Thus, the relationship of fear and respect towards the *Apu* is found in expressions like *"the lake is going to take you away"* or "*there is a bull in the lake*"; or in stories concerning people who have died trying to get to the lakes as they did not show enough respect.

"Se pone celoso el Auqui[24] (...) The Apu es un poderoso. Ellos Apus, Auquis se ponen celosos. Se ponen ofensivos. Por eso al toque cae nevada, rayo, trueno y eso rápido llama el Apus. Te pone castigo.

"It gets jealous, the Auqui (...) the Apu is powerful. They, Apus, Auquis get jealous. They get offensive. That is why the snow comes quickly, the lightning, the thunder and those are fast called by the Apu. It gives you a punishment.

Resident from San Isidro de Chicón, male, 57 years old

"Siempre los Apus son, como quien dice, son salkas (indomable en Quechua) ¿Por qué? Porque cada vez que vas yendo hacia la altura (...) ya tienes nieve, ya te está agarrando la cabeza, desmayo. Entonces quiere decir ya que estás bajando del poder, lo que tienes. Entonces los Apus ya te están consumiendo."

"The Apus are always, as one would say, they are salkas (indomitable in Quechua). Why? Because each time that you go to the altitude (...) you have snow, your head is being taken, fainting. So that means that your power is getting low, from what you have. So the Apus are consuming you."

Worker from the JASS of Ccatán Pino, male, 52 years old

But the Apus are also protective entities[25] who manifest in dreams or deities that are asked for help. This is a statement that I could find throughout the sub-basin in some interviewees who felt close to the *Apus*. However, the sense of protection was mainly ascribed to the capacity to sustain life through the provision of water, which explains why

[24] Another term that is used for Apus

[25] Also see Miranda and Valer, 2018; Sánchez Garrafa, 2015 and Paerregaard, 2013 as in their studies in the Peruvian Andes a common attribution that is ascribed to the Apus is their capacity of protection.

in the Chicón sub-basin the *Apus* are not only assigned to the spirits of the mountains, but also to the water sources.

Sí. Apu Ocoruruyoq, Apu Quehuiñayoq, Apu Padreyoq. (…) Esos Apus nos han mantenido a nosotros ¿Por qué? Como si fuera un hombre que está orinando, así igualito viene el agua y tomamos eso. Eso es Apu.

"Apu Ocoruruyoq, Apu Quehuiñayoq, Apu Padreyoq. (…) Those Apus have maintained us. Why? Is like a man that is peeing; in the same way, the water comes, and we drink from that. That is Apu."

Resident of San Isidro de Chicón, male, 65 years old

In this regard, the communication that is established with the *Apus* is crucial to maintain the harmony in the *wayqu*. This is expressed in the different practices and rituals that are part of the daily life and festivities of the Chicón sub-basin. Moreover, these practices and rituals denote that the relation with the *Apus* is not restricted to the local mountains or water sources. In contrast, in every practice or ritual, different Apus from other basins and provinces are recalled. In this respect, Sánchez Garrafa (2014) explains that each *Apu* is not an isolated entity; on the contrary, they all are part of a more significant system in which the *Apus* communicate with each other and in which hierarchies are established between them.

Thus, a first practice is the *ch'allado*. This is a moment before eating or drinking (generally beer or *chicha*[26]) in which the first zip or bite is sprayed to the ground to feed the *Pachamama* and the *Apus* as they can be thirsty or hungry. Whereas this is seen in rituals that are practiced close the Nevado like the *pagos a la Pachamama*, or during a special visit there*;* it is also present during the daily life in the sub-basin.

"Sí, como usted sabe, la tierra es lo que va a dar fruto, lo que nos da de comer, para la vida. Entonces siempre echamos lo que es la cerveza, la chicha, primero a la Pachamama."

"Yes, as you know, the earth is what is going to bring fruits, what it gives us to eat, for life. So always we spray the beer, the chicha first to the Pachamama".

Water authority from Ccatán Pino, male, 56 years old

"Sí, nosotros somos fieles al nevado, el nevado es como un padre. Nosotros creemos en la Pachamama, ¿qué es la Pachamama? la tierra. Digamos que quieres empezar a tomar una chicha, una cerveza; primero a la Pachamama tienes que echarle. También para comer una comida tienes que darle una cucharita a la Pachamama. (…) Así como decían los antiguos, de repente existen - dice - la tierra, la Pachamama; entonces tenemos que alimentarla.

"Yes, we are loyal to the nevado, the nevado is like a father. We believe in the Pachamama. What is Pachamama? The Earth. Let's say that you want to start drinking chicha, beer; first, you have to give it to the Pachamama. Also, to eat a meal, you have to give a spoon to the Pachamama. (…). So, as the elders used to say, maybe they exist, the earth, the Pachamama; so we have to feed her".

Resident of Ccatán Pino, male, 38 years old

"(Los Apus) tienen hambre. Siempre hay que hacer. La primera chichita que sacas, esito, en un vasito sacas. Entonces a todos los Apus hay que dar, hay que invitar."

"(The Apus) are hungry. Always it has to be done, The first chichita (chicha), that you take out, that, you put in a glass. Then, you have to give the Apus some, you have to offer them".

[26] Another term used for chicha es Quelloukuku.

Resident of San Isidro de Chicón, female, 66 years old

Thus, the *ch'allado* is a way to recall the Apus one is thankful for. It is also a way to communicate with them without the necessity to approach physically to them as it can be practiced in any place. Moreover, as mentioned, I noted that during my observations and interviews many *Apus* that were recalled were not necessarily within Chicón. For instance, people who have moved to Chicón mention their own Apus during the *ch'allado;* or people from Chicón also call *Apus* from Urubamba such as Saywa, Yawarmaki, Pumahuanca, Tantanmarca or Verónica; or one could call the *Apus* that are considered the most powerful ones such as Salkantay or Ausangate, which are the highest peaks in the Cusco region.

Another expression of how the relationship with the *Apus* is not solely based in the territory is the pilgrimage to the sanctuary of the Lord of Qoyllurit'i (shining snow). This is the main festivity that shows Andean religiosity, in which Catholic and pre-hispanic religions are displayed. The ritual takes place every May-June in the basin of the Nevado Sinakara, while the main ceremony takes place in the Nevado Ausangate (province of Quispicanchis). The pilgrimage congregates around 70,000 people (Allison, 2015) who organize themselves in function of their localities. Thus, eight big groups are denominated "nations", being Urubamba one of such pilgrim nations.

One of the most important moments of the pilgrimage is led by the *ukukus* (bears in Quechua), characters that are the mediators between the gods and the villages (Allison, 2015: 497). Until the year 2000, the *ukukus* used to ascend the glacier to bring blocks of ice that were shared with the other pilgrims due to the medicinal properties that are attributed to them (Allison, 2015; Miranda and Valer, 2018). However, with the process of deglaciation, this is a practice that is now forbidden by the ritual authorities. Instead, each *ukuku* only can fill small bottles with ice or water; and also the pilgrims are more aware of carrying big candles that might cause impact in the glacial area.

Pilgrims from the Chicón sub-basin also attend the Qoyllurit'i. While in Yanacona, Chichubamba and Ccatán Pino each pilgrim or family go on their own, in San Isidro de Chicón the residents organize themselves to attend the pilgrimage as a whole in the representation of the community. Although this an event that is not attended by everyone in Chicón, an important number of residents engage with the preparation of dances to be presented at the pilgrimage. Moreover, each year one person from the community offers to be in charge of the food, music, music band and transportation for all the pilgrims of San Isidro from the previous days of the pilgrimage until they come back to the community. These acts express the gratitude and faith towards the Lord of Qoyllurit'i.

The pago a la Pachamama

Another ritual that expresses the relationship between people and their Apus are the *pagos* or *haywarisqa*. The *pago* is a ritual that is practiced on August, before the planting season, and it expresses a relation of reciprocity and obligation towards the *Apus* (De la Cadena, 2015; Zegarra and Jiménez, 2018; Miranda and Valer, 2018). Thus, as the *Apus* can behave in a benign or malign way, the *pagos* are propitious to maintain good relations with these entities (Sánchez Garrafa, 2014; Paerregaard, 2013; Miranda and Valer, 2018) to ensure water for the productive activities and to ask for protection.

A *pago* is led by a shaman who is in charge to communicate with the Apus. The communication is established through an offering that usually contains coca leaves, wine, alcohol and other local products like corn and flowers, which are displayed in the ceremony. During the ritual, it is essential that the shaman has extensive knowledge about the different *Apus*[27], as their names are invoked during the *k'intu*[28]*;* moreover, it is essential that the shaman can speak Quechua to conduct the ritual. The *pago* concludes when the offering is buried or burned in the ground, and with a meal that is shared among the assistants.

The *pago* can be practiced within each household, community or locality. Thus, it becomes a space in which requests oriented to the water provision and other personal desires are expressed.

"Almakunaman ima sutinmantan, almakunaman mañakunki, hananqpachakunaman taytacha mañakunki chayka, chaquiriykunamanta kayushanki, pay wawayki, hawachaykikunapaq, qolquecha qananpaq, acnakunata ruananpaq"

"In the name of the souls, you have to ask the souls, to the lord of heaven you have to ask, so there is no drought. You ask for your sons, for your grandsons, so there is money and all that".

Resident from San Isidro de Chicón, female, 51 years old

"Para los Apus, pidiendo pues que haya abundante agua, que haya lluvias, invocando ¿no? a todos los Apus. Empezando por Apu Chicón, que es todo el nevado, y los diferentes Apus en cada lugar."

"To the Apus, we are asking for abundant water, for rains, invoking, right? To all the Apus. Beginning with the Apus Chicón, which is all the Nevado, and the different Apus in each place".

Authority of the JASS of San Isidro, female, 65 years old

"Bueno, de acuerdo con las creencias, y usos y costumbres ancestrales siempre se ha acostumbrado (al pago) ¿no? dentro de la cosmovisión andina siempre se cree eso, de que cuando uno le hace su despacho a la tierra, al

"Well, according to the beliefs, and ancestral uses and customs, they have always been used to (the pagos), right? Within the Andean cosmovision, this has been always a belief, which is when one makes a pago to the earth, to the water, we will not be

[27] In this observation of the *pago* that took place in Ocoruruyoq in 2017, Ben Orlove describes that nine Apus where invoked, being the first ones to be mentioned the Apus Salkantay and Ausangate due to their importance in the Andean cosmovision. After those, regional and then local Apus were recalled during the ceremony (see: http://glacierhub.org/2017/09/05/a-ritual-to-honor-mountains-in-a-peruvian-village/). The hierarchy of Apus it is also explained by Sánchez Garrafa, who explains that there are major Apus like the Ausangate and minor Apus that are considered sons of the dominant Apus (Sánchez Garrafa, 2015: 68).

[28] A *k'intu* usually comprehends the blowing of three coca leaves in the direction to the Apus, while invoking and asking them to listen to their requests.

agua, no nos va a faltar el agua, siempre va a haber más agua o los cultivos van a florecer mejor, todo eso. Entonces eso es a criterio de cada persona, de cada usuario."

without water, there will always be more water, or the crops will flourish better, all that. So, that is the criterion of each person, of each user".

Authority of the central irrigation committee, male, 53 years old

During the last years, the irrigation committees of San Isidro, Yanacona, Ccatán Pino, Chichubamba, and the Central Irrigation Commission have been organizing a *pago* as a whole. As the *Apus* are the owners of the water sources (see also, Paerregaard, 2013; Sánchez Garrafa, 2014; Orlove, 2017; Miranda and Valer, 2018) it is important that the *pago* is done in a sacred place, close to the Nevado and next to important water sources in order to establish a successful communication with the *Apus.* The *pago* is realized every August, and one of the four committees leads the organization each year. Being the committee in charge supposes the organization of the activities (dances, discourses, an invitation to the authorities), the hiring of a shaman, the coordination of the transportation to the ritual place.

During my stay in Chicón, I could not participate in any *pagos*[29], but I was given descriptions and perceptions regarding their purposes and how they have been changing in a context of glacier retreat. The *pago* of 2017 congregated a considerable number of attendees, including authorities and politicians from the province, which highlight the importance and institutionalization of the ritual beyond the sub-basin. Thus, the *pago* became a propitious space where local, provincial and even regional scale actors interrelate addressing different concerns, political promises, the visibility of leaderships and the need to maintain the sub-basin united.

In regard of the ritual, the organization for that year was in charge of the *Comisión de regantes* (Irrigation commission) and more specifically, the hiring of the shaman, transportation and logistics were in the hands of the irrigation committee of San Isidro. The irrigation committee hired a shaman woman, which is not usual in the *pagos* according to some interviewees. Indeed, the fact that a woman guided this ritual was questioned because the *Pachamama* is a female entity that cannot *negotiate* with another woman. Besides the pago organized by the irrigation committee of San Isidro, another *pago* was spontaneously led by one of the authorities of the JASS of Yanacona, who is also a shaman in the community.

The realization of different *pagos* seeks to ask for the water provision for the own organization. However, in 2017, this was not followed by the other three JASS. This differentiation caught my attention, as the users of the irrigation committees are the same ones as the JASS. Thus, according to my data, it seemed to me that water for irrigation

[29] A detailed description of the *pago* of 2017 can be found in Orlove, B. (2017). A Ritual to Honor Mountains in a Peruvian Village - GlacierHub. [online] GlacierHub. 5 September 2017. Available at: http://glacierhub.org/2017/09/05/a-ritual-to-honor-mountains-in-a-peruvian-village/

was prioritized over water for human consumption, despite the same origin of both "waters."

"Es que el JASS, (es) como usuario de consumo, esa tradición nosotros no estamos cultivando productos de la tierra. No estamos consumiendo el agua. En cambio los productores que son del Comité de Regantes le tienen el respeto a la tierra y a raíz de eso hacen su pago para tener mejor producción, que el agua también abastezca, que no les falte. A raíz de eso hacen. (…) El pago a la tierra es costumbre aquí que hacen en todos los lugares a la tierra porque la tierra está viva. Es una tradición incaica todavía que viene esa tradición que le hacen un pago con todos los insumos que hay ¿no?"

"It is because the JASS, is a user who consumes, we are not cultivating products from the ground according to the tradition. We (JASS) are not consuming the water. On the contrary, the producers are from the Irrigation Committee; they are respectful towards the Earth, so that they can have better production, so that they can have a water supply. That is why they (irrigation committees) do it. (…). The pago to the Earth is a custom that they do everywhere because the ground is alive. Is an Incan tradition that still comes, and they do this pago with all the supplies, right?"

Water authority of the JASS of Ccatán Pino, female, 34 years old

Entrevistado: "En los JASS ya son secundarios. El principal es de riego. Nosotros como regantes pensamos en eso porque el JASS ya también es solamente....como es entubado piensa el agua que viene así.

Entrevistadora: No es la misma agua
Entrevistado:"No...pero la misma agua pero viene entubada, pero en riego está abierto."

Interviewee: "The JASS(s) are secondary. The main is for irrigation. We as irrigators we think that because the JASS is only…as it is piped, one thinks that the water comes like that".

Interviewer: It is not the same water
Interviewee: "No…but the same water comes piped, but in irrigation comes open."

Worker from the JASS of Ccatán Pino, male, 52 years old

One clue from my data suggests that despite that this is a ritual that invokes for the water supply in general, this is a practice in which are expressed notions of identity that link people, place, and production (Boelens and Gelles, 2005: 321). Thus, as these cites refer, there is a stronger attachment from the irrigation users towards the ritual than other users, as the *pago* is an expression of the long-standing relationship between people, the *Apus* and the *Pachamama.* On the contrary, water for human consumption is portrayed as piped, contained and recent. This distinction was an interesting aspect for me as one water user can change their relationship with water according to the purpose, infrastructure, and type of water. Although I consider that this is a topic that could be still deepened, the rituals and symbolic relations with the Apus nowadays can illustrate the different water systems that are present in the Chicón sub-basin.

Finally, Although the attitude of respect and sacrality that predominate the *pagos*, the discourses and prayers also are expressing more awareness of the damage and changes the glacier and lakes have gone through (Orlove, 2017; Miranda and Valer, 2018). According to some interviewees, the *pagos* are also a response to the rapid retreat of the glaciers, but also to avoid the population to be punished, especially after radical changes

occurred in Ocoruruyoq. Thus, the perception of the climate and environmental change is manifested throughout rituals (Paeregaard, 2013).

3.2. The construction of danger in the Chicón sub-basin: the GLOF in 2010 and their implications for risk management measures

The Chicón sub-basin has been a scenario of extreme events, especially in 1942 and 2010, in which a glacier lake outburst flood caused critical material loses and raised the concern about the safety in the sub-basin. But it was not until the last GLOF in 2010, in which not only these concerns came back; but this also meant a breaking point in the narratives that emerged to explain the GLOF and the further actions that resulted from this event.

3.2.1. The GLOFs of 1942 and 2010

On January 28th of 1942, a GLOF originated after a block of glacier ice fall into the Azulcocha lake (Carlotto *et al.,* 2012; Concha Tupayachi, 2008). The overflow ran throughout the Chicón sub-basin until the city of Urubamba, which was the most affected site. The magnitude of the GLOF was tremendous causing 70 deaths (Concha Tupayachi, 2008; Gade, 2016), the destruction of many hoses and another material loses, including an ancient irrigation channel, named *Incallarq'a* (Incan irrigation channel) (Zegarra and Jiménez, 2018).

The GLOF of 1942 occurred during the time of the *hacendados;* in consequence, the descriptions and the narrations of experiences about this event are few nowadays. However, the flood of 1942 remains in the collective memory throughout the sub-basin, recalling it as the first extreme event in the sub-basin, and relating it to the lake that existed in Ocoruruyoq before the flood.


URUBAMBA, la PERLA del VILCANOTA, ha SIDO ARRASADA por una avalancha de AGUA y LODO,

Se desbordó el riachuelo de Tullumayo, inundando parte de la población.-Hasta el momento se cuentan 19 muertos y treintidos heridos


Desolador aspecto presentaba Urubamba después del espantoso aluvión de la madrugada de ayer

La población está presa de intenso pánico.-Escenas de terror y actos de heroísmo. La labor de las autoridades.-Ayer a las ocho de la noche llegaron a esta ciudad los heridos siendo hospitalizados en el Nosocomio de Belén.

Banco Popular del Perú

Institución netamente nacional

ESTABLECIDO EN 1860.

Photos 7 and 8: Newspaper articles about the GLOF in 1942. Headliners: *"Urubamba, the pearl of the Vilcanota has been devastated by an avalanche of water and mud*." 28 January of 1942 (photo 7), "*Desolate aspect in Urubamba after the terrible alluvium of yesterday's morning."* 29 January, 1942 (photo 8). Source: El Comercio. Archive from the Municipal Library of Cusco.

Decades after, on October 17 of 2010, another GLOF alarmed the population of the Chicón sub-basin. A block of ice produced an overflow in a small glacier lake, which in turn increased the flow of a small creek which in turn caused the flood of the lake Pukacocha, and of the Chicón river afterward (Carlotto *et al.*, 2010; Cárdenas *et al.*, 2013). Unlike the GLOF of 1942, in 2010 the event did not cause human losses; but it occasioned considerable material losses throughout the sub-basin, leaving 581 families affected by the GLOF (Predes, 2010).

Table 2: Overview of the material damages caused in the Chicón sub-basin after the GLOF in 2010

Locality	Length of the irrigation channel affected by the GLOF (in Km)	Extension of the cultivation area affected by the GLOF (in Ha)	Number of Reservoirs affected by the GLOF	Number of houses damaged by the GLOF	Number of houses destroyed by the GLOF
San Isidro	4	-	-	34	-
Yanacona	8	9.22	-	4	13
Chichubamba	6	11.67	1	25	14
Urubamba city (including Ccatán Pino)	4	-	-	13	2
Total	**22 km**	**20.89 Ha**	**1**	**76**	**29**

Source: Informe de Emergencia N° 378-26/10/10/COEN-SINADECI. Instituto Nacional de Defensa Civil. 26 September 2010. Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/02CA9784CFF6AE42492577CA002002EF-Informe_completo.pdf

Photo 9: Cover about the GLOF in 2010. Headliner: *"Overflow of the Tullumayo (Chicón) river caused an alluvion over Urubamba which caused 240 victims so far".* Source: El Comercio. 19 October, 2010. Archive from the Municipal Library of Cusco.

The following days after the GLOF a group of residents from the four localities went up to the glacial area to observe the damage and to analyze the causes of the event. According to the interviewees who went to the glacier, the landscape changed completely as the area surrounding the lake (now known as) Rit'icocha was full of enormous stones and fragments of ice below and up in the lake. But the main change was that the area surrounding the lake was no longer covered by ice; instead, the formation of a new or a bigger lake predominated in the new landscape. After this event, the new lake started to be called Rit'icocha (Snow Lake).

Together with some residents, institutions like PREDES[30], Defensa Civil[31], INGEMMET[32] and the Municipality of Urubamba also went up to the glacial area to analyze the situation after the GLOF. They observed that the damages in the high areas of the sub-basin evidenced sliding areas and places where the alluvial material is deposited (PREDES, 2010). In this regard, their recommendations prioritized the constant monitoring of the glacier areas susceptible to produce floods (PREDES, 2010; Carlotto *et al.*, 2010; Cárdenas *et al.*, 2013).

However, in regard to the analysis of the causes that originated the flood, the observations made by the residents and the institutions were not entirely coincident. On the one hand, according to these institutions, the changes in the temperature (PREDES, 2010) and the consistent glacier retreat caused the ice detachment that originated the GLOFs of 1942 and 2010 (Carlotto *et al.*, 2010). Moreover, according to the same studies, the dissemination of rocks and ice blocks that were observed by the residents was more a result of the force of the ice blocks that fall into the lake. In any case, these studies have stated that the possibility of similar events in the future is most likely to occur again in the Chicón sub-basin.

In contrast to the observations made by engineers, glaciologists, and geologists, most of my interviewees stated that the last GLOF was the result of the *"man's hand."* The observation of the disseminated rocks and ice blocks over the lake caused suspicions and doubt among many residents of the sub-basin.

"El agua vino con atentado (…)Eso pasó el 17 de octubre. (…) Entonces, el 19 fuimos al nevado y toda esa pampa estaba lleno de piedras, llenecito de piedras. Entonces no había nada, era un caos. (…)encontraron, más que nada las personas que fueron, los varones, encontraron como una bomba que se habían bombardeado. Quisieron sacar algo. Entonces ves que sacaron algo (….) acá estaba el nieve, las rocas...las nieves...acá pasó

"The water came out after an assault. (…) That happened on October, 17th (…) So the 19th we went to the glacier, and all that plain was full of stones. Nothing was there, everything was a chaos (…). They found, mainly the people who went, the men, they found like a bomb that was bombarded. Someone wanted to take out something. So you see that they took something (…) The snow was here, the rocks…the snow…here this happened…the

[30] Centro de Estudios y Prevención de Desastres (Center of Studies and Prevention of Disasters)
[31] Defensa Civil (Civil Defense) is a Governmental institution focused in the prevention and protection of the population in case of disaster. They count with decentralized offices throughout the Peruvian territory. In Urubamba they count with an office within the Municipality of Urubamba.
[32] Instituto Geológico, Minero y Metalúrgico (Geological, Mining and Metallurgical Institute).

eso…las nieves en ningún momento se van a subir para arriba, en ningún momento van a subir arriba, en ningún momento esa dinamita...dinamitado estaba (…). Tendría que si algo pasa tendría que barrer para abajo. (…) (Las autoridades) Ellos lo han dicho que era un aluvión pero ahora que se ha investigado todo, y la gente de la comunidad (San Isidro) se puso caprichosa y se dijo "eso no es natural, eso es dinamitado" porque han encontrado pues, en la dinamita que han encontrado en ahí. La gente de Chicón dijo "esto no es natural" porque el agua estaba bien cuidado con rocas. Entonces ¿Cómo esas rocas se han roto para venir acá? ¿Y las rocas? Esta roca ¿Cómo crees que va a subir al nevado acá arriba? Es imposible y estaba acá esta roca estaba esparcido interno del nevado. (...) Se supone que si el agua hubiera provocado, la roca tendría que venirse para abajo, todo no subir pues para arriba, es imposible que suba para arriba."

snow is not going to go up, in any moment that dynamite…it was dynamited…(…) If something happens, it should be swept from below (…) (The authorities) They have said that it was an alluvium but now that everything was investigated, the people from the community (San Isidro) became capricious and said "This is not natural, that was dynamited" because of the dynamite that was found there. The people from Chicón said "This is not natural" because the water was well kept with the rocks. So, how these rocks broke to come here? And the rocks? How do you think that this rock is going up in the nevado up here? It is impossible that rock was spread within the glacier. (…) If the water provoked that, the rock would have to come down, and not everything had to go up, it is impossible that (the rock) goes up"

Resident from San Isidro de Chicón, female, 30 years old

"Al día siguiente (del aluvión) me fui de madrugada con dos trabajadores. Y yo vi. Si tú estás acá y miras, está abajo la laguna ¿no? Qué raro ¿Quién puede explicar esto?. Así han metido dinamita o que sea. Semejantes bloques que vuelen acá, es como que tú de la olla...de cuando tuestas la palomita, la canchita, explosiona y bota ¿Qué fue eso? (…) no alcanza mi mano esos bloques de hielo, echado ahí. Entonces dije "No, yo no sé qué fenómeno ha pasado acá ¿Quién va a explicar?" porque es como es si desde adentro hubiera botado algún gas y algo así."

"The following day (of the GLOF) I went in the morning with two workers. And I saw. If you are here and look, the lake is under, right? That is weird. Who can explain that? That's how they put dynamite. Huge blocks (of ice) that fly here, is like when you from the cooking pot…like when you make popcorn, it explodes. What was that? (…) My hand does not reach those ice blocks. So I said "No, I do not know which phenomenon happened here. Who is going to explain?" Because is like from within (the glacier) some gas or something came out."

Authority from the Irrigation Committee of San Isidro de Chicón, male, 32 years old

"Parece que este aluvión fue provocado por la mano del hombre porque se dice de que donde hay nevados hay minerales. Posiblemente algún travieso ha ido a dinamitar porque iban a encontrar oro, y al dinamitar cayó un bloque de nieve a la laguna y rebalsó el agua. Y eso arrasó el camino. Otras instituciones no han creído. Las personas dicen eso porque las piedras del piso aparecieron arriba del nevado y esas piedras no pueden estar ahí.. (…) El aluvión es una preocupación para las instituciones y nos pueden dar sugerencias y nos convencen que nos hablen del agua y el nevado está desapareciendo".

"Seems that this alluvium was provoked by the man's hand because it is said that where there are glacier, there are minerals. Possibly some prankish went to dynamite because they were going to find gold, and when they dynamited a block of ice fall into the lake and the water overflowed. Other institutions did not believe that. People say that because the stones in the floor appeared up in the nevado and those stones cannot be there. (….) The alluvium is a concern for the institutions and they can give us suggestions and the convince us that they speak to us about the water and that the nevado is disappearing".

Resident from San Isidro de Chicón, male, 67 years old

The narratives around the GLOF as a provoked event were found in most of my interviews; while in a lesser extent, the causes attributed to the GLOF among the residents coincide with the arguments that are provided by the institutions. In spite of this, the

predominant narrative of the GLOF as a provoked event is sustained in the idea that this occurred during the dry season and due to the presence of minerals within the Nevado Chicón, such as gold and copper (see also Miranda and Valer, 2018; Tecsi and Tupa, 2017).[33] However, despite the recurrence of this narrative, it is also stated that there are no certainties regarding the responsibilities nor about the evidence yet.

In this point, it is important to distinguish between the narratives related to the GLOF and the ones referring to the constant retreat of the Nevado Chicón. Indeed, throughout the sub-basin, the perceptions that explain the deglaciation are various: contamination, waste burning, and global warming, not only in Chicón but worldwide. Less frequent or mainly attributed to the elderly residents is the lack of *pagos* that have been given to the *Apus*. Thus, the perceptions regarding glacier retreat are less likely to be a consequence of the anger of the *Apus*, but of a process of environmental changes. On the contrary, the GLOF is mainly perceived as a result of an assault. Because of this, it was considered that the *Apu* had been damaged, and therefore, the relationship with them had to be repaired.

Entrevistado: "Bueno, por causalidad, derepente, ha podido entrar el ser humano (al nevado) pero no poner las dinamitas, no romper, no llevar otras cosas que van a destrozar su naturalidad, todo eso. Para el Apu es un enojo eso. Claro, estamos destruyendo.

Entrevistadora: Pero la desglaciación no es una.....
Entrevistado: Claro que no es parte del enojo de los Apus. Claro que no. Eso que no se entienda por ese lado sino que ahora la desglaciación sabemos muy bien que es por calentamiento global. (...) No confundamos con lo que nosotros hacemos deidades, de que con los Apus para que nos proteja, que siga conservando todo eso. Pero es aparte el famoso de la contaminación del calentamiento global"

Interviewee "Well, by coincidence a person could have enter (in the glacier) but not putting dynamites, not breaking, not taking other things that are going to destroy its nature, all that. For the Apu it is an anger. Of course, we are destroying.

Interviewer: But the deglaciation is not a…
Interviewee: Of course that is not part of the anger of the Apus. Of course not. That should not be understood in that way; we know very well that the deglaciation is because of global warming. (...). We do not have to confuse what we do with the deities, with the Apus so they protect us, to keep preserving all that. But is aside from the famous contamination of the global warming".

Water authority of the JASS of Yanacona, male, 58 years old

In this regard, a phenomenon like the GLOF it is not only explained by the process of climate change, which is already widespread in the Chicón sub-basin, but it enters in contact with other narratives that persist until nowadays, like the explosion in the glacier. Both narratives seem contradictory but they coexist, and both can be used to explain the same phenomenon, and they can be distinguished by the following actions that were taken after the GLOF in 2010.

[33] Following Sánchez Garrafa (2014), the *Apus* are deities who own deposits of precious metals, which is part of their characterization as beings of power (Sánchez Garrafa, 2014: 28).

3.2.2. The lake Rit'icocha and the risk management measures after the GLOF in 2010

The apparition of the lake Rit'icocha after the GLOF in 2010 caught the attention of all residents in the Chicón sub-basin. Indeed, many of the inhabitants did not recall about the existence of a smaller lake before the GLOF in 2010, as their visits to the glacial area were none or very few, or as nobody talked about that. In San Isidro, the allusions to the existence of a previous lake than Rit'icocha are few and not concordant between them, but those come primarily from male residents who used to go to the glacier. For instance, they state that before Rit'icocha there was a smaller lake named Pukacocha (Red Lake) or that the lake did not have a name; while others observe that the apparition of the lake is part of the process of glacier retreat.

The consequences of the GLOF also raised the concern of governmental institutions and NGOs as Rit'icocha started to represent a risk for the population. Thus, the number of projects and researches working on the evaluation of risks, risk management measures and adaptation to glacier retreat increased in the sub-basin (see table 3) since 2010 until the present.

Table 3: Projects and reports conducted in the Chicón sub-basin (2010-2018)

Name of the project	Leading institutions	Project date	Main objective	Activities in Chicón	Other institutions involved
"Strengthening Capacities of Sub-National Systems of Risk Management, and Developing the Resilience of Communities Vulnerable to Disasters" (1)	Welthungerhilfe, Diakonie Katastrophenhilfe Soluciones Prácticas, and PREDES	2011-2012	Impulsing the adaptation to climate change and the preparation in case of emergencies to contribute to the risk reduction in the Andean region.	Implementation of a (model) Early Warning System which included a constant actualization of the rain gauges and the hydrometric stations; and the diffusion of the alerts and the information from the pluviometers. Constant monitoring in the Nevado Chicón every Wednesday to observe any anomalies in the glacier Organization and implementation of the communication network (only in case the Early Warning System – EWS- is activated).	Municipality of Urubamba, Centre of Operations of Emergencies (local and regional), National Service of Meteorology and Hydrology of Peru (SENAMHI), National Police of Peru, Ministry of Health SENAMHI, PNP, Cuerpo General de Bomberos Voluntarios del Perú (Firefighters of Peru)
Proyecto Glaciares + (2)	CARE Perú, University of Zurich, COSUDE	2015-2018	Consolidating the capacity of adaptation and risk management, and improving the management of opportunities that come with the reduction of the glacial surface.	Leadership training program: "Integrated Management Planning of the Water Resource for Community Development" addressed to leaders in the basins of Chicón, Pumahuanca, and Yanahuara in the province of Urubamba. Capacitation with the population of the sub-basin in disaster risk management. Visits to the Riticocha lake to monitor the retreat of the glacier.	Municipality of Urubamba, University San Antonio Abad del Cusco

Perceptions of the deglaciation and climate change among the population of the Chicón basin- Sacred Valley of Cusco: A Psychosocial and Anthropological study.	University San Antonio Abad del Cusco	2015-2017	Analyzing from the Psychosocial and Anthropological approaches the perspectives regarding the deglaciation and climate change among the population of the Chicón basin, Cusco.	Conduction of Psychological and Anthropological studies in the Chicón sub-basin. Organization of an International Forum of Social Science. "Interdisciplinary dialogues on climate change, disasters and governance. ». Cusco, August 2017.	Regional Gobernment of Cusco, CARE Perú, University of Zurich, INTE PUCP

Sources: (1) PREDES : www.predes.org.pe, Los Sistemas de Alerta Temprana en la Región Cusco; (2) Proyecto Glaciares +: http://www.proyectoglaciares.pe, information retrieved from fieldwork; (3) Proyectos Canon- Universidad Nacional San Antonio Abad del Cusco – Vicerrectorado de Investigación http://pincanon.unsaac.edu.pe/reporte-canon/

Other reports conducted in the Chicón sub-basin after the 2010 GLOF:

- Technical Evaluation of the Nevado Chicón. Technical-Glaciological report. INGEMMET (2011)
- Study of Hazards in the Chicón sub-basin. INDECI (2011)

Among the risk management initiatives that took place in the Chicón sub-basin, the one that caused the most signficant impact occurred in 2011. In this year, the Municipality of Urubamba started the concession to implement the project *"Instalación del Servicio de Protección en la Cuenca del Río Chicón"* (Installation of the Protection Service in the Basin of the Chicón River). The project included the construction of a retaining wall, a dissipation dam in Ocoruruyoq, a river defense in the Chicón river, the decrease in the water level of the lake Rit'icocha, and the installation of an early warning system in Ri'ticocha, Ocoruruyoq and other sectors throughout the sub-basin. The project was carried out by the enterprise JERGO with an inversion of 14,364,483 Nuevos Soles (4,331,635 Swiss Francs approximately).[34]

During the implementation of the project, it was necessary to build a road to Occoruruyoq to facilitate the transportation of pipes, cement, and other materials; a pedestrian path was also implemented between Ocoruruyoq and Rit'icocha to transport materials to the lake. In this point, the following measures sought to reduce the volume of the lake Rit'icocha to decrease the possibility of any further risk event. However, this action was stopped by the immediate reaction of a large group of residents of the four localities.

"¿Ha ido usted a Ocoruruyoq? ¿no? ¿No ha visto usted que han formado como una defensa y tiene sus desfogues así como tunelcitos? Ese es el dique. Eso igualito iban a hacer en Rit'icocha pero la gente no ha aceptado ¿Por qué? Porque dijeron que eso es con el fin de que lo van a llevarse mediante tuberías el agua a otro sitio, a otro pueblo o a otro sitio, o a alguna obra grande (…) y por eso que dijeron "para que vean ustedes que ya está pasando en el mismo sitio el terreno de la laguna. Vamos todos". Hemos ido más de 150 personas. (…) la gente decía que (la empresa) se iban a llevar el agua pero para mí no se iban a llevar el agua, sino que era como para controlar o como algo de limitar el exceso de que baje. (…) Entonces no han dejado. Entonces como la mayoría decía que no "eso es mentira, que nos van a robar con esos fines" pero según ellos habrán hecho su estudio (…), entonces pienso que lo han hecho con ese fin."

"Have you gone to Ocoruruyoq? No? Have you seen that there is a defense and it has a venting like tunnels? The same they wanted to do in Rit'icocha but the people have not accepted it. Why? Because they said that the objective was to take the water through pipes to another place, town or to some big work (…) and that is why people said "It is already happening in the same area of the lake. Let's go everyone". More than 150 people went. (…) People said that (the enterprise) was going to take the water away, but for me, they were not going to do that, but it was more to control or limit the excess that is going down. (…) So people stopped it. Most of them said that "that is a lie, they are going to steal us with those purposes", but according to them (the enterprise) they have conducted their studies (…), so I think they have done (their job) with that purpose".

Resident from San Isidro, male, 59 years old

Entrevistado: El 2012 o 13 subimos (a la laguna) (…) (La empresa) Han llevado cemento, tuberías. (…) incluso me han dicho que el Jergo es lo que ha hecho todo lo que ves de la canalización para arriba. Se subieron hasta Ocoruro, exploraron maquinarias, después se subieron a Rit'icocha llevando tuberías. Desde ese momento pareciera mentira un poquito se está alejando la nevada. Desde el momento que llevaron cosas, cemento, tuberías, no sé qué cosas (…) dice que...hasta han

Entrevistado: In 2012 or 13 we went up (to the lake) (….) (The enterprise) brought cement, pipes. (…) they even told me that Jergo has done everything you see in the canalization up there. They went to Ocoruruyoq, explored with machinery, and after they went to Rit'icocha bringing pipes. From that seems a bit like a lie, but the nevado is going away; since that moment that they took things, cement, pipes, I do not know what else. (…) it is said that…even they could have

[34] Sistema de Seguimiento de inversiones (Investment Tracking System) of the Ministry of Economy. Available at http://ofi5.mef.gob.pe/sosem2/Inicio.aspx?tipo=2&codigo=2220973

podido detonar, dice, explosivos ¿no? Pero así hablaron los compañeros. Pero no te miento lo que han llevado cemento, han llevado tuberías, y nosotros lo paramos.

Entrevistadora: ¿Qué era lo que les preocupaba de que trabajen en la laguna?

Entrevistado: (…) "Era en octubre del 2010 que ha venido toda la avalancha y lo ha llenado todo este riachuelo, con lodo, con todo (…) Con ese cuento Jergo llegó, y estaba un alcalde que (decía) "Hay que vaciarlo esta pequeña lagunita como es Rit'icocha". (…) Querían vaciarla (…)Entonces lo iban a sacar el agua, lo iban a sacar en esas tuberías ¡Qué idea tan…pues señorita! (…) ¿Cuál habrá sido la intención? Eso hemos parado también las cuatro bases. Hemos ido todos juntos."

detonated it, they say, explosives, no? But that is what the fellows say. But I am not lying that they brought cement, pipes and we stopped that.

Interviewer: What worried you about the works in the lake?

Interviewee:"(…) It was October 2010 when the flood came and filled all this river with mud, with everything (..) With that tale, Jergo came, and there was a major that (said) "We have to empty this little lake like Rit'icocha". (…) They wanted to empty it (…). So they were going to take the water away and in these pipes. What an idea so....right, miss? (…) What would have been the intention? The four committees stopped that. We went all together."

Water authority from Ccatán Pino, male, 56 years old

"Nos hemos organizado porque el comité central de cuenca Chicón nos ha llamado, tenemos que asistir. ¡Cómo va a secar nuestra lagunita! no podemos dejarlo. La empresa Jergo quiere secarlo, entonces hemos ido a hacer un paro. (…) Nos juntamos los de 4 bases y vamos a los lugares donde es necesario estar presente y no dejamos de hacer nada. (…) sí, cemento han hecho llegar hasta el nevado. Cuanto se habrá desperdiciado cemento ahorita. (…) no hemos dejado que lo pongan porque la laguna esta una pampa, por debajo hay una roca, por esa roca esta chorreando una catarata de agua, eso querían secarlo por debajo, secarlo esa batea de agua, esa laguna de agua querían secarlo en ese tubo, eso es lo que no hemos dejado (…) eso nos ha dado explicación diciendo que corre peligro por esta laguna, si no habría esta laguna cae cualquier lodo de, bloque de nevado, no corre riesgo, así nos quería convencer, pero nosotros no hemos dejado."

"We organized because the central committee of the Chicón basin called us, we have to assist. How our lake is going to dry! We cannot let that happen. The enterprise Jergo wants to dry it, so we went to make a strike. We did not let them doing anything. (…) From the 4 committees we were together and we went to the places where it was necessary to be, so did not let them do anything. (…) Yes, cement they brought to the lake. A lot of cement is now wasted. (…) We did not let them putting (the pipes) because the lake is in a plain and underneath there is a rock, and under that rock, there is a waterfall. They wanted to dry it in that pipe, so we did not allow that (…) They gave us the explanation that it is in danger because of the lake, that if there is no lake and any ice blocks fall, there is no risk. That was the way they wanted to convince us, but we did not let them."

Worker of the Irrigation Committee of Chichubamba, male, 48 years old

Thus, led by the four irrigation committees and the Central Irrigation Commission of the Chicón sub-basin, many residents went to Rit'icocha to demand the stoppage of that component of the project. They claimed that they were not informed about this action nor they gave permission for the execution of the works. In this regard, the drain was not conceived as a necessary measure given the physical characteristics of Rit'itocha; in fact, it is characterized as a lake that does not have enough water to be drained. Moreover, the lack of trust sharpened with the claims about the presence of minerals and in the glacial area and the possibility to transport the lake water to other localities under the project.

The demands to stop the drain of the lake Rit'icocha were supported by the *Autoridad Administrativa del Agua XII Urubamba Vilcanota (*Administrative Water Authority XII

Urubamba Vilcanota), a decentralized entity from the National Authority of Water (ANA)[35] that solved to stop the works in the lake Rit'icocha in 2014[36]. The Municipality of Urubamba requested an authorization to the Administrative Water Authority to run the project in natural water sources. The Municipality sustained their request with glaciological and hydrological studies of the lake Rit'icocha, and with an Evaluation of Risk made by Defensa Civil (Civil Defense).[37] However, the water authority decided to reject such request due to the absence of other studies needed to carry out a project of this magnitude.

Both, the strike in the lake and the intervention of the ANA, meant the end of the works in Rit'icocha. However, after this event, the protection of the Nevado became a priority in the sub-basin, especially in San Isidro. First, right after the culmination of the project, the community of San Isidro organized guards to watch over the glacier. Although this is a practice that is less recurrent nowadays, the visits to the glacial area to observe how the ice is retreating, with the colocation of stones in the ice, remain until nowadays. The lake Rit'icocha is also monitored by Defensa Civil and the Municipality of Urubamba on a daily basis through a camera installed in the lake, and even with regular visits to the glacier.

Photo 10: Gate at the entrance of the Nevado Chicón - San Isidro de Chicón

Nowadays, when any institution or external person want to visit the glacier, this always have to be consented by the Directive Board of the community of San Isidro. In this regard, the protection of the Nevado Chicón is also expressed with the construction of a gate at the entrance to Ocoruruyoq. The construction was approved, financed (with pro-fund activities and constructed (with communal work) by the four localities to prevent any possible harm in the Nevado, but the current management is in charge of the Directive Board of San Isidro. Thus, each visitor or institution who wants to access to Ocoruruyoq and the glacial area of the Nevado Chicón has to ask the Directive Board of the community of San Isidro

[35] The National Authority of Water (ANA by their acronym in Spanish) is the maximum authority in regards of the technical norms for the national management of the water resources; also it is the entity in charge to grant the water licenses throughout the Peruvian territory . The ANA is decentralized into 14 Administrative Water Authorities, one of them Urubamba-Vilcanota.

[36] Resolución Directoral Nro. 691-2014-ANA/AAA XII.UV
Available at http://portal.ana.gob.pe/sites/default/files/normatividad/files/12-rd-0691-2014-03_0_0_0.pdf

[37] A governmental institution in charge of the prevention and protection of the population in case of a disaster.

for the key. Thus, the decisions regarding who can enter or not into these areas depend entirely on the directives of San Isidro.

Currently, the risk perceptions regarding the lake Rit'icocha are not located in the amount of water that can overflow, but rather in the water shortage of the glacier. Thus, the idea to preserve water in Rit'icocha contradicts any other possibility of works in the Nevado Chicón in the future (on risk management, water transfers or dams). This aspect represents a lack of trust regarding the future infrastructures; but also an issue that has strengthened the coordination between the four localities, especially from the lower parts of the sub-basin who had little access to the glacial area until the GLOF.

3.3. Current representations on the *Apus* and new meanings of the landscape in a context of increasing water scarcity

The GLOF in 2010, and the risk management measures afterward caused a significant impact on the social dynamics that involve the presence of the glacier, water sources, and *Apus*. These changes are expressed in the different representations of danger over the same event, and in the new relationships with the landscape due to the changes in the primary water sources.

Despite that deglaciation is a continuous process that has been identified within and outside the sub-basin, the GLOF in 2010 evidenced coincident narratives, but also contradictory discourses that led to tensions afterward. For example, nowadays there is an increasing consensus to reforest the area of Ocoruruyoq and a shared concern to ensure water for the dry season. Given these concerns, there are different workshops, studies, and projects on adaptation to climate change that are yet conducted in the sub-basin, which seek to involve the participation of the residents of the four localities.

But on the other hand, the GLOF evidenced opposing discourses such as, on one side, the inherent risk of a new glacier lake and; on the other, the possible damages that people can do in the Nevado to extract resources from it, like minerals or water. The importance of both is shown in the predominance they have in the public domain, and in the ways that they are recalled in the present. However, the implementation of specific measures over others evidence that these discourses not only coexist, but that can result in frictions and disagreements, as the strikes in the lake Rit'icocha and the further actions to protect the glacier.

Here the representations of the Nevado Chicón or *Apu* are based in a system of meanings and values that makes sense for a collective or a group (Moloney *et al., 2014:* 2*).* These representations are shaped by the different interactions with the environment and the level of attachment to a place (Adger *et al.*, 2012). In this regard, the changes in the glaciers

can also impact in the cultures and the human subjectivity, especially among people who are closely related to them (Allison, 2015: 494).

For example, according to my data, the powers that are attributed to the *Apus* remain despite the glacial loss. Thus, among my interviewees who express a close relation to these deities, their protective and punisher attributions does not lie in the amount of ice; however, they are losing their powers as water providers. This identification constitutes the main risk concerning the Nevado Chicón. Therefore, the *pagos* (at the sub-basin level) or the prevention of actions that can bother the *Apu* are actions oriented to protect the Nevado Chicón and to strengthen the relationship with the *Apus.*

But at the same time, another aspect that evidenced the GLOF of 2010 was the level of awareness in relation to the Nevado Chicón and especially regarding the area surrounding the lake Rit'icocha, especially in the lower part of the sub-basin. Indeed, according to my interviewees, the physical approach towards the glaciers and lakes was more distant and even not known, in exempt of the residents of San Isidro, who are recognized as the ones who are familiar with the surroundings of the glacier.

"Entrevistadora: Antes de que fuera el aluvión ¿Usted tuvo la oportunidad de ir a Rit'icocha?
Entrevistado: No, no porque no tenemos cómo alertarnos porque nunca había pasado eso. Pero más antes ha pasado, pero después de eso no. No había motivo para ir a ver qué está pasando, no había. Pero después de si...cuando ha pasado ese aluvión, varias veces hemos ido y hemos visto de que efectivamente esa laguna era natural."

Interviewer: "Before the alluvium, have you had the opportunity to go to Rit'icocha?
Interviewee: No, because there is not a way to alert with each other because this did not happen before. But before it did happen, but none after that. There was no reason to go to see what was going on. But after yes…when this alluvium happened. Many times we went and we saw that, in effect, that lake was natural".

Authority of the central irrigation committee, male, 53 years old

Iban los antiguos, los más antiguos al sitio. Pero acá nosotros Ccatán Pino, ya después de todo cuando ha pasado cosas hemos ido a ver. Pero los antiguos siempre conocen su sitio, ahí tienen sus ganados ariscos, como dicen, salvajes. Y ahí lo que nosotros queremos de ese sector siempre unirnos ¿Para qué? Sacar el agua de arriba, a ver, con el futuro hacer nuevos reservorios, cosechar el agua cuando hay bastante agua y cuando necesitamos soltar. Eso es lo que queremos nosotros acá abajo (…) Si no pasaba ese aluvión, nada. Hasta ahorita estaríamos nada sabiendo, nada. (…) No pasa nada entonces normal. Pero cuando pasa alguna cosa recién nos damos cuenta de que esto hay que hacer, que otra cosa hay que hacer o hacemos una laguna artificial y sacamos la cosecha de agua."

"The elders used to go, the most elders in site. But here in Ccatán Pino, we went after everything happened. But the elders always know their site, where they have their wild livestock. And what we want always from that sector is get together. For what? To get the water from above, let's see, so in the future, we can make new reservoirs, harvest the water when there is enough and when we need to let it go. That is what we want here below. (…) If that alluvium did not happen, nothing. Until now we wouldn't know anything. Nothing happens, so that is fine. But when something happens, then we realize that this has to be done, that another thing we have to do, or that we can make an artificial lake or the water harvesting."

Water authority from Ccatán Pino, male, 56 years old

The quotes illustrate how the different levels of proximity to the glacier; but also how the appearance of Rit'itocha produced a particular way of seeing the landscape. In this regard,

despite that the residents of San Isidro and Yanaconas are seen as more familiar with the glacier landscape, it has been described previously that the relationship with the *Apus* at the symbolic level has been maintained throughout the sub-basin without the need to approach physically to the glaciers and lakes. However, the GLOF of 2010 and the risk management works afterward, supposed a starting point to a new relationship with this landscape. On the one hand, the recognition of a "new" space that was not approached before these events. And on the other side, the construction of new meanings around the risks from the glacial area. Such meanings involve the observations and the coordinated actions of the four localities as a whole; and the influence of the scientific and institutional findings regarding the GLOF.

To sum up, in terms of the narratives that emerged after the GLOF, it can be concluded that despite the two narratives that have been identified (the GLOF as a natural event in a context of climate change, and the GLOF as a provoked event), they are not entirely separated, as there are points in agreement, disagreement, and even tension when it comes to decision-making processes. But at the same time, both narratives can be used by one person to explain the current changes in the environment. Thus, the different narratives and meanings that construct the landscape show how different scales can become part of the same picture; in which each scale is defined by a reach of actions, patterns, and rationalities (Xiang, 2013).

Moving to another point, there are different manifestations of place attachment that vary throughout the sub-basin. On the one hand, it can be stated that the relationship with the *Apus* is not linked necessarily in the physical proximity with them; but they are still linked to a sense of belonging and identity through the system of values and attributions that are given to them. But on the other hand, the events in the Nevado Chicón constituted a breaking point, as the risk perception increased throughout the sub-basin. As a result, the physical proximity was reduced through the constant monitoring, the new infrastructure and the identification of the changes in the landscape, especially among the residents of Ccatán Pino and Chichubamba.

In this regard, the organization at the sub-basin level to protect the Nevado Chicón also enhanced new collectivities that are inscribed into a political organization that is maintained through the local authorities, including the JASS and the irrigation committees; for example, through the institutionalization of rituals towards the *Apus* and the restrictions to enter into the Nevado Chicón as measures to ensure water for the future. In this regard, these actions not only denote which are the concerns regarding the glacier; but also, which are the risks that people in the sub-basin identify as important, regardless of the natural hazards themselves (Jurt. 2009: 227). Thus, the way how different groups understand and feel responsible for the climate and their landscape invite to rethink how further negotiation processes that involve the glacier, lakes, and *Apus* could be addressed in the future.

IV. WATER MANAGEMENT IN THE CHICÓN SUB-BASIN

Following Boelens (2012) an irrigation system in the Andes is defined by a set of domains: the physical infrastructure, the construction of water rights and norms, the presence of people who organize and maintain the system, the political and economic structures, and the rules and practices that are embedded in meanings, symbols and values culturally defined (Boelens, 2012: 69). As a result of the confluence of all these elements, the first part of the chapter will explore the organization, actors, and practices that conform the water management in the Chicón sub-basin.

The second part of this chapter will address how the rules, rights, and practices are being negotiated, contested or sought to persist given the increasing perception of water scarcity. Moreover, the water system the Chicón sub-basin, as other contexts in the Peruvian Andes, is characterized by the presence of conditions of legal pluralism (Boelens, 2008, 2012; Boelens & Zwarteveen, 2005; Orellana, 2014; French, 2016) in which rules and principles of different origin and legitimization coexist.

On the other hand, given the implications that climate change has in the water flows (Gagné and Rasmussen, 2016), another aspect to be addressed is the role of infrastructure and technical measures to deal with scenarios of hydric stress. The presence of this kind of initiatives also involves the constant negotiation and creation of rights, uses, and practices; which has an impact in the current water organization in Chicón.

4.1. Organizing water in the Chicón sub-basin

The first part of the chapter will describe the operation of the water organization system in the Chicón sub-basin regarding water for human consumption and irrigation as a whole. In this chapter, I will center in the aspects that the four localities have in common concerning their organizational structure, objectives, duties, joint activities, and irrigation practices. On the other hand, I will also describe the role of the governmental water in regard to the water management in the Chicón sub-basin briefly.

4.1.1. The irrigation committees and JASS

a) Structure

Water management in the Chicón sub-basin is conducted between the four localities that integrate the Chicón sub-basin: San Isidro, Yanaconas, Chichubamba, and Ccatán Pino. Given the infrastructure and uses of water, there are two types of water organization: one for irrigation and another for human consumption. For both of them, the distribution of water is conducted in two levels: the first one is within each locality, in which the four

irrigation committees and four JASS are responsible for the maintenance of the infrastructure and schedules of their jurisdictions. The second level groups the four committees and JASS into one central organization at the sub-basin level. In the case of irrigation this is the *Comisión de Usuarios Sub-Sector Hidráulico del río Chicón Urubamba* (Commission of Water Users of the Hydraulic Sub-Sector of the Chicón river), and the case of the water for human consumption, the *central JASS - Junta Administradora de Servicios y Saneamiento de Agua* (Administrative Board of Services and Sanitation of Water).

Table 4: Information about the irrigation committees and the JASS in the Chicón sub-basin

Name of the Commission /Committee		Number of users	Payment made by users (in Nuevos Soles) [38]	Water sources that are under the management of the JASS/ Irrigation Committee
Comisión de Usuarios Sub-Sector Hidráulico del río Chicón Urubamba (Commission of Water Users of the Hydraulic Sub-Sector of the Chicón river).	Irrigation Committee of San Isidro de Chicón	148	S/. 1.50 (per topo)[39]	Chicón river
	Irrigation Committee of Yanacona	120	S/. 1.50 (per topo)	Chicón river
	Irrigation Committee of Ccatán Pino	82	S/. 1.50 (per topo)	Chicón river
	Irrigation Committee of Chichubamba	280	S/. 1.50 (per topo)	Chicón river
CENTRAL JASS (Junta Administradora de Servicios y Saneamiento de Agua Entubada)	JASS of San Isidro de Chicón	100	S/. 2 per month	Willkamayucha, Ñustayoq and Ninaspiquio creeks
	JASS of Yanacona	100 (approx)	S/. 3 per month	Willkamayucha, Ñustayoq, Ninaspiquio and Yanacona-Chicón creeks
	JASS of Ccatán Pino	75	S/. 5 per month	Willkamayucha, Ñustayoq and Ninaspiquio creeks
	JASS of Chichubamba	190	S/. 5 per month	Willkamayucha, Ñustayoq and Ninaspiquio creeks

[38] S/. 1= CHF 0.30
[39] 3 topos = 1 hectare

Source: Information retrieved from interviews with the presidents and authorities of each committee and JASS.

Every commission[40] and committee is led by a board of directors and an Assembly, the central instance of the decision-making processes. The board of directors is elected every four years by the assembly; and it is composed by a president, vice-president, secretary, treasurer, and a spokesperson. They are in charge of the maintenance, access, and quality of the water itself and the infrastructure containing the resource. On the other hand, they are responsible for the coordination between the committees, commissions, the Municipality of Urubamba and other institutions, like the JUC[41] or ALA to address projects, discuss water norms and evaluate the infrastructure.

Every user of the committee composes the Assembly; and in the case of the commission, by every user of the four committees. For the JASS, an user is a person who has access to water for human consumption in their house; however, there is a distinction when the household members come from outside the sub-basin. This distinction applies to the condominiums in Yanacona and hotels in Chichubamba, which have a different tariff of water imposed by the JASS in charge. For the irrigation committee, an user is a person who has a terrain within the jurisdiction of the committee and irrigates with the water that is managed by that committee. For instance, an user living in San Isidro that has terrains in Yanacona can belong to the JASS of San Isidro and at the same time, be part of the irrigation committee in Yanacona.

One of the main characteristics of the assembly is the regularity of the meetings to address different topics such as changes in the rules, the main concerns of the users, the schedules of the *faenas* (collective work), the election of the committee board and the diffusion of information from governmental or private institutions, and NGOs. The call to every assembly is in charge of the directive board, and the assistance is mandatory[42]; otherwise, a fine (which is previously agreed by the committees and commissions) applies for the users who do not assist.

Other important actors within the irrigation committees and the JASS are the *gasfiteros* and *tomeros.* The *gasfiteros* are workers within the JASS, and they are responsible for the maintenance, cleaning, reparation, and supervision of the water catchment, the pipes, and the reservoirs to ensure the good functioning and distribution of the water network. Moreover, they are in charge of the chlorination and disinfection of the central reservoir and the four other reservoirs per locality. All these activities are in constant coordination

[40] The directives of the Central Commission and Central JASS are usually represented by users of different irrigation commiteess and JASS.

[41] Board of (Water) Users from Cusco (Junta de Usuarios del Cusco)

[42] Besides of the assemblies, the water authorities can also convey that other activities such as workshops with institutions (Municipality, NGOs, etc.), fundraising events and special occasions as the *pagos* might be of mandatory assistance.

with the directive boards of the four JASS, of the Central JASS and the Municipality of Urubamba (specifically the OMSABA- Municipal Office of Basic Environmental Sanitation) who are in charge of providing the chlorine and materials for the maintenance of the water network.

Moreover, the *gasfiteros* are in charge to control the fair use of water. In this regard, the water for human consumption cannot be used in other activities such as irrigation, construction, and commerce. In the same way, the *gasfiteros* have to monitor if the users have permanent access to water in their houses, especially if they are registered in the JASS. On the contrary, the *gasfiteros* have to report the directives if a household is not registered in the JASS but still count with access to water.

On the other hand, the *tomero* or hydraulic operator is the person in charge of the water distribution within their irrigation committee. The distribution of water is only delivered during the dry season. In this regard, the *tomero*, unlike the *gasfitero* who works throughout the year, only works between July and October. Thus, while the access to the river to irrigate the crops is free during the rainy season, during the dry season, the irrigation committees control the schedules and the amount through the *tomeros*.

Thus, the *tomero* is the main responsible for the water distribution. The distribution is done on a daily basis within a schedule that varies across the committees, which is previously agreed upon by the four committees and the central commission to ensure water for all the committees. To access to the water, every user has to attend the catchment of their committee and ask the *tomero* for a water shift according to the extension of their field and the availability of water.

Besides the water distribution, the *tomero* supervises that all the users who requested their dotation of water are irrigating their fields within the time that they were assigned; and in turn, controlling if the users who did not ask a turn are irrigating their fields. In this point, the *tomeros* also act as mediators if any tension or discussion happens among the users. Finally, the four *tomeros* are in constant coordination between them, especially if the water flow is not supplying the fields of their committees.

b) Creation and objectives of the irrigation committees and JASS

The creation of the JASS coincided with the construction of infrastructure for water consumption, such as reservoirs and pipes, between the end of the 90s and the beginning of the 2000s. Previously, the access to water for human consumption was mainly through the irrigation ditches, and therefore from the Chicón river. However, after the increasing population and the concerns over the contamination of the river, the JASS was focused on the catchment of the creeks in the high areas of the sub-basin.

Until 2003, each of the four JASS worked independently within their localities; but the need to manage the maintenance of the shared infrastructure and the necessity to strengthen the JASS organization at the sub-basin level encouraged the creation of a Central JASS. Thus, the Central JASS was created to initiate the search of more significant water projects that could benefit the sub-basin as a whole; but also it was founded to strength water the organization especially in front of institutions such as the Municipality, the ALA, and other governmental institutions.

In respect to the irrigation committees, each of the four communities was in charge of their regulations and uses over the water sources based in the knowledge they have gained over generations. However, these practices did not suppose coordination between the four communities, so there were no guarantees to ensure the same access to the resource across the sub-basin. Consequently, the sensation of inequality increased, especially in Ccatán Pino and Chichubamba.

This scenario consolidated the creation of the *Comisión de Usuarios Sub-Sector Hidráulico del río Chicón Urubamba* by the year 2000. Thus, this central commission promoted the coordination between the four irrigation committees to establish endowments and schedules for irrigation. On the other hand, the foundation of a central commission responded to need to manage, maintain and repair the irrigation infrastructure that was constructed and modernized over the 90s throughout the sub-basin. And finally, the central commission started to act as a mediator of conflicts within or between localities.

Both, the irrigation committees and the JASS, share the same objective of ensuring water for irrigation and human consumption to all the users who belong in their organizations. This objective is accomplished through the preservation of the water sources and the monitoring of the adequate use of water. Moreover, the JASS and the irrigation committees and commissions, have as objectives to be recognized by the Peruvian State (through a process of formalization) to be backed up by the ANA and ALA, as constitutionally all the water sources belong to the Peruvian State.

c) The *faenas*

The *faenas* or collective works are an important component of the organization of the JASS and the irrigation committees. They represent the principle of the common property in the Andes as every user has to fulfill this type of work to gain access and rights to the water resource (Gelles, 2006). On the other hand, the participation in the *faenas* allows the management and maintenance of the hydraulic infrastructure by the water organizations in the sub-basin. In case the users do not attend the *faenas*, they are bounded to pay a fine.

Thus, every registered user must comply their *faenas* in the correspondent JASS (location of the household) and the correspondent irrigation committee (position of the agriculture plots). For instance, for the JASS, the *faenas* consist in a day in which all the users clean the reservoirs and pipes. In regard to the central reservoir, a *faena* is organized among the five presidents of the JASS, in which all the JASS users of the sub-basin are required to attend. In respect of the other reservoirs, each JASS call for their *faenas* independently.

On the other hand, the *faenas* in the irrigation committees follow a similar structure. When the maintenance or construction of the hydraulic infrastructure is required to do as at the sub-basin level, the coordination between all the irrigation authorities must be coordinated. Within each irrigation committee, this is decided within each *Asamblea*. In general, the *faenas* are centered in the maintenance of the ditches and irrigation channels of the committee.

4.1.2. The ALA and the JUC

Besides the committees and commissions, the organization of the water resources involves the coordination with instances at the regional level, which in turn are articulated with national instances which have an important role in the decision making processes within the Chicón sub-basin.

In the first place, the National Authority of Water (ANA) is the maximum entity that elaborates and regulates the national system of the water resource management. According to the National Law of Water Resources[43] their main functions are the proposal of norms that ensure the integral and sustainable management of the water resources; the supervision of the implementation of the water management plans, politics and norms in all the basins; and the grant (or rejection) of the water licenses requests in the Peruvian territory.

In a local level, the ANA is represented by 14 Administrative Authorities of Water (AAA- *Autoridad Administrativa del Agua*), which in turn are represented by 71 units denominated Local Authorities of Water (ALA- *Autoridad Local del Agua*) across the Peruvian territory. Precisely, the water authorities of the Chicón sub-basin coordinate with the ALA when it comes to problems that cannot be solved within the sub-basin; and in relation to the implementation of the national norms in the Chicón sub-basin.

The National Authority of Water is also in charge of the supervision and inspection of all the irrigation boards, commissions, and committees in Peru. Thus, all the irrigation users of Cusco are integrated into the Board of Water Users of Cusco (JUC- *Junta de Usuarios de Agua del Cusco*), an organization that represents all the irrigation commissions and

[43] The Law of Water Resources is the current normative that regulates all the water uses within the Peruvian territory. Ley de Recursos Hídricos N°299338, Capítulo II, Artículo 14°

committees of the Cusco region. In turn, the JUC represents all the water users of Cusco in front of the JNUDRP (National Board of Users of the Irrigation Districts of Perú- *Junta Nacional de Usuarios de los Distritos de Riego del Perú*). The Peruvian State recognizes all the organizations of water users (Law N° 30157- *Ley de las Organizaciones de Usuarios de Agua*) as entities that channel the participation of the water users in the management of this resource.

Precisely, the central commission and the four irrigation committees of the Chicón sub-basin are in constant relation with the JUC, as they have to allocate a part of the payments they receive from the users for representation purposes. On the other hand, the JUC watches over the maintenance and operation of the hydraulic infrastructure; and it gathers all the water authorities in the province to discuss changes, concerns, and improvements in the water norms, so that they can communicate them to the ALA, AAA, ANA and the JNUDRP.

4.1.3. Daily irrigation practices

a) Irrigation seasonality

The irrigation practices in the Chicón sub-basin are strongly bounded into two big seasons: the dry and the rainy season. Each of them defines the activities and the uses of water. The rainy season starts in November, and it lasts until March. During this time all the crops are irrigated with the rainwater, and the access to the irrigation channels is free. This means that there are no restrictions in terms of schedules or water endowments; nor regulations from the irrigation committees. However, during my time in the field, I could observe that farmers were facing difficulties as there were several days in a row without rain. These difficulties increased the need to take water from the river and consequently it caused an overlapping among people who wanted to use the water at the same time.

The dry season starts in May, and it lasts until October. During this time the irrigation of fields is only made through the distribution that is in charge of the irrigation committees. In this regard, the endowments per irrigation committee are previously agreed by the authorities of the four irrigation committees and the central commission. Thus, San Isidro de Chicón receives four *tandas*[44], Yanacona two *tandas*, Chichubamba four *tandas*, and Ccatán Pino two *tandas*. This way of distribution reflects the prioritization given to the localities with the largest amount of users. In the case of Chichubamba the amount of water that they receive is possible due to the reservoir that is filled during the night in the dry season.

[44] 1 tanda is equivalent to 40 liters per second

Within each committee, every water user has to buy a water endowment in advance according to their land extension. With that payment, they go to the water catchment of their irrigation committee (usually between 4 am and 5 am for all the committees) to ask the *tomero* for a time slot. As all the users make this request at the same time, the *tomero* fills the time slots prioritizing the users who arrived first, the ones who did not irrigate their fields in the previous days, or the eldest users.

Moreover, during this season every irrigation committee has a schedule. In San Isidro and Yanaconas all the users can irrigate their fields between 4 am and 4 pm; so that the reservoir in Chichubamba can be filled during the night. However, as this is the season with more water scarcity, the tensions between users within the same irrigation committee and with the other committees are more frequent if they are feeling that the resource is scarce and it is not getting on time to their fields.

b) Types of irrigation

In the Chicón sub-basin there are two predominant types of irrigation: *por inundación (*or *gravedad)* and *riego por aspersion.* The irrigation *por inundación* consists of "flooding" the plots so that the crop absorbs the water. In order to connect the irrigation ditches to the crops, every user has to open a path so that the water can run through their plot. Moreover, every user has to make furrows in the parcel so the water can deposit next to the crops.

Photo 11: *Riego por inundación* of a corn parcel in San Isidro

The *riego por aspersión* is less extended than the previous one but is more necessary in plots that have a slope. It consists in the implementation of a sprinkle in the parcels, so all the crops are irrigated on the surface. Similarly, as the irrigation *por inundación*, the users communicate the irrigation ditches with the crops through hoses where the sprinkler is placed. Moreover, the furrows are usually made horizontally when the plot is in slope so that the water is contained between the crops.

Thus, the decision to use one or the other depends on different factors: First, the degree of inclination of the parcels, to avoid the waste of water and the landslides of the terrain.

And secondly, the type of soils. For example, soils like *cascajo* (rocky soil) require more water because they dry very fast; while softer soils like *arcillosas* (clayey) become mud very fast and retain humidity for a longer time, so these do not need much water.

Although the irrigation *por inundación* is still predominant, it also demands more amount of water. This is perceived among the users across the sub-basin, especially due to the cultivation of crops that require more amount of water, such as vegetables and flowers. This concern has raised the interest in projects that impulse more technical irrigation systems, which during my fieldwork were perceived as a possible path for the future of agriculture in the Chicón sub-basin.

4.2. Implications of the increasing sensation of water scarcity: contested rights and the new roles of water infrastructures

Despite the coordination and practices in common within the Chicón sub-basin, there are also contrasting discourses regarding how the water should be used. These discourses are sustained in the particular ways in which water rights are shaped (Paerregaard *et al.*, 2016) and in the distinct notions of justice (Boelens, 2008) regarding the current uses and about the future of water.

In this section, I will address the different notions of water rights that are found in the sub-basin and how the negotiations and tensions take place when water scarcity becomes a concern. On the other hand, I will address one aspect of the current *water culture* that is being driven by the Peruvian government (French, 2016; Paerregaard *et al.*, 2016). In other words, the promotion for more technical irrigation and the implementation of infrastructures to deal with the water scarcity. In this part, I will describe two examples that show the implications of such measures in the Chicón sub-basin.

4.2.1. Who owns the water?: Perceptions over water control and scarcity

It has been addressed that the current water organization for irrigation in the Chicón sub-basin is based on the coordination between the four localities. One of the main aspects of the organization is the water distribution based on the number of users per committee, as a measure to ensure a regulated and balanced access to water for all the committee. However, despite that San Isidro and Chichubamba are the committees that count with more water endowments for irrigation, there is a strong perception that Chichubamba and Ccatán Pino are the localities that face most of the problems regarding the access to water.

"El agua era más cantidad. Entonces, tenías menos problema para regar, antes alcanzaba ¿no?	*"Water used to come in more volume. So you had less problems for irrigation, before (water) was*

Pero ahora para tener que regar hay que está peleando "que me toca a mí". O sea, la distribución es un poco difícil. (...) De comité...hasta en las comunidades...porque a veces lo utilizan más el agua y no deja fluir para Chuchibamba o para Yanacona. Entonces hay peleadas con la otra comunidad. (...) En época de sequía es más la pelea entre comunidades

enough, right? But now to irrigate you have to be fighting "that is my turn". I mean, the distribution is a bit difficult (...) From the committee…and also in the communities…because they sometimes use more water and they do not let it flow for Chichubamba or for Yanacona. (...) During the dry season is more about the fighting between communities.

Authority from the JASS of Ccatán Pino, female, 44 years old

"Si san isidro acapara el agua, el agua va ser escaso para Ccatán y para Chichubamba (...) ellos ya saben ya. A San Isidro le toca 3 tandas, años, de sus ancestros, ellos persisten, pero como está cambiando..(...) ellos persisten de que no. Como ahora se están dedicando a la floricultura, están llevando mangueras, agua; otros no están empadronados, así."

"If San Isidro hoards the water, it is going to be scarce for Ccatán and Chichubamba (...) They know already. San Isidro gets 3 tandas, from years, from their ancestors, they persist, but this is changing..(...) They persist that no. As they are working now in floriculture, they are carrying hoses, water; some of the users are not registered."

Water authority from Chichubamba, male, 62 years old

"Cuando vayas (abajo) vas a ver que te van a decir: "¡Uy! Nosotros sufrimos del agua. Y los de San Isidro a la hora que quieren se tapan. Ahorita estamos bien. pero luego de noche no más regamos". Así te van a decir, se van a quejar. Y esa es la realidad, ellos no hablan por gusto. Yo me doy cuenta que es cierto que sufren. "Si tuvieras tu chacra abajo llorarías por agua". Así me dicen. Claro, y tienen razón de hablar así porque no les alcanza el agua (...)Así es el recurso agua, problemático.

"By the time you go down (in the sub-basin), you will see that (people) will tell you: "Uy! We suffer of water. In San Isidro they stop using the water the time they want. We are now fine, but we only irrigate during the night". That is what they are going to tell you, they are going to complain. And that is the reality, they do not speak in vain. I realize that is true that they suffer. "If you had your terrain down (in the sub-basin) you would cry because of water". That is what they tell me. Of course, and they have reasons to tell me that because water is not enough for them. (….) This is the water resource, problematic".

Water authority from Yanacona, male, 59 years old

These perceptions are based in daily experiences such as the constant irrigation of crops that need more water (vegetables and floriculture, for instance) and the struggles that are felt when the water does not flow towards the lower basin at the agreed hours and quantity. But also, the sensation of inequality from the higher to the lower part of the sub-basin is based in the conceptualization of water as a finite resource and the perceptions of water scarcity for the near future. Thus, this scenario is strengthening the demands to change the ways water is currently controlled.

Indeed, during my time in the field, one of the most discussed concerns was the water rights corresponding to each of the localities, given that the water control is perceived to be stronger towards the localities in the headwaters. In this point, it is important to distinguish two aspects. First, the concept of *"usos y costumbres"* (uses and customs) which is attributed to the *Comunidades campesinas* (like San Isidro de Chicón) and

nativas across the Peruvian territory[45] by the law. And secondly, the cultural aspects that legitimize specific uses over water.

Thus, the *comunidades campesinas* have some autonomy in regard to their rules and norms, including the access to water (Orellana, 2014). This is recognized by the Law of Hydric Resources (Law N° 299338, *Ley de Recursos Hídricos*), the most important regulation over water matters in the country. Thus, according to the law[46], *"The State respects the uses and customs of the peasant communities (comunidades campesinas) and native communities (comunidades nativas), as well as their right to use the waters that flow through their lands, as long as it does not oppose the Law. It promotes knowledge and the ancestral technology of water[47]."*

Besides the legislation, the customary rights over water are based in the identity that is established between the people who live next to the glaciers and the *Apus* (Sánchez Garrafa, 2014; Gelles, 2006), being the activities, rules, and rights involved in the water control the ways to reproduce local identity. For the case of Chicón, Miranda and Valer (2018) explain that the origin of life is symbolized in the union of the glacier waters that gives birth to the basin, which in turn originates the irrigation and agriculture (Miranda and Valer, 2018: 78; also see Sánchez Garrafa, 2014). In this regard, the supernatural authority, embodied in the *Apus,* enhances the legitimacy of certain regulations and actions over water (Boelens, 2012).

In this regard, the concept of *usos y costumbres* within water management is linked to a sense of belonging that varies across the sub-basin, attributing the priority in the headwaters of the sub-basin. The *sense of belonging* has been expressed among some interviewees when it comes to their mainly daily struggles in the access to water; in the questionings regarding *who owns the water*. But also in decision-making spaces to discuss the distribution, access, and uses of water, especially for irrigation.

In the following lines, I will present quotes from interviews and also a transcription from a meeting among irrigation authorities. Both show how in this case the variation regarding the sense of belonging over the water resource is reflected in discourses, and in the rule-setting. Moreover, it is important to recapitulate the existence of different kind of political organizations in the Chicón sub-basin (*Comunidades campesinas,* annexes, and

[45] Comunidades campesinas (translated as peasant communities) are the communities that passed through the process of the Agrarian Reform in 1969. They are mostly located in the Peruvian Highlands and in less extent in the coast of Peru. On the other hand, the comunidades nativas (translated as native communities) are referred to the groups that have their origins in the Peruvian rainforest; and which share a language, territory and socio-cultural aspects.

[46] Ley de Recursos Hídricos (in Spanish). Web page of the National Authority of Water http://www.ana.gob.pe/sites/default/files/publication/files/ley_29338_0.pdf

[47] Article III, principle 5°

association of medium and small owners) which also reflect rules and principles of different origin and legitimization (Boelens, 2015; Strensrud, 2014) in the same sub-basin.

"Al final nosotros estamos en la cabecera, entonces nosotros somos dueños de nuestra jurisdicción. Entonces de acuerdo a ley como comunidad podemos hacer reconocer más manantes en nombre de la comunidad, y nosotros verificamos qué cantidad necesita cada comité para poder darles a ellos, dotarles agua".

"At the end we are at the headwaters, so we are owners of our jurisdiction. So, according to the law, as a community (comunidad campesina) we can make recognize our creeks in name of the community, and we check how much each committee needs in order to give them, to give them water".

Authority from the community of San Isidro de Chicón, 27 years old

"Sí, los de Chicón son un poco más posesivos, del hecho de que ellos se encuentran más cerca al nevado, se podría decir. Entonces, ellos quieren tomar la batuta "de que nosotros queremos ser presidente de JAS, nosotros queremos ser del riego". Ellos en cierta medida quieren ser los que...los que quieren dominar en todo esto, pero como le reitero, tratamos de que las cosas se lleven en paz y las cosas se hagan por igual"

"Yes, (the people) of Chicón are more possessive with water as they are close to the glacier, you could say. So that they want to lead "We want to be presidents of the JASS, of irrigation". They, in certain way, want to dominate all this; but, as I tell you, we try to make sure that things are taken in peace and done equally".

Water authority of the JASS of Ccatán Pino, female, 34 years old

"Ellos (en San Isidro) dicen que a los usos y costumbres. Claro, los usos y costumbres eran antes. A la hora que querían se soltaba el agua... eso es usos y costumbres. Pero ahora ya no pues. (….) No en tiempo seco. Ellos (en San Isidro) siempre hablan así arriba... "no, que usos y costumbres no podemos olvidar". Bueno, de repente, pero en tiempo de escasez de agua no hay usos y costumbres. Tiene que ser al máximo el agua utilizado. Ha sido costumbre que un topo[48] de agua se regaba en un día. Eso es uso y costumbre. Pero ahora, bien regado a lo mucho necesita dos o tres horas de riego. Porque es uso y costumbre no voy a estar regando todo el día, perjudicando a otros que en la parte de abajo necesitan.

"They (in San Isidro) talk about the uses and customs. Of course, the uses and customs were before. At the time they wanted they could let the water run down. But not now. (…) Not during the dry season. They (in San Isidro) always say "we cannot forget the uses and customs". Well, maybe; but in times of water scarcity there are not uses and customs. The use of water has to be used as high as possible. Before it was a custom to irrigate one topo of land in one day. That is use and custom but nowadays, it requires between two and three hours to irrigate. Because it is use and custom I am not going to be irrigating all day long, harming other people in the lower part of the sub-basin that also need (water).

Water authority from the irrigation committee of Yanacona, male, 59 years old

[48] 3 topos = 1 hectare

Transcript of a meeting observation that discusses the Rules of Procedure of the COMISIÓN DE USUARIOS DE AGUA DEL SUB-SECTOR HIDRÁULICO DEL RÍO CHICÓN- URUBAMBA[49]

The meeting is attended by all the irrigation authorities of the four localities: San Isidro, Yanaconas, Chichcubamba and Ccatán Pino; and the authorities from the Central Commision of Irrigation.

(….) The representative of the Central Commission proceeds to read the article 17° of the internal statute: *"The Irrigation Committee of San Isidro will use the four tandas[50] (40 liters per second) from 5am to 6pm. At that time they will must secure their gates with a padlock and let the water run down the river until the reservoir of Chichubamba*".

After the reading, the participants start giving their opinions:

The authority of the Irrigation Committee of San Isidro de Chicón mentions: "*We said that (water) has to be used according to the uses and customs. We do not want to disagree because, in fact, according to our uses and customs, you even have said that yes, that we take water from 5am to 6pm, and after we close the gate with a padlock, so that the reservoir (in Chichubamba) can be filled, and the other sectors can also have water availability. Even I said that in order to not to be excluded, we are ascribed in the Commission; however, we are still a comunidad (campesina). So as a community (comunidad campesina), the norms still support us when we use the water according to our uses and customs. That is what the Law says, the Law 30157 (Law of the User Commissions- Ley de las Comisiones de Usuarios) ratifies it.*

Authority of the Irrigation Committee of Ccatán Pino: "*What does it mean uses and costumes?"*

Authority of the Irrigation Committee of San Isidro de Chicón: *"We have used the water resource from our first settlers in San Isidro, both for human consumption and agriculture, and this has become in a custom regarding how we irrigate, how we take the water from the ditches and how the faenas are made. So I do not want to exclude myself because I am also part of the basin; but the law support us as communities (comunidades campesinas). This means that the properties or the associations of small and medium owners have other kind of treatment. That is why I said that this should be respected. (…) "*

Authority of the Irrigation Committee of Yanacona: *"Do you refer to the current or the ancient uses and customs? It is assumed that the uses and customs are referred to ancient times, to the past times in which we had more water, but now it has lowered. Before we did not work vegetables, but now we do. So it is not like before in which there was a lot of water. And, well, uses and customs, like before..."*

Authority of the Irrigation Committee of San Isidro de Chicón: *"Sure, but this is currently applied because the norms say so…"*

Authority of the Irrigation Committee of Yanacona: *"But now there is water scarcity as we work more. (…) So I do not agree with all this of the uses and customs because we are working more in agriculture, we are doing more work and that water is decreasing little by little.*

Authority of the Irrigation Committee of San Isidro de Chicón: *"In the future, these norms are going to have lots of modifications. (…) But I am not going to take advantage of the argument*

[49] In this transcript I will omit the charges of the authorities who attend the meeting. Instead I will use the denomination "authority" to refer their participation.
[50] 1 tanda is equivalent to 40 liters per second

that we are a community (…) No, what we want is that we want to preserve the uses and customs in the way we irrigate the water. (…)"

Authority of the Central Commission: *(Towards the representative of San Isidro) (…)You even received congratulations from some fellows from Chichubamba "That detachment of the San Isidro irrigation authority is good". So we established that your committee was going to use four tandas and now you tell us about the "uses and customs".*

Authority of the Irrigation Committee of San Isidro de Chicón: *"I said that we irrigate in four tandas. I cannot forget because I was talking about the uses and customs. So what is missing here (in the article) is "San Isidro will irrigate or will use the water according to their uses and customs, using four tandas and then the water will flow down in the programmed hours between 5am and 6pm". That is what I said and it has been this way."*

Authority of the Irrigation Committee of Ccatán Pino: *"But I think that you cannot put "uses and customs". I do not agree with that. It can be a background that…"*

Authority of the Irrigation Committee of San Isidro de Chicón: *"It is the law."*

Authority of the Irrigation Committee of Yanacona: *"What does it mean "uses and customs"?*

Authority of the Irrigation Committee of Ccatán Pino: "*Yes, what does it mean? Does it mean that you are going to do it in your way? Or it is not going to be respected?"*

Authority of the Central Commission 2: *"Well, you know that climate change is happening. Climate change is what is melting our glacier. Water for sure is scarce. Now, if we are going to purpose this, right? Are we going to consider the uses and customs? We will have to respect the endowments that San Isidro has from long ago, right? And they for sure will have to approve this because in San Isidro there is always this about "the water is ours". They have this criteria that the water is theirs. No, the water is from the State and it should be used in a rational way. So, that is what they say, and I think that this is not right because it should change. (Towards the Authority of the Irrigation Committee of San Isidro de Chicón) I remember that we have congratulated you because you said that we were going to adequate to the current reality. I think so too."*

Authority of the Irrigation Committee of San Isidro de Chicón: "*It is true. During an assembly in Chicón someone said "we are community, so that we are owners of the water". And I said "Fellows, let's be careful. We all are owners of the water, not only San Isidro". And I was lately perceived as a traitor in the community. But I am adjusting to the changes. What the article then can say is that we irrigate with four tandas according to their uses and customs. Nothing else."*

Authority of the Central Commission: "*No. We did not agree that the other day. We agreed that "San Isidro will use four tandas from 5am to 6pm. At that time they will must secure their gates with a padlock and let the water run down the river until the reservoir of Chichubamba". We did not agreed in any moment that this is going to be ruled by the uses and customs. If so, I would have…"*

Authority of the Irrigation Committee of Yanacona: *"Ok. That is fine"*

(The topic of the meeting changes)

The previous quotations distinguish the different kind of rights that are attributed to the localities located next to the main water resources (glacier, lakes, and creeks) in comparison with the localities situated in the lower part of the sub-basin. But the perceptions over differentiated access and rights over water, are not only determined by the physical proximity to the water sources, but also by the customary uses and norms that legitimize different levels of autonomy within the sub-basin.

However, despite the presence of the different discourses, in a context of increasing water scarcity, such differentiation in the use of water is becoming more contested. As the quotations reflect, the need to rationalize the water raises the question of how to reformulate water distribution considering the particular rules and uses of each locality. But also, how the water organization should be rethought for the upcoming dry seasons which are expected to be longer; and in regard of more water uses, such as floriculture and construction in the lower part of the sub-basin.

In this context, from the meetings I could attend during my fieldwork, the sub-basin, as a unit, is increasingly conceived as the shaft of the water organization. The organization of water as a whole is also encouraged by the kinship ties that are present across the sub-basin. Indeed, during my time in the field, I could meet families in one locality who had families in other localities; and also families whose residency and workplace (agricultural plots) were in two different localities. Secondly, this type of organization is being encouraged by the role of the technical measurements and water infrastructures that are linked to the future in the sub-basin, to cope with the new demands and limited resources. Thus, such shifts make it more difficult for each locality to organize water without the others nowadays and the future.

4.2.2. The role of infrastructure and technical irrigation for the water futures

The use of technologies and infrastructure for water conservation and distribution has always been present in the Andean societies, reflecting on how they have adapting and organizing in the face of harsh environments (Earls, 1998). In Chicón the use of such technologies and infrastructure has been changing drastically. In the beginning, the water system was based in Incan channels known as *Inca Llarqa* (Zegarra and Jiménez, 2018) which were destroyed after the floods in 1942; and by a set of ditches or *canales rústicos* made of stones and wet grasses (or *ch'ampas*), which still exist to this day. Nowadays, the water landscape is dominated by channels, pipes, river defenses, reservoirs, and ditches. The modernization and expansion of such infrastructure are part of how the future is conceived regarding the water system in the sub-basin.

In this regard, while at the sub-basin level, the irrigation committees and JASS have centered their work in the regulation of the water distribution and uses, and in

strengthening their organization; the role of other institutions located outside of the sub-basin such as the JUC, ALA (ANA), the Municipality of Urubamba, the Regional Government of Cusco, and the decentralized entities of the Peruvian Ministries (like the Sub-sector Program of Irrigation - *Programa Sub-sectorial de Irrigaciones, PSI-*, Agrorural and Sierra Sur of the Ministry of Agriculture) have focused their efforts in the development of water infrastructure and in the implementation of more technified irrigation projects in the Cusco region.

The increasing role of the technical measures and the implementation of irrigation infrastructure is part of the "water culture" that is being promoted by the Peruvian State. The "water culture" is characterized by a technocratic approach that privileges the efficiency, modernization, and productivity (French, 2016; Paerregaard *et al.,* 2016). In this regard, these are values that are expected to be homogeneous throughout the basins in the Peruvian territory (French, 2016; Stensrud, 2014).

One of the measures to optimize the use of water and increase the agricultural productivity is expressed in the Law N° 28585 – Law that creates Technical Irrigation Program (*Ley que crea el Programa de Riego Tecnificado*), which is being implemented by the Ministry of Agriculture. The law promotes the installation of irrigation systems not only to use water rationally and efficiently, but also to enhance the institutional strengthening of the local irrigation organizations.

In the Chicón sub-basin, the projects of technified irrigation have been gaining more interest as new proposals to deal with the increasing water scarcity, especially for the lower parts of the sub-basin. During my time in the field, the Municipality of Urubamba, the Regional Government of Cusco, and the decentralized entities from the Ministry of Agriculture were diffusing the importance of changing the current or more traditional water irrigation practices[51], especially the irrigation *por gravedad* (see chapter 3.2) in the sub-basin.

Indeed, despite that the *riego por gravedad* is the most extended type of irrigation in the sub-basin, it is also perceived as a type of irrigation that requires a great amount of water in comparison to the *riego por aspersion* (sprinkle irrigation) and others like the drip irrigation. In this regard, during my time in the field, all the irrigation committees and the Central Commission were working on the documentation and procedures to start with the project, while solving the doubts from the users in the assemblies. These doubts were mainly referred to the uncertainty that represents changing the primary type of irrigation and the own customs; and, on the other hand, if the amount of water from the technical irrigation would be enough to irrigate certain kind of crops.

[51] According to the Law N°28585, the Technical Irrigation Program seeks to replace progressively the traditional irrigation systems in the agricultural sector, as the current agricultural policies seek to massify the technified irrigation in the Peruvian territory.

Another kind of project that was sought to implement in the sub-basin was the *"Installation of the water service for irrigation and technification of the parcel irrigation for the improvement of the productive agricultural capacity in Sacro-Chinchero, Maras, Huayllabamba-Urubamba-Cusco",* or also known as the Sacro project. This initiative was started by the Municipality of Urubamba, and the Ministry of Agriculture to dam the waters from Ocoruruyoq and transverse them to the localities of Sacro, Maras, and Huayllabamba. Although this project was not yet implemented, during its planning, it found strong opposition from the water users.

First, the project was mainly contested due to the new paths that the water could take, as the water from the Chicón river was going to be used in other sub-basins in the province. This possibility raised the concerns in the lower parts of the sub-basin due to their current difficulties in the access to water. Secondly, the scale of such project in Ocoruruyoq could put the sub-basin in risk. In fact, before the GLOF of 2010, the Municipality of Urubamba was planning to do a similar project to store water in the high areas of the sub-basin for the dry seasons; however, after the last GLOF, the first priority switched to the risk management measures in Ocoruruyoq.

The planning of both projects shows the increasing role that the technical measures, as well as new infrastructure, is having for the water futures in the sub-basin. This approach has implications in the water organization of the sub-basin, as the local committees and JASS are expected to fit in the current "water culture" promoted by the Peruvian State. Although these values are not unrelated to the aims of the irrigation committees, it is yet a concern that the current water laws are more thought for how agriculture is conducted on the Peruvian coast. In other words, more technical irrigation in larger extensions of land, which cannot be reached under the current conditions of the irrigation committees and commissions. On the other hand, another concern regarding the current water laws is the increasing control that might be given to the governmental institutions through mechanisms that measure the water intake in sub-basins like Chicón.

Finally, the water futures in the sub-basin poses the question regarding the future flows of this resource. Precisely, after the GLOF of 2010 and the risk management works, the distance to the Nevado Chicón has shortened, which increased the awareness about the water flows especially from the glacial area and lakes. Consequently, the possibility of infrastructures in the places where the water born, such as Ocoruruyoq and the lakes, find more resistance among the population than the initiatives that are most likely to be implemented in the production area of the sub-basin. On the other hand, the perceptions regarding the future of water include the possibility of finding new water sources in the sub-basin (especially creeks in the high areas) which poses the question of the role of the local organizations and governmental institutions for the future.

5. DISCUSSION

The primary objective of this thesis has been to understand the current water management in the Chicon sub-basin, considering the context of glacier retreat and the changes in the landscape. I argue that to understand the current organization and practices around water is essential to identify the construction of the different meanings and relationships around the water sources. In this regard, it will be possible to understand how the localities that share the same water management, face the changes in the water flows and the increasing sensation of water scarcity in the Chicón sub-basin.

Water as an element that structures the Chicón sub-basin

By addressing the structure of the Chicón sub-basin or *wayqu* I wanted to understand how the space is conceived and divided. In the Chicón *wayqu*, water is the element that structures the space, and the ordering shaft of the social and cultural life (Mujica, 2016). But the *wayqu* is also the space in which land, people, and the other elements of nature come together and interact (Gagné & Rasmussen, 2016; Mujica, 2016). In this structure, how the water flows throughout the sub-basin leads to a series of different meanings, configuring distinct kinds of organization around the water sources.

Thus, the Chicón *wayqu* is conceived as a unit, as all the water sources are part of the same system; but also, different notions of water converge. Thus, the water from the Nevado Chicón is not separated from the one in the lakes, nor from the water that runs throughout the river and the hydraulic infrastructure. But on the other hand, there are different types of water: from the sacred one that is owned by the *Apus*, to the piped and contained one that runs through the hydraulic infrastructure.

In this regard, these different notions of water result draw distinct relationships with this resource displayed in the *wayqu*. According to the paths that the water take, two spaces can be distinguished in the sub-basin. One is the space where the water sources are born: the Nevado Chicón, the lakes and the plain of Ocoruruyoq. The second is the water that flows through the production area where the main economic activities are conducted, especially agriculture. Therefore, this is the area in which locates most of the hydraulic infrastructure for irrigation and human consumption. The findings regarding each of these spaces will be described in the following lines.

The Nevado Chicón and the *Apus*

Different studies have described the role of the *Apus* in the Peruvian Andes (Allison, 2015; De la Cadena, 2015; Bolin, 2009; Scoville-Simonds, 2018; Mujica, 2016; Sánchez

Garrafa, 2014; Miranda and Valer, 2018) to understand the relationship between people and glaciers; and which are the implications of the receding glaciers at the emotional, spiritual, and moral level (Allison, 2015; Brugger, *et al.*, 2013; Gagné *et al*., 2014; Jurt *et al.*, 2015). Based on these contributions this thesis aimed to explore the different representations of the Nevado Chicón and other water sources to understand their importance in the current water management practices.

To being with, throughout this thesis, I have been using the terms nevado and *Apus* to refer to explore the relationship with this water source and sacred entity, respectively. Both terms can apply to the same "object"; however, the relationship with one and the other is not the same. While the *nevado* (also named as *glaciar* – glacier- in Spanish or Rit'i – ice- in Quechua) necessarily involves the accumulation of ice and snow, the *Apu* is a sacred entity that lives in the glacier; but also in the mountains that do not have ice, and even in other water sources. Indeed, in the Chicón basin, *Apu* was also used to denominate the lakes and the plain of Ocoruruyoq; which highlights their importance as water providers and their symbolic significance in the sub-basin.

Thus, the Nevado Chicón (including the lakes) is the primary water provider of the sub-basin, while the *Apus* own the water sources. In this regard, the relationship with the *Apus* in the Chicón sub-basin comprehend the recognition of them as powerful (Bolin, 2009; Allison, 2015; De la Cadena, 2015; Scoville-Simonds, 2018; Mujica, 2016; Sánchez, 2014) and protective entities (Miranda and Valer, 2018; Sánchez Garrafa, 2015 and Paerregaard, 2013). Therefore, they should be given respect throughout different practices like the *ch'allado,* and *pagos* to ensure the access to water for the four localities.

Another difference is identified in the ways of approaching the *Apus* and the Nevado Chicón Thus, it has been described that the *Apus* can be present in dreams or by invoking them without the need to be physically close to them. In this regard, when some of the interviewees in Ccatán Pino and Chichubamba explained that although they did not approach to the glacier area before the GLOF of 2010, they could still feel close to the *Apus*.

With the ongoing changes in the glaciers in the Peruvian Andes, a question that has been addressed in previous researches is how deglaciation is changing the narratives around *Apus*, as they are losing their powers, primarily as water providers (Bolin, 2009; Allison, 2015). According to my results, I suggest that the power of the *Apus* does not rely on the amount of ice. Thus, this process is not exempting the *Apus* from their protective/ punisher attributions; nor from the characterization of owning minerals like gold and copper. In this regard, I did not find any evidence that glacier retreat is directly linked to a change in the Apus behavior.

However, the process of deglaciation is affecting the capacity of the glacier and the *Apus* to provide water to the sub-basin. Indeed, climate change is widely identified throughout

the sub-basin as a process related to the contamination and global warming in the world, causing changes in the glacier. The narratives around risk management and climate change have also been part of the work of the NGOs in the site, and of the Municipality of Urubamba. But the GLOF in 2010 was less attributed to a process of climate change. In this case, the characterization of the Nevado Chicón/*Apu* as an entity that possesses minerals led to different narratives and joint actions after the event. Or the institutionalization of the *pagos,* which became a space of encounter in the sub-basin to ask for water to the *Apus.* In this perspective, the characterization of the *Apus/* Nevado (or glacier) can be useful to understand further actions involving resources management, that also might cause encounters and discounters.

Concerning my research, the overlapping of the two concepts was challenging at times due to the different experiences and emotional attachment to the Apus and the Nevado Chicón. And also, in regard the different narratives and representations to name the places. For instance, the use of the terms *nevado* and *glaciar* to design the same object were sometimes used indistinctively during my interviews in Spanish (also by myself); or the space of Ocoruruyoq was also conceived as part of the Nevado, which also needed to be protected. Based on these challenges, the study of the representations of the glaciers/Nevados could be enriched with the linguistic analysis of expressions, toponyms, and meanings (in both Quechua and Spanish) of all the terms related to the glaciers in different situations. This contribution could deepen in the distinction between *Apus,* glaciers, Nevados and other categorizations of the landscape in contexts of environmental change, which also may contribute to further discussions about culture/nature.

The current relevance of the GLOF of 2010 and the risk management measures in the lake Rit'icocha

In this point of the discussion, I would like to address the relevance of an event like the GLOF of 2010 and the following risk management measures to understand the current water management in the Chicón sub-basin. Indeed, both events remain in the collective memory of my interviewees, as it has originated a different kind of narratives and emotional implications regarding the causes and effects of both events.

Indeed, both the GLOF in 2010 and the risk management measures afterward, led to a recognition of "new" places in the area of the lake Rit'icocha and Ocoruruyoq. In this regard, the physical transformation of the main water sources caused a significant impact in the social dynamics in the sub-basin, in terms of how the new landscapes are understood, and which are the roles and responsibilities to face new contexts.

On the one hand, the different discourses regarding the causes of the GLOF (the explosion in the glacier/ process of glacier retreat) led to new collectivities in the sub-basin to protect the glacier. Precisely, after the risk management works in Rit'icocha the local authorities

started to mobilize the population and asked for the union of the sub-basin to protect the lake. The strikes in Rit'icocha, the initial monitoring from the residents of San Isidro, and the construction of a door to enter into the glacial area, and the *pagos* in Ocoruruyoq are some of these examples.

Due to these changes, I argue that the level of awareness regarding these water sources has increased. Most of all, because agriculture and water for human consumption are sustained with the water that comes from the Nevado Chicón and its lakes; and, on the other hand, due to the increasing pressure over the water resources.

In this regard, the concerns regarding water availability include the current and future paths of the glacier water, and the possibilities of controlling those paths for the future of the sub-basin. Although there is no evidence about the contribution of each part of the Nevado to the Chicón river in this research, there is a current concern regarding the water flows that originate in the lakes, especially Rit'icocha and Azulcocha.

Indeed, after the observations in the lakes from some residents, it is identified that the lakes feed both the sub-basins of Chicón and Pumahuanca; but is not possible to predict where does the water go, as one year the flows can go to one or the other sub-basin. But also, it is widely recognized that the lakes are great contributors to the Chicón river. In this regard, the Chicón sub-basin is not unrelated to the proposals of future infrastructure to reserve water from the lakes, in spite of the precedents in Ocoruruyoq and Rit'icocha. Even more, as it was described in the thesis, the future infrastructure may include other sub-basins that also face problems of water scarcity.

Although the role of water infrastructure for the future of the sub-basin has not been addressed in depth in this thesis, I described how the dynamics around the infrastructure constructed in the production area of the sub-basin are contrary to the ones implemented in the headwaters, as these have been widely contested. In this regard, I argue that the GLOF and the risk management measures afterward are a precedent of how water has been redefined and how that is changing the relationship with the landscape.

In this regard, future research could address the implications of the role of infrastructures and technical measures to face water scarcity and their impact on the water systems. Precisely, previous studies have addressed the challenges that this kind of actions represent for the institutions, as the as the increasing reliance on technical solutions does not prevent the emergence of new risk and inequalities (McEvoy & Wilder 2012); but also for the local water organizations, who are most likely to face other difficulties to organize and maintain the new infrastructures (Postigo, 2013). And finally, which kind of knowledge would be necessary to face water scarcity as the upper areas are being redefined as spaces of water provision (Rasmussen, 2016).

The construction of water rights in the Chicón sub-basin: agreements, disagreements, and challenges for the water futures

The water management system in the Chicón sub-basin illustrates a diversity of irrigation traditions (Boelens *et al.*, 2009). First, the bureaucratic role of the State, which is reflected in the rules and rights. These rules include the formalization of the committees and commissions, the payment of taxes, and the conferment of the water licenses to authorize the use of different water sources. Secondly, the link of the spiritual powers that are linked to the water sources (Paerregaard, 1994; Sánchez Garrafa, 2014; Miranda and Valer, 2018). Thus, It has been described that the role of *pagos* is crucial to ask for permission to the *Apus* who control the access to water. And third, the customary uses, which are linked to the previous point and which are recognized by the Law. These are referred to the traditional uses of water in *comunidades campesinas*, like San Isidro, which constitute a vital part of the local identity of the community (Sánchez Garrafa, 2014; Gelles, 2006).

On the other hand, the rights of the access to water are also changing with the transformations in the landscape. Indeed, the productive and urban area of the Chicón sub-basin was subject of constant changes during the 90's in terms of hydraulic infrastructure for agriculture and water consumption. For agriculture, this resulted in the harvest of more crops per year, and in the cultivation of products that require more water. And on the other hand, farming in *tierras de secano* (areas irrigated with rainwater) is no longer prioritized, giving way to the agriculture that can be irrigated with the hydraulic infrastructure.

In this respect, the construction of the hydraulic infrastructure for irrigation and water for human consumption not only enabled a joint organization for the JASS and the irrigation committees; but it also created water rights and duties derived from the hydraulic infrastructure. This is materialized in the presence of the *tomero* and *gasfitero* who are in charge of controlling the water flows that run through this infrastructure. And also in the obligations of all the users to repair and maintain the hydraulic infrastructure.

Nowadays, given the increasing sensation of water scarcity in the lower localities of the sub-basin, some of the established rights are being challenged and discussed in the decision-making spaces. The sensation of scarcity in the lower areas of the sub-basin is mainly attributed to the greater use of water for irrigation that is made in the upper areas of the sub-basin, generating difficulties in the access to water for Chichumbamba and Ccatán Pino. And also, between these two localities, it is only Chichubamba which has access to a water reservoir for irrigation; in contrast to Ccatán Pino that waits for the water remnants to irrigate their crops. In consequence, water distribution becomes the main cause of tensions and disagreements in the sub-basin organization.

In this regard, the unequal distribution of water generates opposing discourses regarding how the water should be used. Each of them are sustained in the relationship with the

water sources, but they also imply recognition and legitimization from the other water users (Boelens *et al*., 2009). Thus, conflict arises as water users with different interests interact (Orellana, 2014); but also conflict becomes an inherent part of the water system as none of the water sources is used independently.

A clear example is the notion of *uses and customs (*usos y costumbres). Among most of my interviewees of San Isidro, this is a water right that is not only recognized by the State; but it is an expression of the relationship with the water sources in the headwaters, giving their residents a sense of belonging. This sense of belonging is, in one hand, sustained by the attribution of the *Apus* as the resources owners who give origin to life in the sub-basin (Miranda and Valer, 2018). On the other hand, the sense of belonging is constructed by the fact that the places where the water starts are in the jurisdiction of the community of San Isidro. In this regard, water and land are not dissociated (Gagné and Rasmussen, 2016) in the sense that the owners of the land it is also an owner of the water sources, giving them the right to decide over their access (Orellana, 2014). The other three localities do not base their water rights in the notion of *uses and customs* as irrigated agriculture is done on privately owned plots of land; however, their use of water is also recognized as a result of their accumulated irrigation knowledge.

But also, with the changes in the irrigation infrastructure the water rights were also modified, as the water availability increased and there were more control over the water flows. This is identified with the reservoir of Chichubamba, which was built to supply water specifically to this locality (the largest in the sub-basin). In this regard, at nowadays, this infrastructure gives this locality the capacity to make decisions about water reserves and over the water flows that run from this reservoir. The daily use of the infrastructure, especially during the dry season, is also recognized in the internal rules of the water organizations in the sub-basin.

The display of these arguments has a correlation in the daily water uses through claims that legitimize the differentiated access to water. (Boelens, 2008; Boelens *et al.*, 2009). Thus, it can be argued that, to a certain extent, the current water system in the Chicón sub-basin includes the rights that are claimed in the headwaters. These are subject of discussion, rejection, and negotiation in decision-making spaces. Primarily, during my time in the field, the claims from the lower parts of the sub-basin sought to regulate the current uses in the headwaters, to promote an equal distribution in times of climate change. These claims are also expressed in daily and contrasting discourses regarding *who owns the water,* showing that either the water belongs to the State or to the community of San Isidro.

The perception of the future uses of water involves other challenges, mostly regarding competition. Despite that in agriculture the changes in the uses of water are constant (like the more number of harvest per year) new economic activities as floriculture are slowly

gaining attention, especially in San Isidro. In consequence, it is generating opposing opinions regarding the amount of water that this activity is using. On the other hand, as stated, the increasing demand of the water of the sub-basin poses an open question regarding other uses of water than agriculture and human consumption; such as the construction of condominiums and hotels in the lower part of the sub-basin; and the water transfer to other basins in the province.

In conclusion, the water management in Chicón sub-basin is composed of a complex system of cultural, technical, organizational and political dimensions. The sub-basin has been comprehended as an organizational unit that manages the water for human consumption and irrigation. Thus, the cohesion between the four localities responds to the changes in the hydraulic, the vision from the State to promote a new water culture and, and the current changes in the water flows from the glacier. But on the other hand, the different notions and representations of water are evidenced in decision-making processes, creating agreements and tensions regarding the current water distribution.

In this direction, the aspects that cohesion and cause tension between localities, in regard to the matters exposed in this thesis, can also be useful to analyze other aspects beyond the context of water. Indeed, some topics that have not been addressed in this research are related to this and other matters, such as the emergence of leaderships in the sub-basin and the political influence of the water organizations; and the organization of the sub-basin when it comes to the management of other resources, for instance. Moreover, the particularities found in the Chicón sub-basin can be certainly found in other sub-basins in the Peruvian highlands. In fact, future research could consider the articulation of the particularities of sub-basins that organize the water sources together, in relation to the national water politics in times of environmental change.

6. CONCLUSIONS

- The main objective of this thesis was to address water management practices in the Chicón sub-basin considering the representations of the water sources and the ongoing changes in the landscape. In this regard, I argue that these aspects play a role in how rights over water and decision-making processes are conducted, not only within the Chicón sub-basin but also in relation with external institutions.

- In the Chicón sub-basin coexist different notions of water: from the sacred one that comes from the Apus; and the contained and piped which runs throughout the hydraulic infrastructure. The different notions of water lead to the establishment of distinctive relationships, organization, and meanings.

- The characterizations and attributions given to the *Apus* and nevados are also distinctive between them. And both help to explain different the relationships that are established in changing landscapes. But also, the different conceptualizations of the same "object" can also overlap. For instance, the process of climate change is recognized as one of the main causes of the deglaciation; however, regarding the GLOF of 2010 was less attributed to a process of climate change, but more to the own construction of danger based in the representations of the *Apus/*nevado as the owner of minerals.

- The narratives around the GLOF of 2010 and the risk management works afterward, showed particular representations that resulted in collective actions to protect the glacier and to preserve the water resources. Precisely, regarding the future, the increasing sensation of water scarcity a higher water demand might foresee the dependency in more significant hydraulic infrastructure and technical measures, as well as the search for new water sources in order to cope the water demand inside and outside the Chicón watershed. However, the reluctance for such constructions in the places where the water is born is higher compared to the infrastructure in the production area. In this regard, the case of the Chicón sub-basin can be useful to understand the ways people would engage with future risk management or irrigation infrastructure in a similar scale.

- The particular representations and uses of water are reflected in the water rights in the sub-basin. Thus, the role of the State, the role of the spiritual powers, and the presence of the irrigation system constitute the base on which water rights are built and transformed. With the changes in the sensation of water scarcity, these different representations become evident in decision-making spaces regarding how water should be distributed and used; and also encourages water rights to be rethought.

- Despite the different senses of ownership regarding water in the sub-basin, the changes in the glacier and the current sensation of water scarcity foresee the increasing relying on the self-organization at the sub-basin level, which is needed

to face longer seasons of water scarcity. The “union” of the sub-basin has been explicitly identified through collective actions to protect the water sources at the headwaters.

- Finally, the role of the State, represented in decentralized water authorities, is crucial as their laws and norms frame the current water organization in the sub-basin. Moreover, through different governmental institutions, the State is promoting a new water culture that privileges values like efficiency, modernity, and productivity; which are compatible with the increasing conception of water as a finite and scarce resource. In this regard, although in this thesis the articulation between the institutional and local views over water management has not been deepened, this topic would constitute an important contribution to water studies. Indeed, the particularities of the Chicón sub-basin constitute one example of all the particularities that are found in other basins and sub-basins in Peru. Consequently, this still represents a challenge for the water authorities to address in their norms and dispositions, which to some extent, are perceived as alien to the reality of the sub-basin.

7. BIBLIOGRAPHY

Agrawal, A., (1995). Dismantling the divide between indigenous and scientific knowledge. Development and change, 26(3), 413-439.

Bebbington, Anthony; Scurrah, Martín J.; Bielich Salazar, Claudia (2011): Los movimientos sociales y la política de la pobreza en el Perú. Primera edición. Lima: Instituto de Estudios Peruanos; CEPES; Grupo Propuesta Ciudadana (Serie Perú Problema, 36).

Bernard, H. Russell (2006): Research methods in anthropology. Qualitative and quantitative approaches. 4th ed. Lanham MD: AltaMira Press.

Boelens, R. (2008). The rules of the game and the game of the rules. Normalization and resistance in Andean water control. PhD thesis. Wageningen University, the Netherlands.

—— (2012). "Local Water Management in the Andes: Interplay of Domination, Power and Collective Participation", in Johnston, B.R. (ed) Water, cultural diversity, and global environmental change : Emerging trends, sustainable futures? Dordrecht: Springer, pp.65-75.

Boelens, R., & Gelles, P. H. (2005). Cultural Politics , Communal Resistance and Identity in Andean Irrigation Development. Bulletin of Latin American Research, 24(3), 311–327.

Boelens, R., & Zwarteveen, M. (2005). Prices and Politics in Andean Water Reforms. Development and Change, 36(4), 735–758

Adger, W. N., Barnett, J., Brown, K., Marshall, N. and Brien, K. O. (2012) 'Cultural dimensions of climate change impacts and adaptation', *Nature Climate Change*. Nature Publishing Group, 3(2), pp. 112–117. doi: 10.1038/nclimate1666.

Allison, E. A. (2015) 'The spiritual significance of glaciers in an age of climate change', *Wiley Interdisciplinary Reviews: Climate Change*, 6(5), pp. 493–508. doi: 10.1002/wcc.354.

Boelens, R. (2008) *Tne rules of the game and the game of the rules. Normalization and resistance in Andean water control*.

Boelens, R. and Gelles, P. H. (2005) 'Cultural Politics , Communal Resistance and Identity in Andean Irrigation Development', *Bulletin of Latin American Research*, 24(3), pp. 311–327.

Boelens, R. and Zwarteveen, M. (2005) 'Prices and Politics in Andean Water Reforms', *Development and Change*, 36(4), pp. 735–758.

Bolin, I. (2009) 'The glaciers of the Andes are melting: indigenous and anthropological knowledge merge in restoring water resources', *Anthropology and climate change: From encounters to actions.*, pp. 228–239.

Cárdenas, J., García, B., Astete, I., Zela, J., Ancco, K., Requejo, D., Carlotto, V. and Flores, T. (2013) 'Evaluación geológica y geodinámica en la quebrada Chicón: Aluvión del 17 de octubre del 2010 que afectó Urubamba-Cusco', *oro Internacional Peligros Geológicos, Arequipa, PE, 14-16 Octubre 2013, Libro de resúmenes. Arequipa: INGEMMET, pp. 204-207.*

Carlotto, V., Cárdenas, J., Concha, R., Astete, I. and Castillo, B. (2010) 'Geologia Y Geodinámica De La Quebrada Chicón : El Aluvión Del 17 De Octubre Del 2010 Que Afectó Urubamba-Cusco'.

Cruikshank, J. (2001) 'Glaciers and climate change: Perspectives from oral tradition', *Arctic*, 54(4), pp. 377–393. doi: 10.14430/arctic795.

Cruz Rivera, Y. K. (2017) *Mountain communities' perception of climate change adaptation, disaster reduction and ecosystem-based solutions in the Chicón Watershed, Peru*. Cologne

University of Applied Science - Institute for Technology and Resources Management in the Tropics and Subtropics, Pontifical Catholic University of Peru.

French, A. (2016) '¿Una nueva cultura de agua?: inercia institucional y gestión tecnocrática de los recursos hídricos en el Perú', *Anthropologica*, (37), pp. 61–86.

Gade, D. W. (2016) *Spell of the Urubamba*. doi: 10.1007/978-3-319-20849-7.

Gagné, K. and Rasmussen, M. B. (2016) 'Introduction - An Amphibious Anthropology: The Production of Place at the Confluence of Land and Water', *Anthropologica*, 58(2), pp. 135–149. doi: 10.3138/anth.582.T00.EN.

Gagné, K., Rasmussen, M. B. and Orlove, B. (2014) 'Glaciers and society: Attributions, perceptions, and valuations', *Wiley Interdisciplinary Reviews: Climate Change*, 5(6), pp. 793–808. doi: 10.1002/wcc.315.

Jurt, C., Burga, M. D., Vicuña, L., Huggel, C. and Orlove, B. (2015) 'Local perceptions in climate change debates: insights from case studies in the Alps and the Andes', *Climatic Change*, 133(3), pp. 511–523. doi: 10.1007/s10584-015-1529-5.

De la Cadena, M. (2015) *Earth Beings. Ecologies of practice across andean worlds*.

Lamadrid, A. (2014) 'Climate Change , Adaptation, and Water in the Central Andes', in *Irrigation, Society and Landscape. Tribute to Tom F. Glick.* Valencia, Spain: Editorial Universitat Politècnica de València, pp. 820–832. doi: 10.4995/ISL2014.2014.195.

McEvoy, J. and Wilder, M. (2012) 'Discourse and desalination: Potential impacts of proposed climate change adaptation interventions in the Arizona-Sonora border region', *Global Environmental Change*. Elsevier Ltd, 22(2), pp. 353–363. doi: 10.1016/j.gloenvcha.2011.11.001.

Paerregaard, K. (1994) 'Why fight over Water ? Power , Conflict and Irrigation in an Andean Village', in Mitchell, W. and Guillet, D. (eds) *Irrigation at High Altitudes: The Social Organization of Water Control Systems in the Andes. vol. 12*. American A. Washington DC, pp. 189–202.

Paerregaard, K. (2013) 'Bare Rocks and Fallen Angels: Environmental Change, Climate Perceptions and Ritual Practice in the Peruvian Andes', *Religions*, 4(2), pp. 290–305. doi: 10.3390/rel4020290.

Paerregaard, K., Bredholt Stensrud, A. and Oberborbeck Andersen, A. (2016) 'Water Citizenship: Negotiating Water Rights and Contesting Water Culture in the Peruvian Andes', *Latin American Research Review*, 51(July). doi: 10.1353/lar.2016.0012.

Rhoades, R. E., Ríos Zapata, X. and Ochoa, J. A. (2002) 'Mama Cotacachi change and glacier retreat in the ecuadorian andes', pp. 218–228.

Scoville-simonds, M. (2018) 'Climate , the Earth , and God – Entangled narratives of cultural and climatic change in the Peruvian Andes', *World Development*. Elsevier Ltd, 110, pp. 345–359. doi: 10.1016/j.worlddev.2018.06.012.

Stensrud, A. B. (2014) 'Climate Change, Water Practices and Relational Worlds in the Andes', *Ethnos*, 1844(March 2015), pp. 1–24. doi: 10.1080/00141844.2014.929597.

Salzmann, N. et al., (2009). Advances in Geosciences Integrated assessment and adaptation to climate change impacts in the Peruvian Andes. *Advances in Geosciences*, 22, pp.35–39.

Scoville-simonds, M. (2018). Climate , the Earth , and God – Entangled narratives of cultural and climatic change in the Peruvian Andes. *World Development*, *110*, 345–359. https://doi.org/10.1016/j.worlddev.2018.06.012

Stensrud, A. B. (2014). Climate Change, Water Practices and Relational Worlds in the Andes. Ethnos, 1844(March 2015), 1–24. https://doi.org/10.1080/00141844.2014.929597

Tecsi, L. & Tupa, J. (2017) "Aluvion en Chicón". Representaciones Sociales de un desastre glaciar en la Cuenca Chicón-Urubamba. Tesis de licenciatura. Universidad San Antonio Abad del Cusco.

Trawick, P. (2003). The Struggle for Water in Peru. Stanford, CA: Stanford University.

Unidad de Glaciología y Recursos Hídricos. (2014). Inventario de lagunas glaciares del Perú. Huaraz. http://www.ana.gob.pe/media/981568/lagunas.pdf

Zans Candia, L. (2007). Urubamba, benemérita ciudad y provincia arqueológica del Perú. Cusco: JL editores.

Zegarra J. and Jimenez D. (2018). Percepciones y prácticas del agua de riego en un contexto del cambio climático por los pobladores de San Isidro de Chicón- Urubamba-Cusco. Tesis de licenciatura. Universidad San Antonio Abad del Cusco.

Articles from Web pages,

Orlove, B. (2017) *A Ritual to Honor Mountains in a Peruvian Village.* 5 sept, 2017. http://glacierhub.org/2017/09/05/a-ritual-to-honor-mountains-in-a-peruvian-village/

8. Personal Declaration

I hereby declare that the submitted thesis is the result of my own, independent, work. All external sources are explicitly acknowledged in the thesis.

María Dulce Burga Hidalgo

Lima, 30/09/18