LOOKING FOR THE PAST IN THE PRESENT: ETHNOARCHAEOLOGY OF PLANT UTILIZATION IN RURAL BOLIVIA

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Abstract

Ethnoarchaeology is a still developing field of anthropology, where the methods of ethnography and archaeology are combined to interpret archaeological findings and generate and test hypotheses. Ethnobotany is the study of people and plants and their interactions.

Through these two fields of study, I investigated the way contemporary people utilize plants in the rural Andean community of Huancarani, Cochabamba, Bolivia in the summer of 2008 to interpret and hypothesize about the floral remains of the archaeological site of Pirque Alto in Parotani, Cochabamba, Bolivia, which I excavated as part of my fieldschool in the summer of 2007.

Introduction

Ethnographic data has been used to interpret archaeological findings as early as the seventeenth century. Since then, conscious attempts have been made to systematize the use of ethnographic analogy in archaeology. These methods combined are termed ethnoarchaeology, a still developing subfield of anthropology. Ethnoarchaeology by definition is “the use of ethnographic methods and information to aid in the interpretation and explanation of archaeological data” (Stiles 1977), using, thus, the present to explain the past. Ethnoarchaeological data can be obtained from the literature of ethnographies and early accounts of travelers, but most directly through ethnographic fieldwork. This data can be applied to the archaeological record through direct comparison to archaeological findings and the generation and testing of archaeological hypotheses (Stiles 1977).

The interpretation of archaeological finds ultimately depends upon analogy. Archaeologists use their own life experiences, what they have heard, seen and read to interpret the fragmentary archaeological record. Common sense, which is founded on the archaeologist’s cultural background and world views, is not adequate to base analogies about the behavior of other past cultural groups (David and Kramer 2001). Thus, ethnographic analogies, specifically done through ethnoarchaeology, provide a more complete context “to understand cultural processes and the structure and function of prehistoric societies,” rather than the archaeological record alone (Stanislawski 1974).

Ethnobotany is the study of people and plants. Ethnobotanists study the way people utilize plants, as for example, how people collect wild foods, use herbs for medicinal purposes and craft canoes from plant materials (Paye 2000). Ethnobotanists can help archaeologists in the interpretation of plant remains by working in contemporary settlements and combining data about native plant classification, conceptions of plant-animal-human ecology and economic botany (Messer 1979)

Through these two fields of study, ethnoarchaeology and ethnobotany, I have investigated the way contemporary people utilize plants in the rural Andean community of Huancarani, in Cochabamba, Bolivia through the ethnographic methods of participant observation and structured interviewing. Huancarani is a small community composed of about 67 families, consisting mostly of women and children, since the men emigrate around the country and the world to work. The few men that do live there usually own their own land. There are two kinds of people that work the land: people that own and work their own land and people that work for the landowners (Hippert 2007). This ethnographic data, combined with the literature review, provides analogies that I have applied to the archaeological record, specifically to the floral remains of the Pirque Alto Site in Parotani, Cochabamba, Bolivia. I conclude with an ethnoarchaeological interpretation of the floral remains.

Background

Ethnoarchaeology

Archaeology as a discipline is a branch of the broader social science of anthropology. Thus, as an anthropological science, archaeology supplements the cultural perspective obtained from historic documents and informant testimony collected through ethnography. In turn, ethnography aids in the explanation of archaeological material by placing them in a cultural context. Their integration can be expressed through what Julian Steward said, “If one takes culture history as his problem, and peoples of the early historic period as his point of departure, the difference between strictly archaeological and strictly ethnographical interests disappear.” (Oswalt 1974).

Ethnoarchaeology involves the fusion of ethnography and archaeology and it broadly examines human behavior and the material, spatial and environmental context in which it originates. In other words, it is “the study of material culture in systemic context for the purpose of acquiring information, both specific and general, which will be useful in archaeological investigation” (Schiffer 1978). It is ethnoarchaeology’s fundamental task to enhance the archaeologists’ awareness of alternative human behaviors that could have occurred in order to make convincing archaeological interpretations. Even if extinct cultural systems might not have resembled any that exist in the present or that have been recently documented, the starting point for inference is still the ethnographic present (Gould 1978). Patterns of ethnographic behavior are useful to be compared with patterns of artifacts, ecofacts and features (Gould 1974).

A Brief History

In the United States, the use of ethnoarchaeological interpretations has been practiced throughout history with respect to Native American finds. However, the word ethnoarchaeology was first used at least as early as 1900 by Jesse Fewkes (Oswalt 1974). The initial period of ethnoarchaeology begins in the decade of 1956-67 with concerns of the “role of analogy in archaeological interpretation and the interrelationships of the archaeological, ethnological, ethnographical and historical approaches to the past.” Karl Heider’s work is one of the pioneer examples that initiated this sub-discipline. Heider subtitled his work “a cautionary tale” as a call to “alert archaeologists to the existence of a variety of models and to invite them to sharpen their analytical tools and develop new ones” (David and Kramer 2001).

With the rise of Lewis Binford’s New Archaeology came the realization of the need of models of human behavior from which to generate and test hypothesis in the archaeological record. This encouraged the use of ethnoarchaeology. In the recent period, from 1982-90, Ian Hodder concludes that artifacts are symbols in action that reflect and constitute culture. Later, from 1990-98, there is an increasing productivity of non-Western ethnoarchaeologists, although they are being trained in Western anthropological tradition. Also, the topical area of ideology emerges, giving insight into the meaning of material culture (David and Kramer 2001).

Analogy

The core of doing ethnoarchaeology is analogy, since it is what allows for the integration of archaeological and ethnographical data for interpretation. Analogy is simply the assignation of cultural purpose to artifacts, assaying the unobserved behavior with referral to the observed one, which is relevant to the comparison. It is implied that a particular meaning given to an object by people can be inferred as the meaning of a similar artifact. These implications are more valid when there is cultural continuity (Oswalt 1974).

Some issues in Ethnoarchaeology

Data collection in ethnoarchaeology poses some problems. Informant interviewing is a method utilized by ethnographers, but it encounters problems when applied to ethnoarchaeology. Informants might not be able to provide from memory enough details about all events and activities in order to derive accurate behavioral generalizations. Also, discrepancies between the informant’s knowledge and the archaeological record can exist. On the other hand, as with Rathje’s Garbage Project, informants can be very accurate. Due to this uncertainty, it is more prudent to rely on observations of actual behavior. Informants, seeing the archaeologist as ignorant might provide childlike responses. Thus, behavioral observations should be taken in order to assess possible biases (Schiffer 1978). Through participant observation, the “ideal patterns” or “normative statements” offered by the informant can be avoided (Oswalt 1974).

Another problem found in ethnoarchaeology is that of archaeological visibility. First, preservation of organic material and what remains after they have been deteriorated might not be a representative sample of the past behavior of a society (Gould 1974). Their absence in the archaeological record may indicate that they were, first, not present in the environment; second, not classified as edible, in the case of food remains; and third, by chance, they were not preserved in the archaeological record (Messer 1979). Other aspects of visibility are the transitory nature of many ethnographic sites, especially hunter-gatherer camps, and the danger that, because of natural factors, no archaeological traces will be left (Gould 1974).

The temporocentric perspective of ethnography “can seriously distort the view one obtains of the dynamics of an ongoing system,” like for example, when events in a behavioral system are not observed during a research period. However, unobserved data can be discovered by extrapolating the synchronic statements from a time period long enough to reveal any processual anomalies or inconsistencies (Schiffer 1978).

Another issue with time is that ethnoarchaeologists tend to assume a “pristine” nature of the societies’ studied or only consider that which is perceived as traditional. However, it is necessary to take into account the “radical cultural discontinuities occurring in the period of European expansion and colonization.” Therefore, ethnoarchaeologists should make clear when, where and how they made their observations, and analogies should be grounded in specific time-space contexts (David and Kramer 2001).

Theory and Models in Ethnoarchaeology

Society consists of the sum of relations that include material culture and the environment, within which individuals and groups stand. Human behavior cannot be explained completely by reference to social rules because people possess intentionality. People act in “open-systems,” co-determined by a variety of factors, including the social factor. However, some aspects of their behavior are more constrained than others, leading to what can be called “closed” or “restricted systems.” The simpler the system, the more closed it is and the more predictable it becomes for the archaeologist (David and Kramer 2001).

A model is crucial and should be based on both empirical observations and a logical approach derived from general system's theory. In a discontinuous model, one in which the ethnographic or historic people no longer live a traditional way of life, analogy most be derived from ethnographic studies that were made in an area with similar ecology, resources and technology. In a continuous model, on the other hand, one in which the living, ethnographic society can be shown to be historically continuous with the prehistoric cultures being excavated in the same region, there is greater probability that the model derived in the present is applicable to the past in that region (Gould 1974). Thus, continuous models rely much less on uniformitarian assumptions and offer a higher degree of probability in interpretation (Gould 1978).

Ethnobotany in Archaeology

Ethnobotany, as already mentioned, is the study of people and plants, and can be very useful to archaeologists as well as ethnoarchaeologists that are studying plant remains. The more ethnobotanical data the archaeologist has, the more complete their functional interpretation of paleobotanical remains is. Ethnobotany can provide the range of potential edible plants and how single plants are used over the course of their life cycle. The latter can also suggest why certain plants became candidates for cultural manipulation and cultivation (Messer 1979).

Environmental Setting

Bolivia has three well-identified regions, divided by their altitude and climate:

Altiplano. The altiplano or the highlands has an altitude beyond the 3500m above sea level, consisting of mountain chains and plains that cover a 23.2% of the country's land. The climate is predominantly cold, having wind currents during the day and frosts during the night for approximately 180 days a year. Precipitation varies between 80 to 600mm annually between the months of September through March.

In pre-Hispanic times, several important groups settled there, including the Tiwanakus, the Kollas and the Incas. During the colonial era, it was the exploitation center of the mines and the native people. It is the place of origin of crops such as potato, *oca*, *isaño*, quinoa and others. Currently it is the most densely populated zone along with the valleys.

Valley. The valley is composed of lands found at an altitude between 1500 to 3500m a.s.l. These lands consist of ample plains, plateaus and valleys between hills. It covers a 14.6% of the national territory. The climate is benign with a pluvial precipitation of 400 to 900mm per year, distributed in a span of six months. The temperature ranges between 18°C and 24°C, having 4 to 8 days of frost per year. Geographically, the valley is a central stripe in the national territory and agriculture is one of the principal economic activities of the people, including small agro-industries and handcrafts. Since colonial and republican times, the valleys have been, and still are, the providers of the most diverse foods from tubercles, grains, fruits and vegetables to several citric and coca leaves.

Plains. The plains consist of 62.2% of the land with ample savannahs, forests and hills. The climate is tropical and the annual precipitation varies from 600 to 4,000mm. Its low population density allows for a variety of wild plants and animals, forming part of the Amazon.

As the economic activity, animal husbandry is exploited in the plains. Also, enterprises have developed crops such as cotton, soy, rice and sugar cane. The colonized areas have been settled by Japanese, Mennonites, Quechuas, Aymaras and others (Tapia-Vargas 1994).

The Central Valley of Cochabamba(Sipe Sipe)

The Central Valley of Cochabamba is physiographically located inside the zone of mesothermal valleys, next to the central mountains, lying in the valley region of Bolivia. Altitude variation in the Central Valley ranges from 2740 m a.s.l. to 5030m in the Tunari, which is the highest peak of the Tunari Cordillera. To the west of the Valley, the mountains reach a maximum height of 4000 m with Cerro Toro Huanuña. The plain on the central part of the valley has an elevation of 2600 m above sea level.

The Cochabamba Central Valley basin is a tectonic plaque that has been occupied by a lake for a long period of time. Therefore, the deeper parts of the sediments are composed of lake deposits. The lake coverage diminished and enlarged. Most of the Cordillera is covered by Paleozoic rocks, and to a lesser degree, Mesozoic rocks. As a result of the last glaciation, there are glacial sediments and a great number of residual lagoons.

On the north and west sides of the valley, where rivers with a strong current deposit their “charge” in lower lands, there are formations of alluvial fan deposits, which form the alluvial plains next to the mountains. These fans are important in order to take advantage of the underground waters that get their water from direct filtration of the rain or the water from the Cordillera and irrigation water (Peredo and Clavijo 2006).

Sipe Sipe

The second section of Sipe Sipe represents four "altitudinal flats". The first one, where Sipe Sipe and most communities are found, ranges from 2450 to 2650m above sea level. Sipe Sipe is found at 2530m and Parotani at 2459m. The second flat, is between 2650m to 2850m, having communities located on the slopes of the mountains to the north and west. The third flat, between 2850m to 3050m, is represented by the communities of Tamaca, Millota and others. The last flat, above 3050m, has he communities of Villa Bolivar, Ankoage, Escalera and Uchu Uchu.

There are also three ecological floors or flats in Sipe Sipe:

Montano Bajo: sub-tropical spinous steppe. This zone is characterized by an altitude between 2450 and 2650m above sea level, with an average annual temperature of 19.5°C and an annual average precipitation of 538.1mm. To this floor belong 24 communities of which some of the most populated are Sipe Sipe and Parotani. The land is favorable for the cultivation of corn, onions, carrots, *betarraga* (*betarraba*), alfalfa, potato and vetch as well as fruit orchards like apple trees.

Montano Bajo: sub-tropical dry forest. This zone is characterized by an elevation of 2650m to 2850m above sea level and a temperature between 15°C and 18°C. The average annual precipitation is of 654mm. The land is also favorable for agricultural production, especially for cultivating corn, onion, potato, fava beans (*haba*) and fruits. Its topography, having a 6% to 13% of slope, is being eroded by water, provoking the loss of agricultural fields.

Montano: humid forest, sub-tropic. With an elevation of 2850m to 3450m, an average temperature of 6°C to 12°C and a precipitation between 683mm to 770mm, this zone is favorable for the production of potato, *oca*, wheat and barley. In this zone there are 12 communities (Peredo and Clavijo 2006).

Topography

The relief can be divided in three zones: the Mountainous Zone, consisting of the Tunari Cordillera; the Slope and Piedmont zone, consisting of the plain that surrounds the Cordillera; and the Plains Zone, formed by lake deposits.

The topography of Sipe Sipe presents slopes of 0-5% plain or almost plain, slopes between 6%-13% slightly inclined and from 40%-60% moderately steep or very steep (Peredo and Clavijo 2006).

Climate

The second section of Sipe Sipe corresponds to the dry climates, having scarce and irregular rain and long droughts. These are mesothermal valleys found on the south. The average temperatures during spring, summer and fall are “medium”, going beyond 15°C. During winter, the temperature goes down and frosts are registered. The first frosts are registered on April and the last on September. The rest of the year has no danger of frosts.

In the Valley, rain fluctuates from 380mm to 700mm per year. And in Sipe Sipe, the average annual rainfall is between 470mm and 500mm, distributed during the months of October to March, January being the rainiest month. There are approximately 60 days of rain during the year. On the lowlands, between 2500m to 2800m, the climate is template and semi-arid (Peredo and Clavijo 2006).

Soil

The soils range from moderately deep, superficial and very superficial. The presence of gravel and stone in the surface varies from little to abundant. The textures are clear clayey, clear, clear sandy and clear clayey-silt. They are weak to moderately structured soils with variable infiltration and permeability; internal drainage is fast, moderate and perfectly drained with a high to moderate retention capacity. They have a natural fertility from low to medium (Peredo and Clavijo 2006).

Flora

The vegetation is poor in species. The vegetal tapestry is populated with grass-like plants. The dominant plants are spinous, cacti and succulent plants that survive from a water deficit.

The hydraulic balance and the temperatures in Sipe Sipe are favorable to the growth of plants from middle November to beginning of May. During summer, the climate is favorable for most of the “template crops” like wheat, barley, corn, potato and vegetables. Also some fruits are successful such as apple, vine, pear, peach and others. Vegetation varies on altitude and density, in relation to the type of soil and physiography (Peredo and Clavijo 2006).

Water Resources

The water resources of Sipe Sipe are primarily dependant on rivers, tributaries and wells. There are five river basins:

1. The Viloma Basin has three rivers: the Viloma, the Santus Mayu and the Chutu Mayu. The Viloma River, the most important one, benefits 32 communities with continuous water all year.
2. The Huallaquea Basin consists of the rivers Charinco and Higuerani.
3. The Pancuruma Basin has one river of the same name: Pancuruma or Chaco River.
4. The Rio Grande Basin corresponds to the discharge of all the waters of the rivers and "used waters" between the municipalities of Sacaba, Cochabamba, Quillacollo, Vinto and Sipe Sipe. In Sipe Sipe, this river served 10 communities and its water is used exclusively for irrigation.
5. The Quinta Basin consists of the Tapacari River with minor affluents. The benefited communities are Parotani, Itapaya and small valleys along the river shore. This water is also exclusively used for irrigation.

Another source of water are the tributaries or affluents from bigger rivers. There are also subterranean sources like *tajamares*, which capture the filtration of the river beds through a man-made structure. There is also a well system, dated to 1960, that has been continuously been perforated to nowadays as an alternative to scarce water. The wells have a depth of about 60m to 130m (Peredo and Clavijo 2006).

Contamination

The soil is much deteriorated due to poor practices of use and management. This is present in the agricultural fields, which are being urbanized without any criterion, as well as in the river shores. The air is contaminated due to the micro-industries that specialize in bricks, clay and limestone.

The water of the zone that is used for either human or animal consumption or irrigation, is also often contaminated, for there are no rules for the elimination of used waters, adding to that human trash (Peredo and Clavijo 2006).

Natural Phenomenon

Agriculture can be affected by droughts that interfere with the cultivation process. However, during the months of January to March, the rains cause overflowing of the rivers, destroying agricultural fields. Another climatic risk is the strong winds, typical of the Sipe Sipe region, which can destroy the crops of wheat, corn and fruit trees. It also causes erosion and the lost of superficial layers of the soil (Peredo and Clavijo 2006).

Cultural Chronology in the Andes

The cultural chronology in the Andes varies from region to region. The following discussion provides a chronological context within which the Parotani region and the Pirque Alto Site can be understood.

The Archaic Period

In the altiplano, the Archaic Period spans from 8000 B.C. to 2000 B.C. Little research has been done on this period, but what is known is based on research done in the highlands of northern Chile and Peru. Based on this research, the Archaic Period is believed to have been characterized by "small groups of hunter-gatherers, pursuing a relatively mobile way of life, moving with resources on a seasonal basis." It is clear that in this period agriculture was not practiced, although the first evidence of camelid domestication is present as early as 4000 B.C. within the south central Andes (McAndrews 2005).

The Formative Period

By 1800 BC in Peru and after 1600 BC in the Titicaca Basin, improved climatic conditions and increased rainfall correlates with the southward expansion of intensive agriculture into the drier and higher Cordillera. In the Titicaca Basin, rainfall gradually increased after 1600 BC, facilitating the spread and elaboration of agropastoral adaptations, marking the beginning of the Formative Period. With drought ending around 900 BC, the agropastoral communities grew in number and prospered (Moseley 2001).

During the Formative Period, people in the altiplano had a mixed pastoral and agricultural economy, having domesticated plants such as potatoes and quinoa, and domesticated animals such as llamas and alpacas. They also relied to a lesser degree on hunting and lake and riverine resources (Mcandrews 2005). Dependence on agriculture secured the veneration to Pachamama along with Mayu, or the Milky Way, and other heavenly bodies that are crucial for scheduling agricultural and pastoral activities (Moseley 2001).

The emergence of agricultural economies generally correlates with the appearance of pottery. Pottery is necessary for storing, cooking, and brewing agrarian comestibles. The primary staples of South America were complemented by beans, legumes, squash and fruits. Irrigation was an integral aspect of the new economic order both in the mountains and the coast, with canal systems influencing how people worked and where they lived.

In the highlands agriculture was supported by rainfall, having crops such as tubers and maize. In lower zones, irrigation canals allow for other crops like squash, beans and maize to be sown and harvested earlier than normal. Also, it is possible to plant and reap several times a year. This drew the uplands people into the lowlands both permanently and seasonally.

Having water, most canals can operate independently, forming and supporting a number of agrarian collectives or autonomous groups of people. The same happens with the rainfall-farming in the mountains. This lead to the construction of civic-ceremonial facilities, although without the political organization of *kurakas* and *señorios*.

It is hypothesized that people first entered the Andes as moiety based lineage groups. Thus, it can be reasoned that egalitarian societies were organized by similar principles and by cargo-like office hierarchies. It is likely that, with farming, concerns with kinship and descent as sources of entitlement to collective resources grew. The builders of canals monopolized the land and water. Also, the working of arable land requires intensive labor for plowing, planting and harvesting (Moseley 2001).

In the case that these collective groups claimed the land and used farm labor "then, the means and modes of agrarian production were always corporately controlled and owned. Individual farmers were similar to sharecroppers and access to the means of making a living was based on kinship and paid for by contributing to corporate undertakings." (Moseley 2001).

The settlement patterns consisted of small-nucleated villages with the first material evidence of the emergence of widespread iconographic styles and public architecture. It is argued that the trade networks of Tiwanaku began to form in this period around 1300 B.C. and consisted of the use of llama caravans to transport great quantities of goods between long distance regions (McAndrews 2005).

To this period the civilizations of Chiripa, on the southern shore of the Lake Titicaca, and Wankarani, the south of the Lake in a more arid region of Lake Poopo. Some eastern Wankarani villages occur at lower altitudes near the Cochabamba Valley. These settlements may have been established to exploit temperate maize-growing lands, representing early examples of verticality on the eastern slope of the Cordillera (Moseley 2001).

The Formative Period in Cochabamba (1150 BC-AD 200) is "characterized by a tradition of monochrome pottery with low proportions of decorated pottery (incised or painted)." The ceramic types were based on paste and temper from the Sierra Mokho site and on firing and surface finish from the Mizque site. Little is know about the socio-political organization of this period, though its lack of monumental architecture or large centers suggests relatively simple societies in comparison to the Formative in the altiplano with civilizations such as Chiripa and Pukara (Higueras 1996).

The Early Intermediate Period

Tiwanaku was one of several civilizations that trace their roots to this period. Located 15km from Lake Titicaca, Tiwanaku eventually developed an urban core, a city of monumental architecture and great stelae, once encircled by a shallow moat, beyond which adobe residential compounds, houses and refuse spread up to 10 km (Moseley 2001).

During this period, between AD 200-600, the Formative period ceramic styles decline and give way to four, local, pre-Tiwanaku styles: the Quillacollo style is suggested as the earliest due to its coexistence with the monochrome pottery; the Mojocoya style, located in northern Chuquisaca, south of Cochabamba; the Sauces style, identified in the Mizque Valley; and the Tupuraya style (Higueras 1996).

The Middle Horizon

This period is characterized by the Tiwanaku polity, which lasted from 400 B.C. to A.D 1200. Tiwanaku was supported by raised field agriculture and its capital had connections ranging from the Pacific Coast to Bolivia, Peru, Argentina and Chile (McAndrews 2005).

This period technically dates from AD 600 to AD 1000 in the Ica Valley of Peru. However, "it was set in motion in AD 562 when rainfall began a 25%-30% plunge that lasted until AD 594." Judging from the climate-monitoring ice cores drilled in the Quelccaya glacier south of Cuzco, the dry times were accompanied by increased atmospheric dust, attributable to decreased plant cover and uncultivated fields

Tiwanaku is divided into five phases of occupation starting on 400 BC, having large architecture and agrarian construction during phase 3. During phase 4, or Classic Tiwanaku, the metropolis expanded and began to create regional governments and a hierarchy of administrative centers around the south end of the lake. During phase 5, colonies located at a great distance and caravans were founded, spreading Tiwanaku influence down the Cordillera and the Chilean altiplano.

Tiwanaku's agrarian expansion came after AD 200, as drought gave way to normal and then abundant rainfall. It had an agropastoral economy that integrated farming and camelid herding. Llamas were used as packed animals in caravans that transported goods vertically, up and down the mountain sides, and horizontally, deep into Chile (Moseley 2001).

"The Tiwanaku polity maintained direct control over its immediate hinterland in the Ticicaca Basin." With its more distant contacts, like San Pedro de Atacama in Chile, Tiwanaku had a patron-client relationship, exchanging prestige goods (McAndrews 2005).

After the drought in AD 562-94, "Tiwanaku's integration of the southern, highland pole of Andean civilization shifted from ideological to a more of a political nature." Thus, Phase 5 was characterized by "strong sectarian concerns related to agricultural management in both the imperial heartland and dispersed regional nodes of state control." This lead Tiwanaku to prosper and flourish while rainfall returned to normal and higher levels.

Tiwanaku became the ideological and political essence of high montane adaptations and a true agropastoral state. Its nobility was sustained by surpluses from "field-ridge farming of enormous tracts of flat lowlands around Lake Titicaca", where the water table was high. These ridges were "long, narrow, artificially elevated planting surfaces, with maximum dimensions reaching 15 by 200 m." Essential to high productivity is keeping constant water in the trenches on either side of the ridges, since when the water warms during the day, it prevents frosts during the night. This water is also rich in nutrients and nitrogen-fixing plants. With this technology there were two harvests a year while only relying on rainfall produced one harvest of lesser quality. However, rivers and springs were also canalized and aqueducts were built, for prevention against the fluctuations of lake levels.

Around AD 1100, Tiwanaku started to collapse with the beginning of a four-century drought. The drought dropped the lake levels to 12m and depressed the water-table levels, leaving the ridge fields dry. This caused the population to disperse from the lake margins and shift to high mountain rainfall faring, which remains the general norm (Moseley 2001).

The Middle Horizon can be correlated to Higuera's Intermediate Period, between AD 600-1000, and can be identified with the ceramics of the Cochabamba style, the Derived Tiwanaku style, the Omereque style and the Grey Ware style (1996).

The Late Intermediate Period

Once Tiwanaku collapsed, the south central Andes were occupied by several smaller competing groups including the Colla, Lupaqa and Pacaje, which were still present during Inca and Spanish conquests. There was no unified corporate style or regional political integration as with Tiwanaku. Furthermore, "settlements had become very defensive in purpose and were often times located on hilltops" (McAndrews 2005).

This period (AD 1000-1600), is defined by different styles belonging to each survey area. Grey Ware is also found in this period. In the Capinota-Parotani survey area, the main ceramic style is the Ciaco style. Other styles are the Pacaje and Inca styles, which occur in extremely low proportions (Higueras 1996).

The Late Horizon

By AD 1400, the Incas dominated a stretch along the Andes, from the highlands to the coast and down the eastern slopes of the eastern Cordillera (McAndrews 2005).

History of Agriculture in Bolivia until Colonial Times

Prehistory. During the Stone Age, from the Paleolithic to the Neolithic, there is no evidence of agriculture. Moving to the Metals Era, there are three periods:

The Formative Period or Pre-Classic can be identified by the cultures of Chiripa, Wankarani and Tiwanaku, complemented by the cultures of Tarija and Lipez. This period is characterized by the apparition of the first sedentary communities, agricultural practices and complementary animal husbandry.

The Classic Period is identified with the last three phases of the Tiwanaku culture, having agriculture as its main activity along with projects of technological development such as irrigation canals, soil conservation, construction of terraces and deposits, climatic and astronomical knowledge, identification of deities related to agriculture, like Pachamama and the Sun, and important works such as the Gate of the Sun and the Moon, the temples of Kalasasay and Puma Punku.

The Post-Classic Period is represented by the Kollas, who cover an ample group that was incorporated to the Tawantinsuyu at the Incas arrival.

The Incan Period (1130-1533). At the time of the arrival of the Incas, agriculture was a well-established practice of the groups that inhabited the region. There were well-defined domesticated and regionalized plant and animal species and the use of rudimentary agricultural tools made out of stone, wood, bone and metals. The current Bolivian territory corresponded to the Collasuyu part of the empire.

The domesticated plant and animal species known in Incan times along with the agricultural practices came from previous cultures. The innovation of this period, however, resides in the production organization, having an organic distribution of land and production as well as having regionalization.

The domestication of identifiable plant species not only includes the plants used as foods, but also textiles, woods, and others, apart from the medicinal plants. Some of the current food plant species that have been present well before the discovery of America are, in the valleys and hills: corn, potatoes, pumpkins and beans; in the altiplano and transitions to valleys: quinoa, *cañahua*, *tarwi*, potato, *oca*, *isaño*, *papaliza*, etc; and in the lowlands: *camote*, *yuca*, cotton, coca and peanut. These species only refer to the generic name and not their varieties.

Colonial Period. With the arrival of the Spanish conquerors, agriculture went through irreversible changes. Due to the fact that the provisions coming from Spain were irregular and not enough, the Spanish needed the native production to complement their own. This necessity leads the way for the transplant and imposition of agricultural techniques from Spain to America, including the use of new agricultural tools belonging to the Iron Age and the introduction of new plant and animal species. The natives did not know how to use the new tools or how to take care of the new crops, having no time to assimilate and influencing their agricultural practice.

Some of the main innovations imposed by Europeans on America in relation to agriculture are the use of animals for hauling, like horses and bulls; the introduction of the wheel to drag loads on the road; the use of animals, like donkeys, mules and horses, for load and human transportation; and the introduction of domesticated animal species for meat and fiber such as bovines, ovine, pork and others.

The plant species or crops that were introduced are:

A. Cereals. Wheat, rice, barley, *avena*, rye.

B.Leguminosas. lentils, haba beans, peas(vetch), chikpeas (*garbanzos*).

C. Hortalizas(vegetables). Lettuce, chards (*acelgas*), cauliflower, onion, asparagus, *alcachofa*, celery, spinach.

D. Root crops. Horseradish (*rabano*), turnip (*nabo*), beet (*remolacha*), carrots.

E Fruits. Citron (*cidra*), watermelon, melon, eggplant, orange, lemon, grapefruit, lime, apple, pear, quince (*membrillo*), peach, cherry, *morello* cherry, pomegranate, fig, strawberry, plantain, mango.

F. Spices and seasonings. Saffron, anise, garlic, parsley, cumin, bay leaf, ginger.

G. Other plants, fruits and related products. Grapes and wine, olives and oil, sugar cane and sugar, coffee.

H. Textile plants and fodder. Linen/flax (*lino*), canvas/cannabis plant, wicker, alfalfa, clover (*trebo*l).

The animals that were introduced are horses, bovines, mules, donkeys, pigs, sheep, goats, dogs, cats, bees and silk worms.

Among the introduced working tools there are iron railings, the Egyptian plow, mattock/hoe, sickles, rakes and others.

The changes caused by the application of new agricultural technologies gave way to the extraction of the agricultural work force to work in the mines. Later with the desperate need of exploiting the mines, about a seventh art of the indigenous population between the ages of 18 and 50 were recruited to work in the mines, being reincorporated every six years. Preference for new crops resulted in native crops being left out, such as quinoa, *cañahua* and *isaño* (Tapia-Vargas 1994).

Andean Economic Verticality

The most influential general formulation of the relationship between the ecology and the economy in the south-central Andes was formalized by the anthropologist John Murra. Murra suggested that different ethnic groups in the Andes maintained a self-sufficient economy by controlling the altitudinally stratified ecological tiers.

The people that lived at an altitude of over 3000 m were limited to the kinds of crops they could cultivate. At this altitude, agriculture is risky and prone to frosts, hail, wind, drought and floods. Therefore, the inhabitants at this altitude recurred to lowland resources to enhance their variety and quantity of foodstuffs and reduce the risk of subsistence agriculture. The most prized temperate land crops were maize and coca.

A complex system of merchants and markets was in place in order to move these goods to long distances. However, the consumer had little control over the chains of barter, thus, the highland populations “relied more heavily on direct appropriation of desired resources through a strategy of maintaining autonomous production forces in as many ecological zones as possible.” The goods were produced, processed and transported from each ecological zone by members of a single group.

Two variations of this vertical economy are identified. First, in the compressed verticality strategy, the village or group resides in a location that permits easy access to contiguous ecological zones. Thus, different zones, such as pasture lands or resources like salt and honey, are within a one to two days walk from the parent community. These communities are usually located above 2000m in an agriculturally productive mountain basin.

The community maintains temporary dwellings on several ecological tiers and rotates residence among them in accordance with the agricultural and pastoral cycle of the seasons. This system relies on strong kinship and ethnic bonds, since solidarity and reciprocity are necessary.

The second strategy, called the vertical archipelago, also maintains residence in different ecological zones. However, these zones are widely dispersed, forming independent “islands” of production. In this system, food crops, raw products and other goods circulated through the archipelago instead of people. In some contemporary villages that practice this strategy, community members must hike up to 10 to 14 days from their homes in the mountains to reach distant fields in the tropical lowlands (Kolata 1993).

Raised Field Agriculture in Tiwanaku

Raised field agriculture occurs throughout the Americas and the world in different climatic regions. Depending on the environment, these fields promote drainage and lower local water-tables to reduce the risk of root rot. They also mitigate the killing frosts and promote the conservation of water and the recycling of essential nutrients.

In the Titicaca Basin, raised fields consist of large, elevated planting platforms ranging from 5 to 10 meters wide and up to 200m long, with a planting surface of 30% to 60% of a segment. The remaining portion is occupied by intervening canals that obtain their water from local rivers, natural springs or filtered groundwater. The flow of water was sometimes controlled by massive hydraulic projects designed by agro-engineers of Tiwanaku such as dikes, aqueducts, primary canals and canalized springs, *quebradas* and rivers.

The tools required to build these fields included wooden digging sticks, usually equipped with hard stone, or more rarely, metal bits and foot plows to cut sod and break up soil. Baskets or folded textile bundles were used to transport earth to the construction site. The foot plow, in Quechua called chaquitaklla, was the principal agricultural tool of the Incas, of which similar variants are still in use in today's rural agrarian communities of the altiplano. Throughout the agricultural cycle, the farmers of Tiwanaku would maintain planted fields by weeding them by hand or by hoeing with their essential all-purpose agricultural tool: the wooden digging stick with a hafted, basalt-hoe blade.

The weeds that were extracted from the fields were used as vegetal fertilizer by being worked into the soil, in which their decomposition would add nutrients to the field. The herding of llamas and alpacas brought to the recently-harvested fields an invaluable natural fertilizer. Also, the organic, nutrient-laden sediments that develop in the canals make up for the nutrient deficit of highland soils. These sediments were cleaned periodically from the canals and used as fertilizers. Fish bones left to decay were discovered as a natural fertilizer in the Pampa Koani zone this technique has also been found in Peru, as described by the Spanish chronicler Cieza de Leon and Cristobal de Molina (Kolata 1993).

Levels of Agricultural Technology

Nowadays, agricultural technologies in Bolivia range from the most primitive and traditional to the most modern practices. There are three types of technologies:

A. Traditional technology is characterized for being located in zones where the agricultural fields are scarce and the tools are elementary and rudimentary. The lack of resources and occupational alternatives allows for a high availability of work force and is culturally identifiable with the indigenous population (Quechuas and Aymaras), who settle, mostly, in the altiplano and valley. From Incan and colonial times to the Republic, until close to 1950, they have constituted the area where a great part of the foods consumed nationally is produced. This model is characterized by a high concentration of work force; recycling the intake; the absence of technological change; decision of crops based on personal consumption; limiting technical and economic resources and productive infrastructure; and a high level of diversification of production. This model is composed by about 80% of the agricultural population and covers 50% of the cultivated area. The preparation of land is manual or, sometimes, animals are used for hauling. Seeds last for more than four centuries; fertilization depends on the availability of organic matter; and the technique for re-fertilization is letting the soil rest. The agriculturalist is the principal provider to the cities.

B. The intermediate technology is characterized by having a productive infrastructure; having economic resources for investment; more than 70% of the production goes to the market; and the product has a higher quality than in traditional technology. This consists of 15% of the agricultural population and covers a 20% of the agricultural land.

C. Modern technology substitutes, in great part, the work force with agricultural machinery or chemical products. It is characterized by the capacity to buy or produce their own investigation; the capacity of investment, incorporated with credit; it covers large extensions of fields with high profits; requires having deposits and storage; it defines, to a degree, the different tasks of the sowing process; and it is destined to the agro-industry (Tapia-Vargas 1994).

Agricultural Crops of the Andes

Below, most of the plants mentioned as native to Bolivia in the focus group are described.

Tubers

(Popenoe et al. 1989)
Figure1: Potatoes
Family: *Solanaceae*
Species: *Solanum* spp

Potatoes (see Figure 1) have been cultivated in the Andes for approximately 8000 years. Different types have been selected by the farmers, depending on their needs and preferences, as well as the type of environment they lived in. This selection process has, throughout a long period of time, resulted in thousands of different types of potatoes. Sometimes, more than 200 different kinds are grown on a single field (Popenoe et al. 1989). These species are sown in the Andes from Colombia to Chile (Cardenas 1989).

The potatoes can be of different brilliant colors and particular shapes. Most of them have high nutritional qualities. They also have different culinary qualities such as been less watery or having a nut-like taste and crisp textures. Most of these little known potatoes are adapted to marginal growing environments and possesses resistance to various troublesome diseases, insects and nematodes as well as frost (Popenoe et al. 1989).

Many are grown on high mountain slopes and might be restricted to such environments. Most of them yield less than the modern potato, having deep eyes and irregular shapes that make them harder to process and handle in big quantities than the regular potato. Many of these little known potatoes of the Andes belong to many different species from the common potato elsewhere, but one is its ancestral form. To the north, central and south in Bolivia, there are many "clones" of the species *Solanum andigenum* such as the *runa* and the *imilla* (Cardenas 1989). There are also several hundred species of wild potatoes in the Andes (Popenoe et al. 1989). The main difference between the sown potato and the wild one lies in the size and the flavor. The cultivated potatoes have large tubers that are not bitter, being opposite to the wild ones (Cardenas 1989).

The peasants in the Andes do not think they are having a proper meal if potatoes are not included. However, it is not possible to live eating just potatoes. That is why, in the Andes, potatoes are complementary to maize, acting as a neutralizer to the digestive acidity produced by maize.

Potatoes were found by the Spanish and described in the chronicles of Cieza de Leon and Garcilazo de la Vega in Peru. Archaeologically, they are found represented in Chimu pottery, possibly dating from AD 1300 to AD 1400. They have also been found as *chuño* or dried in ancient Peruvian tombs (Popenoe et al.1989).

(Popenoe et al.1989)
Figure 2: Oca
Family: *Oxalidaceae*
Species: *Oxalis tuberosa* Mol.

In the Andean highlands, oca (see Figure 2) is second to the potato in importance. It looks like a wrinkled carrot and can be colored from white to red. It requires little care when growing and it is tolerant of harsh climates, yielding twice as much more than the potato. It grows in poor soils and at altitudes where most foods would not grow, between 3000 to 4000m. They are good sources of carbohydrates, calcium and iron. Oca has been found in early tombs on the coast of Peru, hundreds of kilometers away from its native habitat, proving its ancientness (Popenoe et al. 1989).

In spite of its importance, oca is only available in the markets for a few months due to its poor conservation. Oca is not divided into several species, since no major differences were found among the collections from Mexico to Bolivia (Cardenas 1989).

Ocas are used in a variety of ways. They can be eaten raw or added to stews or soups. They can be steamed, boiled or baked. In the Andes, they are placed in the sun for a few days to make them sweeter. Bitter varieties are usually dried, in order to get rid of the bitterness, sometimes using the same process to make *chuño*, which involves soaking the tubers in water, exposing them repeatedly to freezing temperatures at night and squeezing the water out by stamping on them (Popenoe et al. 1989). The *oca chuño* is called *caya*, and is also a way to conserve it (Cardenas 1989). Oca plants can also be used as stock feed. Livestock, especially pigs, like tubers and foliage (Popenoe et al. 1989).

(Popenoe et al.1989)
Figure 3: Ulluco or Papa lisa
Family: *Bacellaceae*
Species: *Ullucus tuberosus*. Lozano

Ulluco (see Figure 3) is found and used in many parts of the Andes, but only in a few places it can be considered a predominant root crop. Ulluco is a fully domesticated crop and evidence of it has been found in pre-Columbian art such as Tiwanaku-style paintings on pottery from Pacheco, Peru and as archaeological tubers in the coast of Peru, specifically in Ancon, near Lima (Popenoe et al. 1989 and Cardenas 1989).

These tubers come in bright colors with a waxy, shiny skin. Many are shaped like small potatoes, but others are curiously long and curved. They can be stored up to a year in cooler temperatures and must be stored in the dark, since sunlight turns its leaves green. They are grown like potatoes, often been planted together.

Ulluco is usually prepared by boiling, being sliced, shredded, grated, mashed or whole, rather than baked. They are also mixed or pickled with hot sauces, but generally they are used to thicken soups and stews (Popenoe et al. 1989). In Bolivia, they are eaten in *chupes* (spiced soups), or in a stew with *charque* (dried meat). The stew is called sakkta in Quechua, meaning “smashed” (Cardenas 1989). In the Andes, they are sometimes freeze-dried, like *chuño*, into a product called llingli, which is usually grounded to flour and added to cooked meals. The plant’s green leaves are nutritious and are eaten in Colombia and Peru as salad, boiled to make soup or eaten as spinach (Popenoe et al. 1989).

Grains

To the Incas, corn was a sacred grain and a major food, but climate restricted its cultivation to the lower elevations. Thus, at altitudes where corn could not produce, it was replaced with quinoa, *kinawa* and *kiwicha* (Popenoe et al. 1989).

(Popenoe et al.1989)
Figure 4: Quinoa
Family: *Chenopodiaceae*
Species: *Chenopodium quinoa* W.

Quinoa (see Figure 4) was considered sacred by the Incas as a vital food. In the altiplano, especially, quinoa is still in use. It is a major source of protein, taking the place of meat in the diet (Popenoe et al.1989) Some arguments suggest that quinoa replaced maize. However, nowadays, the natives of the altiplano go down to the valleys to exchange maize for potatoes or salt. Despite its high protein content, it does not replace maize in its product quantity or dietetic qualities (Cardenas 1989).

Prehistorically, archaeological remains of quinoa have been found in the form of branches, loose grains and small "cakes" made out of maize and quinoa flour in regions of Peru and northern Chile (Cardenas 1989). It was probably domesticated in several locations, such as the Andes in Peru, Bolivia and Ecuador, between 3000 and 5000 years ago (Popenoe et al. 1989).

The quinoa sown in Cochabamba at the edges of potato fields and at 2560m high, is well developed with a little grain and a relatively low yield. On the other hand, in the altiplano, near the Titicaca, it is smaller in size, but with bigger grains and a higher yield. . There are a great quantity of varieties of quinoa, which are distinguished by the color of their stems, leaves, fruits and seeds (Cardenas 1989).

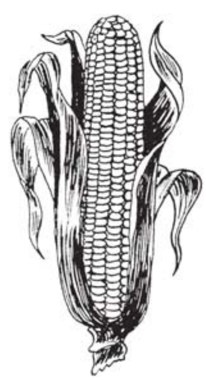
Today, it is used to make flour for baked goods, breakfast cereals, beer, soups, desserts and even livestock feed. Traditionally, quinoa is prepared like common rice or is used to thicken soups, but some varieties are also popped like popcorn. The grains are also traditionally toasted and can be fermented into beer. Quinoa can be mixed with wheat, barley or potato to make a nutritious food (Popenoe et al. 1989). In Bolivia, they also make a fried food with butter called pisara and a fried pasta with cheese. According to the chroniclers, the natives also ate the green leaves of the plant as spinach, although, nowadays, this practice is unknown. The flavor of the quinoa is not the best, being an acquired taste. Thus, perhaps, the ancient inhabitants used it to make beer out of its fermentation (Cardenas 1989). The leaves and stalks can also be fed to llamas, alpacas, donkeys, sheep, cattle and guinea pigs (Popenoe et al. 1989).

(Popenoe et al. 1989)
Figure 5: Kañahua or Kaniwa
Family: *Chenopodiaceae*
Species: *Chenopodium pallidicaule* (Aellen)

Kañahua (see Figure 5) is a very nutritious grain that grows in the highland environments, where wheat, rye and corn grow unreliably or not at all because of the intense cold. Even barley and quinoa cannot grow where kañahua grows, at an altitude between 3500m and 4000m. For example, its native area's annual temperature average is less than 10°C and frost occurs at least nine months a year. Thus, in the high Andes, it serves subsistence farmers as a "safety net" when all else fails. Also, few cereals have the high protein level of a 16%.

At the time of the Spanish arrival, kañahua was an important food in the highlands, and today, it is still grown in the Peruvian and Bolivian altiplano. It is mostly consumed by the family that grows it rather than sold in markets (Popenoe et al. 1989). In Bolivia, it is sown in a small scale near Lake Titicaca to the south of Lake Poopo. Morphologically, it is very similar to the quinoa, suggesting that they were contemporaneous in their domestication (Cardenas 1989).

The seed is usually toasted and grinded to form a brownish flour called *kañihuaco* that is eaten with sugar or added to soups. It is also used with wheat flour in bread, cakes and pudding (Popenoe et al. 1989). In Bolivia, the flour is called “pita” and is made from the toasted seeds prepared by the natives. This word comes from the Quechua pituk and the Aymara pituña (Cardenas 1989). And it is made into a beverage similar to hot chocolate sold in the streets of Cuzco and Puno. The leaves are high in calcium and favorable for the improvement of the soil. It is also an important forage for animals, especially during droughts (Popenoe et al. 1989). Father Bernabe Cobo, a Spanish chronicler, narrates that *chicha* was made with kañahua. It is not known if this was practiced in Bolivia, but since maize could not be sown at this altitude, it is likely that *chicha* was made from quinoa and kañahua before the conquest (Cardenas 1989).



(http://maizeandgenetics.tamu.edu/images/IMG2illustMOD.jpg)

Figure 6: Maize
Family: *Gramineae*
Species: *Zea mays* L.

Maize (see Figure 6) is one three cereals, along with wheat and rice, whose cultivation in America allowed for the development of advanced cultures such as the Aztecs, the Mayas and the Incas. Maize can prosper from sea level to an altitude of 3,814m high. In Bolivia, it is found in the Yungas to the east, in the mesothermal valleys on the eastern plains and in the island of the Sun in Lake Titicaca. However, the areas in which maize production is higher are in the mesothermal valleys in the departments of Cochabamba, Santa Cruz and Chuquisaca.

It is proved that maize was not known outside America before the arrival of Colon. Even though its origin is still debatable, extensive archaeological evidence suggests a Central American or Mexican origin. Its different forms have been identified as different varieties of the same species by some as well as different species by others (Cardenas 1989). Some "races" of maize that are useful for this study are described below.

Altiplano maize is a "race" adapted to high altitudes and a severe ecology in the Andean Plateau. It is found from Ecuador to Chile and Argentina. The plants are very small and their grains have diverse colors. Uchuquilla maize, known in Cochabamba, has a small, hard and white grain. Also yellow and red grains belong to this "race". And Valley maize is found in the high valleys of Peru and the inter-Andean mesothermal valleys of Bolivia. To this "race" belongs the jaka sara, culli, huillcaparu (wilcaparu), morocho and chuspillo corns. The valley maize has grains even on the circled part of the corncob and, with the exception of chuspillo, their grains are big. It represents the highest ramification index in its inflorescence and its number of leaves is very high.

Maize seems a much more important crop in Mexico than it is in South America. In Mexico, maize is consumed in several different ways that are in general not used in South America. In Bolivia, maize is known as green or dry. When it is green, cooked *choclo* is eaten with cheese and is made, preferable, with white maize from the Valleys. *Choclo* is also prepared with a thick soup called jaka lawa and as humintas. Humintas are usually made from grinded grains with salt or sugar, are cooked in the oven and, sometimes, in the leaves of the maize plant. Humintas can also be made from dried corn, being called tamales as in Mexico. In general, however, dry corn is boiled and made into *mote* or *tostado*. From the semi-toasted grains, lawa de jakaquipa is made with wilcaparu maize. *Chicha* is also made from the fermentation of the wilcaparo maize. Another dish that can be made is called tojori, pealing the maize in "bleach" water. Also, the practice of pealing maize in hot, ash-water must be very ancient and is done to facilitate the cooking of *mote*, in which case, it bursts open and is called pataska.

On the mesothermal valleys, maize is still grinded on stone (called maran) with half moon-shaped stone (called maran-uña) described by Garcilazo de la Vega. To the east, it is grinded with a wood instrument called tacu. According to Garcilazo de la Vega, there are three types of maize bread: zancu, for sacrifices, humintas for festivities and presents and ttanta (t'anta) or common bread. To the sara *tostado* (toasted maize), they call cancha, and the cooked one, muti (Cardenas 1989).

(Popenoe et al. 1989
Figure 7: Cucurbits or squashes
Family: *Cucurbitaceae*
Species: *Cucurbita Sp.*

Cucurbits (see Figure 7) consist of a series of related crops that include squashes, pumpkins, vegetable marrows and gourds. They have been particularly important in the Americas, being eaten along with corn and beans by the pre-Columbian civilizations like the Incas, Mayas and Aztecs. These plants are easily handled by peasants and individual gardeners and are easily cultivated, for a moderately moist soil satisfies most of its needs. Its yield to labor per hectare ratio, places the cucurbits among the most effective.

When mature they can be boiled or baked, or else, they are eaten as green vegetables. In some species, the leaves and flowers are eaten while in others the seeds are roasted and consumed as a snack (Popenoe et al. 1989).

There are four cultivated species: C. moschato Duch., C. Pepo L., C. maxima Duch. and C. fisifolia. There has been a lot of speculation about their origin, however, nowadays, their American origins are proven. Except for C. maxima, the origins of the rest lie on the Northern Hemisphere (Cardenas 1989).

Zapallo: C. maxima

Zapallo is a squash of the Andes, exclusively of South American origin. Its center of diversity lies in northern Argentina and Chile, southern Peru and Bolivia. It is a winter squash, thus tolerant of cool temperatures (Popenoe et al. 1989) Although, Cardenas argues that they only come from Peru and Bolivia (1989).

By the 1400's, it had been spread northward to the warmer parts of the Inca empire, though, at the time of Colon, it was still confined to South America (Popenoe et al. 1989). In the chronicles, it seems that the zapallo and the aullama (C. moschato) were the ones that called the attention of the Spanish due to their enormous size. Seeds identified as C. maxima have been found in archaeological sites in Peru such as Ancon, Pachacamac, etc. They are also represented in Chimu pottery (Cardenas 1989).

Achojcha: Cyclanthera pedata Schrader

Achojcha is not a true squash, but it belongs to the same family. It is undoubtly of South American origin, and, perhaps, the Caribbean. Still, it is found from Mexico to Bolivia, growing proficiently in mountainous valleys up to 2000m in elevation. In its immature form, it can be eaten raw or cooked, once its hard seeds are removed. A wild relative is used in several parts of the Andes by peasants. Both are called "poor-people's plant." It seems to tolerate more cold than the other cucurbits (Popenoe et al. 1989). In Bolivia, achojcha is cut into strips and used in the preparation of soups or fried salads during Holy Week. Archaeologically, achojcha is depicted in Cupisnique ceramics (Cardenas 1989).

Purutu or Frejol (beans)
Family: *Leguminosae*
Species: *Phaseolus vulgaris* (L)

Purutu or beans must have been very important in the lower regions where maize was cultivated at the same time and not in the regions of the inter-mountainous valleys, since there, cooking the beans in water would have been very difficult.

The chronicler Garcilazo de la Vega describes beans that were eaten as purutus, and those that were not eaten, which came in different colors, were called chuys. The latter were used in games, although the games were not identified in the chronicles. However, recently, children, workers and peasants in the Cochabamba Valley have been seen playing with them in simple games such as throwing them into a small whole. Also, *pallares* (butter bean) were the biggest beans and best quality, eaten green and stored dry.

Both frijoles and *pallares* have been found in archaeological sites in Peru, in relation to the beginning of agriculture. *Pallares* have been found in many sites such as Pachacamac in Lima, Paracas, etc. These beans were also art elements, being represented in pottery and textiles.

The species *Ph. Vulgaris* consist of all the cultivated beans that are extended throughout the world. In Bolivia, cultivated beans, except for a few varieties, are not utilized as food because of their cooking difficulty. The *porotos* sold in the markets, cooked or raw, come from Chile, the United States or Brazil (Cardenas 1989).

(Popenoe et al. 1989)
Figure 8: Nuñas (Popping Beans)

Nuñas (see Figure 8) or, in Quechua, purutus, are a type of the common bean used by the Incas and their ancestors in high altitudes, since ordinary beans could not be boiled so high. From Ecuador to southern Peru, they are grown above 2500m. They can be seen as the bean counterpart of popcorn. Different than the common beans, they are hard-shelled and come in different colors. They are usually consumed in the household, being rare outside the Andes.

Evidence found in the Guitarrero Cave in Peru suggests that these beans have been present since 11000 years ago, well before the Incas and at the beginning of plant domestication (Popenoe et al. 1989).

Parenchyma

In plants, parenchyma or ground tissue cells have an isodiametric shape and are seldom elongated. They are alive and are found in “the pith of the shoots, the storage tissue of the fruits, the seeds, the roots and other underground organs.” (Sengbusch 2003). The parenchyma found in the floral remains of Pirque belongs to the storage tissue and is generally found in swelled roots, bulbs and seeds (Terceros 2009).

The Community of Huancarani

Profile

The community of Huancarani is located about 27 km from the city of Cochabamba, on the highway that leads to La Paz. Its boundaries are to the east, the community of Sorata, to the north, the community of Montenegro, to the west, Valle Hermoso and to the south, the community of Hamiraya and the Viloma River (Geffroy 2002).

Huancarani belongs to the Sipe Sipe County, one of three counties in the second section of the Province of Quillacollo, which "serves as the administrative center for the surrounding area that borders the province of Tapacari to the west, Capinota to the south, the city of Quillacollo to the east and the department of La Paz to the north." Sipe Sipe, only about 3km west of Huancarani, is also the place where children go to high school, where the people vote and march for national and regional holidays, where they pay their electric bills and shop at the vegetable market.

In the community of Huancarani all structures are made of adobe and/or compounds, with 25% having some cement. The average house has three rooms: one kitchen and two bedrooms. About quarter of the houses have an outdoor kitchen (see Figure 10) in addition to an indoor one. About 80% of the households have electricity and 90% have potable water. There are no sanitation services available such as garbage pick-up.


Figures 9 and 10: The house where I lived and the outdoor kitchen across the house.

There is a school in Huancarani that is attended by about 200 children from Huancarani and the nearby communities from kindergarten to 6^{th} grade. It is a two-story building and it also holds the community's monthly meetings (Hippert 2005).

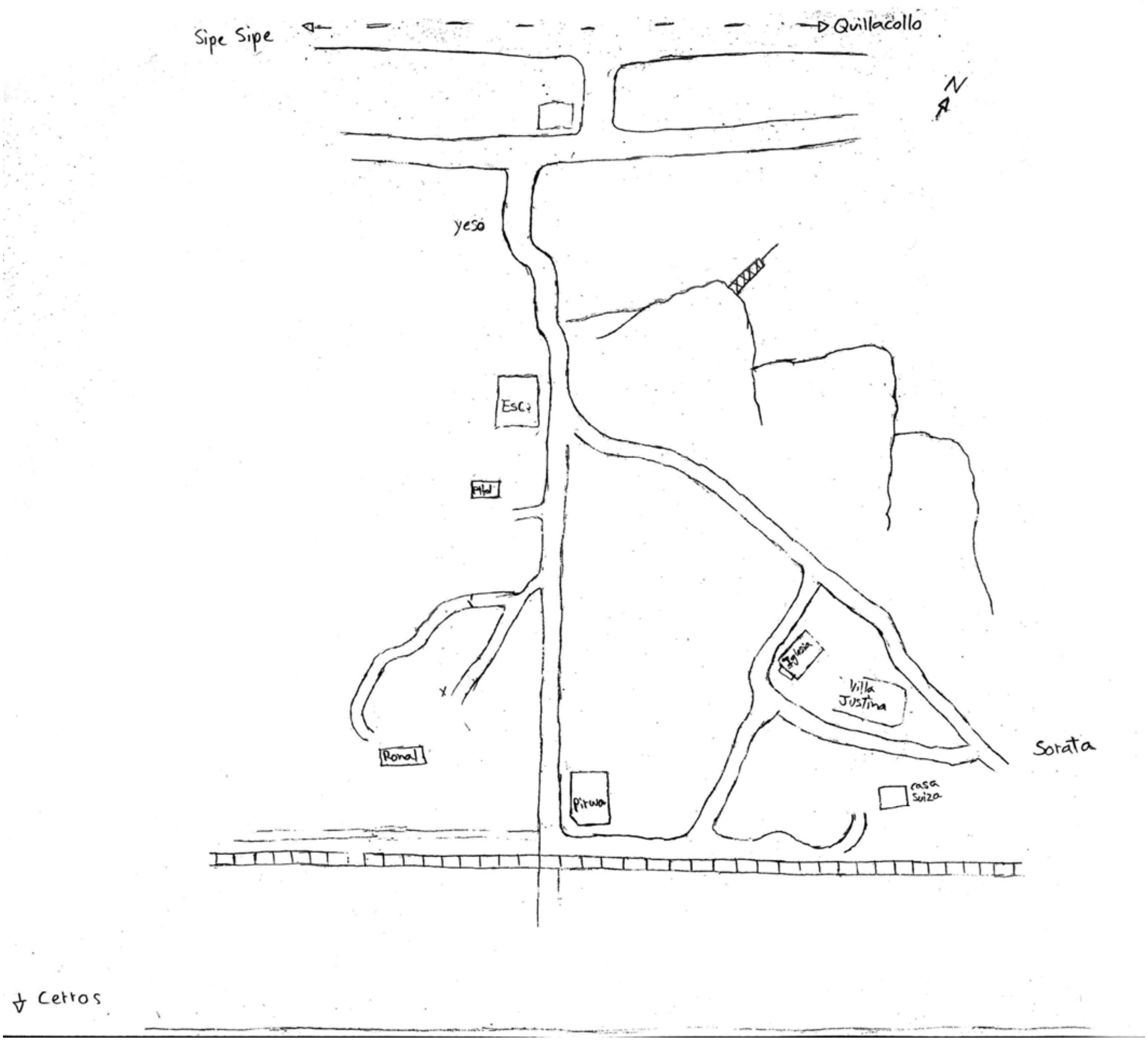


Figure 11: Map of the community of Huancarani

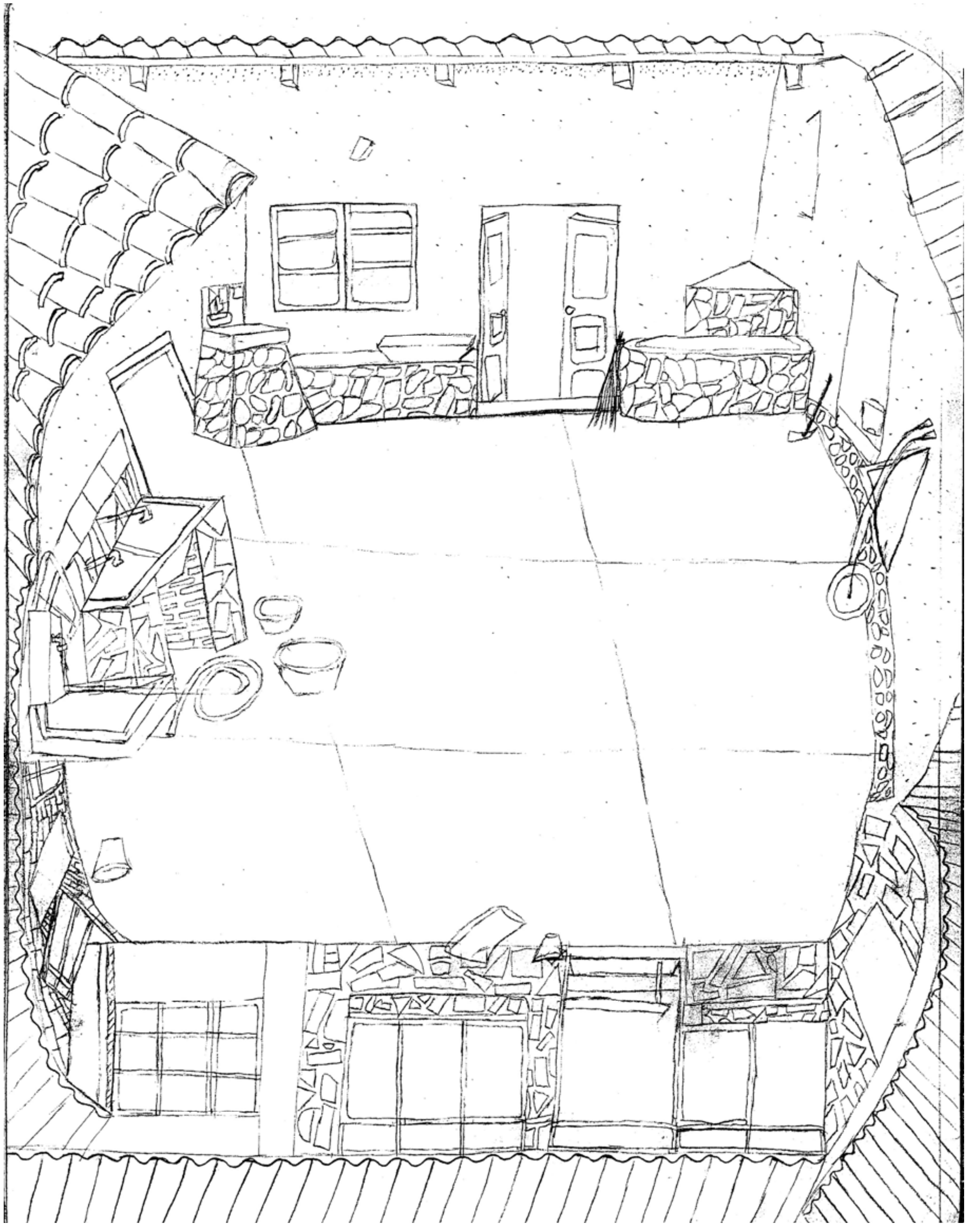


Figure 12: Doña Oneida’s house, where I lived.

History of Huancarani

Prehistory. Residents of the region of Sipe Sipe are the descendants of the Urus, an indigenous group that populated the region of Lake Poopo near Oruro, and whose settlement spread into the lower valley regions of western Cochabamba. During serial waves of migration, the area was settled by the Sauces, Tupurayas, Yamparas, Tihuanacus, Cotas, Cavis, as well as the Aymara-speaking Sipisipis (Hippert 2005). The Sipisipis were settled about 500 BC and shared the zone resources with other settlements in the Tunari Cordillera from east to west, where remains of the Inca Trail can be found (Rocabado 2004).

Before the Tiwanacu civilization, these groups had already formed an agricultural culture and remnants of them can be seen today in Sipe Sipe's current communities including Huancarani, Sorata, Hamiraya, etc. At the beginning of the Tiwanacu fall in the 3rd or 4th century came the Colla as a result of the union of Aymaras that lived in the valley and the highlands. This tribe settled in the valley for years before being disseminated by the Quechuas (Rocabado 2004).

With the arrival of the Incas under the rule of Tupac Yupanqui, the valley was integrated to the empire and subdued to a centralized political system through alliances with the local chiefs. Wayna Capac continued this political system with the goal of maize production for the army that moved towards Cuzco (Geffroy 2002).

The archaeological site of Inka Raqay is found in the Linku Mountain approximately 3100 m above sea level, constructed under the Inca dominance and thought to have served as a military outpost used to alert Cuzco of any invasions coming from the Amazon (Hippert 2005 and Rocabado 2004). The Incas conquered the Sipisipis, who were given the task of maize production for the Inca. Also, in the archaeological site of Cotapachi, between Sipe Sipe and Quillacollo, there is found a number "barrels" used to store high quantities of grains with nutritious as well as warfare purposes. There were more than 2000 of these barrels, placed on circular stone bases of 3m in diameter, constructed 5m away from each other. It is thought that they could store about 4,800 tons of agricultural products (Rocabado 2004). The Sipe Sipe region was also in the path of the preferred route from the Cochabamba Valley to the highlands of La Paz in order to transport agricultural goods to Cuzco, since this zone was also known for its high agricultural yields (Hippert 2004).

The Inca Tupac Yupanqui also delocalized several ethnic groups and brought some to the valley of Cochabamba as *mitimaes*, a sort of slaves that were moved to different regions and assigned in forts and gates to defend the empire. The Inca spread the Sipisipis and other regional groups to later bring to Cochabamba about 14000 workers from different ethnicities (Rocabado 2004). To the Sipe Sipe region, about a 100 *mitimaes* families arrived from Ica, the Peruvian coast (Geffroy 2002).

Colonial Era. The Spanish arrived to the Valley and founded the city of Cochabamba in 1574 with the name of Villa de Oropesa. However, Sipe Sipe was officially founded between 1542 and 1545 as the Real Villa de San Pedro de Talavera under Garcia Ruiz de Orellana.

In the mid 15th century, there is evidence of purchases of land by the Spanish to the Sipisipis, as an usufruct gift from the Spanish Royalty to the conquerors to be used as *encomiendas*. Sipe Sipe was under the direction of Hernando de Silva (Rocabado 2004).

In the Colonial Era, Huancarani was inhabited by *mitimaes* that worked agricultural fields as part of a few local *haciendas* located within a one mile radius in present day Suticollo, Hamiraya and Sipe Sipe. These indentured servants were bought as part and parcel of the *hacienda* property. Some residents of Huancarani could trace their landholdings back to this era when their families worked in the *hacienda*'s fruit orchards and vegetable fields (Hippert 2005).

Historic Period. This was practiced until the early 1950's, when the national Agrarian Reform in 1953 transferred the ownerships of the fields to the workers. The owner of Huancarani, Sr. Valdivieso, partitioned the *hacienda* to the peasants and his children, leaving a small house for the community school. At his death, his children sold their lands and left the community, except for one who married a local peasant (Hippert 2005 and Geffroy 2002). Five years after the Agrarian Reform, Huancarani was part of Sorata as the Sindicato Ovando. And in 1975, Huancarani separated from Sorata and has not been part of any other *Sindicato*.

Since the last century, Huancarani has experienced multiple migrations, forming a diverse population that is composed mostly of women. The decade of 1930-40 was characterized by a lot of migrations. In 1934, with the Chaco War, a portion of the male population left for the war. At the same time, a group of young men migrated to the mines to support the war. A lot of them did not come back neither from war or the mines. Also, some residents migrated to Argentina, in search of better work opportunities. The families that stayed worked on traditional agriculture.

In the 1970's, migration back from the mines started, bringing older people, sometimes with their children. In 1985, with the *Decreto de Relocalizacion*, another migration wave moved to Huancarani. And in the years of 1995-97, residents of Sipe Sipe and La Paz also moved to Huancarani (Geffroy 2002).

The Pirwa

The Pirwa is an organization that was founded as a response to the government's failure to provide the basic services to Huancarani. In the 1980's, the community members "took it upon themselves to create an alternative vision of development which draws on ethnic roots (their Inca past) as well as recent historical dynamics (their life in the mines) in order to improve community and individual health as well as to secure international funding for their work" (Hippert 2005).

This organization is composed of 20 members (see Figure 13), representing 20 families of the community, and two administrators. The Pirwa is based on communal work done in exchange for food and takes place in the Pirwa facilities. Work is done on a weekly basis for an eight-hour work day, and after 17 days, the members receive their ratio of food, funded by European organizations. The Pirwa raises *cuys* (guinea pigs), have a bread-baking project, make adobes and plant and harvest in the Pirwa fields.

Figure 13: The members of the Pirwa that participated in the Focus Group, plus some members of the community.

Agriculture in the Pirwa is done by its members in a traditional and organic way. The members choose the crops they are going to sow, prepare the terrain manually and harvest communally. No chemical fertilizers are used, instead, chicken feathers from the local chicken slaughter houses as well as dried vegetable matter and leaves from nearby eucalyptus trees are used as *abono*. This way of farming resembles the way their ancestors farmed in order to remember who they are, turning the Pirwa to ethnic identity (Hippert 2005 and Geffroy 2002).

Environment and Subsistence Agriculture

The Cochabamba Valley is found in an "ecologic floor" considered fertile for agriculture, especially for the production of cereals and vegetables (*hortalizas*). Thanks to its temperate climate typical of the valleys, it is also good to produce fruits, especially *tuna* (cactus fruit). It covers ample vegetation with different species of trees, such as *molle*, eucalyptus and *algarrobos*, as well as some native bushes and grasses that grow in the rainy season.

Since Incan and colonial times Huancarani has attracted migrants from different regions, being composed of multiple ethnicities. There are two reasons for its popularity. First, the low valley is particularly fertile, since it received water from the Mountain Chain that surrounds it. And, second, it has always been linked to the highlands through a net of traditional routes. These paths were essential to access products that did not grow in the valley. Nowadays, some older people of Huancarani still practice this product exchange with the higher lands of the department (Geffroy 2002).

Figure 14: View of Huancarani from a hilltop

Sipe Sipe and Quillacollo are known as an "oasis of sorts in the middle of what has become a high-plain, semi-arid desert. During the rainy season, from November to March, the community becomes a lush of green as native flora blooms, including cactus fruit (tuna), fruit trees and seasonal flowers and bushes. The region is heavily cultivated and well known for its harvests of potatoes, onions, carrots, fava beans, corn, parsley, beets, *achojcha* (an Andean vegetable) and less often, wheat" (Hippert 2005).

Most residents of Huancarani are agriculturalists that either work their own land or work the land owned by another member of the community (see Figure 15). About 90% of the people in Huancarani work the land during at least one season a year (Hippert 2005). Generally, women are in charge of this activity (Geffroy 2002). "Residents practice dry farming and have dug a system of irrigation ditches on which they rely to water their fields" (Hippert 2005).

Figure 15: A family working as *peones* in one of Doña Oneida's fields

Figure 16: The *sequia* or water canals on the back of Doña Oneida's house.

Agriculture, in these fields, is practiced at a small scale, for the inhabitants only sow small fields on the back of their houses, having an average size of 600m^2. The majority of the crops are grown through dry agriculture, meaning that they only rely on rain water because there is not enough irrigation water to cover all fertile fields, limiting the crops that can be sowed (Geffroy 2002).

Remembering the Past. The people of Huancarani miss the time when vegetables used to grow abundantly only 30 years ago. Back to the decade of 1930-40, the region was favored with irrigation water, having an abundant agricultural production. Older people remember how peaches, grapes, figs, pomegranates, onions, carrots and potatoes used to grow with surplus. These testimonies lead us to infer that Huancarani was a fertile zone with abundant water and agriculture and a surplus of work and production. However, nowadays, irrigation water is not available to many families and the rivers are contaminated. Agriculture can not be practiced at the same proportion as before. In Sipe Sipe, fruit production plummeted due to degradation of the soil and lack of water (Geffroy 2002 and Hippert 2005).

Apart from the practice of agriculture, the majority of the people in Huancarani raise animals, especially sheep. They also raise chickens, pigs, guinea pigs and other animals, generally destined for the consumption of the families. This activity is also mostly practiced by women and often children (Geffroy 2002).

Access to land. Before people migrated to the mines, having agriculture and animal husbandry as the principal activities, Huancaraneños got involved in treaties with each other to have access to land. The *arriendo* system is when a person, the *arrendado*, has the capital and work force to rent the land to the *arrendador,* who is the person that yields their land for some time in exchange for money. When residents returned from the mines, the dynamic had changed, since now, the fields were partitioned, having structures where there used to be fields. Also, the lack of irrigation water makes production difficult, forcing the workforce to look for jobs in other areas. The crops obtained from the agricultural work are distributed equally among the workers.

Land in Huancarani can be obtained in two ways. First, inheritance is the most common way of obtaining land, securing the future families. However, this implies a constant and gradual partitioning of the land with each transferal, diminishing agricultural production for a domestic unit. Second, after the *Relocalizacion*, there was a great demand for land, triggering their purchase. Most of the people in Huancarani that sold their lands migrated permanently to Argentina and other local places like Santa Cruz, Sipe Sipe, Vinto, etc.

The ex-miners that returned with the Relocalizacion, could only access arable land either by purchase or inheritance. Those who stayed, on the other hand, maintained their lands and continued to practice traditional agriculture until today (Geffroy 2002).

Mink'a and Trueque.. The mink'a is almost the same as *peonaje*. It is an exchange of services in exchange of crops or money. It is essentially practiced within relatives, friends and neighbors of the community. This goes beyond a simple mercantile exchange, it could be considered as a subsistence strategy for both sides, the land owners and the workers.

Trueque is a form of reciprocal exchange of products not found in the local geographical zone. This is still practiced in Huancarani by the older women who sometimes travel to other communities in different "ecological floors."

Pachamama. There is also a reciprocal exchange between men and mother earth, Pachamama. This reciprocity is expressed through the ritual of *ch'allar*. "Through this ritual, the bonds between people and the cosmos are strengthened; the earth should only be bothered after the ritual has been done." These are some of the sentiments expressed by the people of Huancarani. Offerings to Pachamama also protect from illnesses and cure the ill. It represents abundance and the fruits of the ground (Geffroy 2002).

Prehistoric Parotani Settlement Project: The Pirque Alto Site

Profile

The investigations of the Prehistoric Parotani Settlement Project have for a goal "to evaluate the Formative Period adaptation in the Parotani region and the nature of Tiwanaku presence in the region of the Department of Cochabamba, Bolivia. The excavations that took place at the Pirque Alto Site in the 2007 field season was directed by Dr. Tim McAndrews and Claudia Rivera and assisted by Zulema Terceros and fourteen students of the University of Wisconsin-La Crosse. Also five members of the community of Pirque Alto assisted in the excavations.

The previous field season in 2005 had performed extensive surface collections, showing that this site was "intensively occupied from the Formative Period through the Middle Horizon (and beyond), when Tiwanaku influenced much of the south-central Andes, and that is clearly evident in the Middle Horizon material culture of Pirque Alto" (McAndrews 2007).

Description

The region of Parotani is "strategically located at the junction of natural transportation corridors leading to the Altiplano, the Titicaca Basin and the Cochabamba Central Valley (see Figure 17)" (McAndrews 2005). The site of Pirque Alto is situated on a prominent bluff overlooking the Rio Tapacari (see Figure 18), which leads northwest towards the Titicaca Basin. Pirque Alto is also at the junction of the Rio Pukina valley, leading northeast to the Central Valley, and a natural corridor where a modern highway has been constructed, leading southwest towards Oruro, Lake Poopo and the Rio Desaguadero in the Altiplano. These routes suggest interregional interaction between Cochabamba and the Altiplano populations. Some of the material remains also suggest a trade connection with Formative Period Altiplano populations in Oruro (McAndrews 2007).

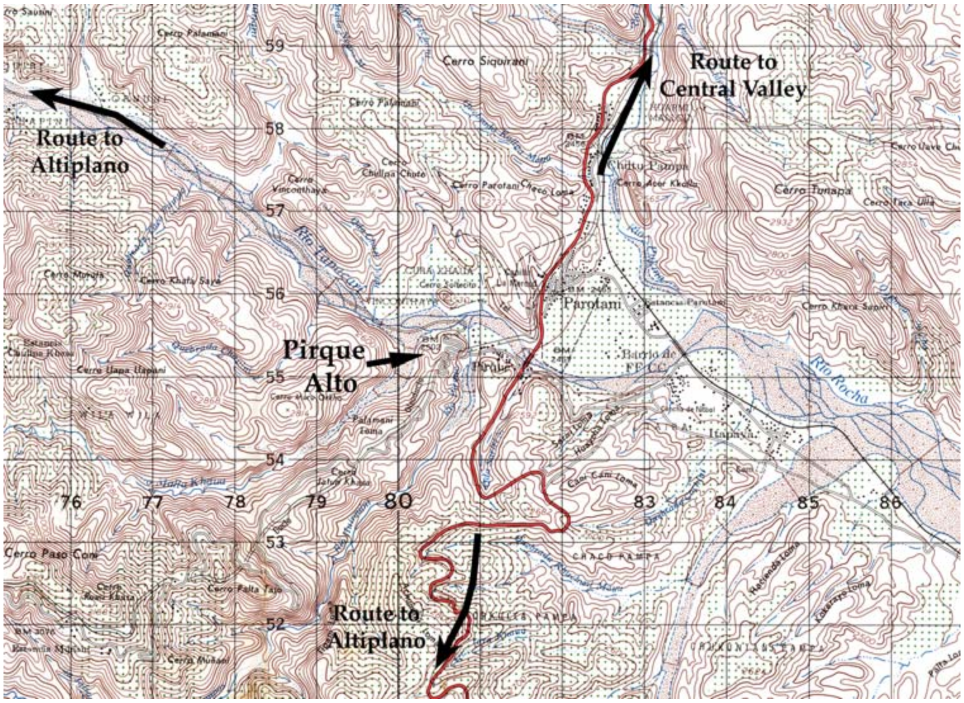


Figure 17: Location of Pirque Alto (McAndrews 2007)

Figure 18: The Pirque Alto Site (McAndrews 2007)

Excavation Blocks

The excavations blocks (see Figure 19) that are represented in the floral remains are described below:

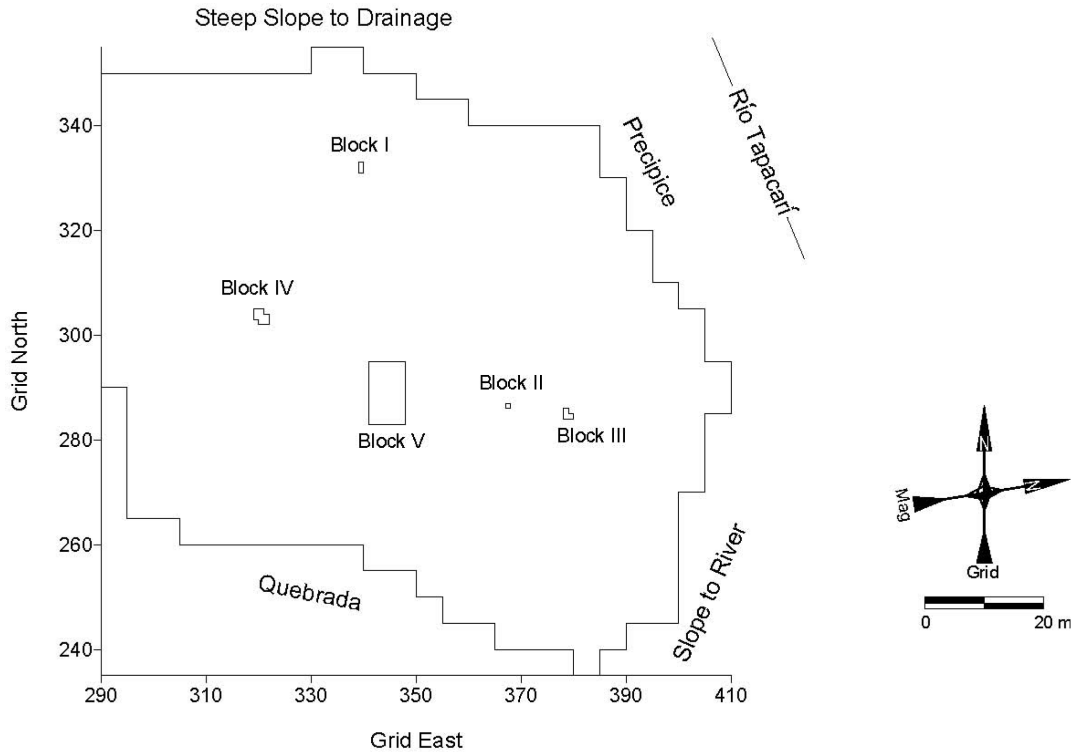


Figure 19: Excavation Blocks (McAndrews 2007)

Excavation Block III

Excavation Block III (see Figure 20) was the easternmost excavation block, comprised of three square meters, excavated in 1x1m units. Along with Block II, it was located in an area with a relatively high concentration of daub and *manos* and *metates*, suggesting a domestic structure. Also, there was a concentration of Formative Period ceramics and the rim of a complete vessel. The latter feature and block was originally a 1x2m unit. The feature was dissected and the vessel removed almost intact. There were a series of stone slabs, forming a large circle, which possibly surrounded a looted human burial to the north. The vertical stones are likely to date to the Middle Horizon (McAndrews 2007).

Figure 20: Excavation Block III (McAndrews 2007)

Excavation Block IV

This block (see Figure 21) was $7m^2$ in size and located on the western boundary of the site, at the edge of a steep slope. Its location was chosen due to a relatively high concentration of Middle Horizon artifacts, recovered during the surface survey in 2005. Underlying the plow zone (Stratum I), Stratum II was rich in Middle Horizon artifacts and Stratum III has Formative Period artifacts. In this block, features 3 and 6, consisting of circular stone lined features, contained artifacts and human bone fragments. Also, there was a dense concentration of an unknown form of slag (McAndrews 2007).

Figure 21: Excavation Block IV (McAndrews 2007)

Excavation Block V

This block (see Figure 22) was excavated in an area containing a dense concentration of *manos* and *metates* as well as Middle Horizon ceramics. It is located towards the center of the site and covered and area of $84m^2$. Excavation was done horizontally to uncover a foundation, which measures approximately 4 x 4.5m in size and has an intact doorway on the eastern wall. Stratum I contained a high concentration of Middle Horizon ceramics and some Early Intermediate sherds.

Figure 22: Excavation Block V (McAndrews 2007)

Methodology

Fieldwork

The collection of raw data for this project has two parts: the archaeological excavation and the ethnographic fieldwork. Both parts were performed separately and in different places.

Archaeology

The archaeological portion of the fieldwork took place in the site of Pirque Alto as part of the UW-L archaeological fieldschool, in which I participated in the summer of 2007 under the direction of Drs. Tim McAndrews and Claudia Rivera. The fieldschool lasted for a month and the methodologies were as follows:

Excavation. A total of 97m^2 were excavated in 5 different blocks across the site to various depths. Excavation units of 1x1m, 2x1m and 2x2m were excavated and placed strategically (non-randomly) based on the surface artifact density (surface collection 2005), artifact patterning and locations with a relatively high potential for intact, stratified deposits.

Vertical excavation proceeded in arbitrary 10cm levels. All soils were screened through a 5mm hardware cloth. All potential cultural features were recorded in plan view through scale drawings and photography, and their locations were plotted in reference to the site's Cartesian grid system. Appropriate features were bisected and systematically excavated in 10cm levels within internal feature strata. Soil samples of 2 liters in volume per square meter excavated (4 liters per 1x2; 8 liters per 2x2) were taken from each 10cm level for flotation processing. All artifacts recovered were processed and catalogued (McAndrews 2007).

Flotation. The flotation method utilized is that of "bucket flotation," in which buckets, 1mm and 0.5mm sieves and a thin piece of fabric (in order to have the least possible loss of light fraction) were utilized. The following description summarizes the process:

First, the volumes of the samples were measured and registered. Second, the first sample was put into a 10 liter bucket with water (the samples were not soaked, since some carbons absorb too much water and do not float, thus the process was done immediately). Then, the sieves were prepared and the floatation started, decanting the water delicately, until the soil came out. The bucket was re-filled with water and the soil was stirred, waiting for more ecofacts to float. The latter step was repeated until nothing more floated. In this step, water was decanted to one side of the bucket as a current, so that the light fraction will float again, collecting as much as possible. Later, the fabric containing the light fraction was labeled and put away.

The heavy fraction was poured in the 1mm and 0.5mm sieves and was washed until there was no soil left and the artifacts were cleaned. Then, the artifacts were put in a coarse cotton fabric with their respective labels to be dried. Once the samples were dried, they were bagged, ready to for sorting and analysis (Terceros 2009).

Analysis and Identification. Analysis of the light fraction looks at the presence or absence of the plant species in the samples as well as the percentage of each species found in each sample, or in other words, their ubiquity. The samples were sorted using a XTL-VI Zoom Stereo Microscope. The light fraction was size graded using 2mm, 1mm and 0.5mm sieves and the samples were weighted. The heavy fraction was screened only through a 2mm sieve.

For the identification, the microscope mentioned above was used. Only the samples that were smaller than 2mm and 1mm were analyzed. Generally, there was a good preservation of the seeds, and in some cases, carbonized and not carbonized "fruits." Only 16 samples out of a total of 102 were analyzed by excavation unit and level.

Identification was hard since there are not many reports of this type in Cochabamba. Thus the species not identified were termed *Morfo Especies* so that their frequency can still be analyzed. There are 24 *Morfo Especies*, 10 of which are carbonized and 14 of which are not carbonized. The two species that have been identified are maize (*Sea mayz*) and quinoa *negra* (*Chenopodium quinoa*). A trip was made to collect a comparative collection, but still, more trips are necessary (Teceros 2009).

Ethnography

My ethnographic fieldwork took place in the community of Huancarani for ten weeks in the summer of 2008. While there, I lived with a local family consisting of an elderly woman, and her two granddaughters. My methodologies were as follows:

Participant observation. I participated in the daily activities of my family, helping with daily chores such as feeding the animals, agriculture-related chores and routine daily life. I also participated in daily community activities such as communal work every Friday, the remodeling of the Church, the community monthly meetings and, sometimes, helped with the children at the Pirwa, which is a communal organization.

Participant observation lasted for two months during which I observed and asked unstructured questions about daily life, especially when we were doing agriculture. I took note of my life experiences and of what I learned everyday, not just about agriculture, but also about community life in general.

Structured interviews. I interviewed and digitally recorded ten separate individuals of the community with prepared, structured questions about their agricultural knowledge, methods and plant utilization. These questions were divided in nine sections based on different topics, for example “Background” or “Agricultural fields.” In total, there were approximately fifty questions, most of which are follow-ups of main or more general questions. The duration of each of the interviews ranges from less than half an hour to almost four hours, depending on each individual. The questions were asked in Spanish. However, a lot of times they were answered in a mixture of Spanish and Quechua and translated with the aid of other family members such as children. The interviews were asked in the participant’s house, whenever they had the time, ranging from 6:00AM to 9::00PM, over approximately a two weeks period. An incentive or presents of gratitude were given in the form of fruits to the household. Also, voluntary consent was given by each individual interviewed.

I recruited interviewees through connections, and by asking the people I knew for an interview. I interviewed neighbors and Pirwa members as well as individuals suggested by my host mother, Doña Oneida, and by Don Rolando, who is in part in charge of the Pirwa. Some of the people that were suggested and I did not know as well, were asked by Doña Oneida, most of the times in my presence.

Focus Group. A focus group was done with the members of the Pirwa at the Pirwa facilities with approximately twelve individuals, of which only two were male and several of which had been interviewed individually. The focus group was done in the late morning after some work for the Pirwa. As with the individual interviews, the questions for the focus group were divided in sections, with a total of seven sections. These questions were more general and included some of the same questions of the individual interviews in order to clarify them. There were approximately 25 questions in total, asked and discussed in a period of one hour. Only a distinct group of people repeatedly answered the questions while others were quiet. After the discussion, a "feast" or lunch was given as a sign of gratitude.

Decoding the Interviews. To obtain the data from the interviews and the focus group, I listened to each one and wrote down the responses for each question asked. Pseudonyms are used in order to keep the participants' confidentiality.

Literature Background

The literature background complements, supports and gives an overview of the raw data and methods presented here. It consists of, first, general information about the subfield of ethnoarchaeology in order to give the reader a sense for the base of interpretation. Second, an overview of the environment in reference to agriculture and the cultural groups both generally, in Bolivia, and specifically, in Sipe Sipe, the county where the ethnography took place, presents the reader with an understanding of the ecology, which is essential to the practice of agriculture. Third, a description of the cultural chronology of the Andes, the history of agriculture and agriculture in Bolivia gives a time frame Fourth, I include a description of the crops that were found in the floral remains and those mentioned in the focus group as native to Bolivia. This gives the reader an overview of the environment and cultural uses of each crop.

Fifth, information of the place where the ethnographic fieldwork took place supports the reason why Huancarani is representative of continuity, and is therefore, useful in this research. Sixth, information of the Pirque Alto site, from which the floral remains were obtained places this research in its archaeological context. Finally, the results of the ethnographic fieldwork as well as the raw data of the floral remains are included as an appendix to provide details on the base for interpretation.

Analogy

The ethnographical analogy performed in this research looks at the crops that were found in the floral remains of the Pirque Alto site and the crops that are cultivated by the people in the community of Huancarani and their knowledge of other crops. The crops, both from the site and the community, are compared based on their presence or absence. The chronological periods in which the floral remains happen are looked at in order to determine the frequency of each crop in each period represented.

Results and Analogy

Considerations to be taken into account

As discussed in the *Ethnoarchaeology* section, there are some issues that need to be taken into consideration when doing an ethnoarchaeological analogy. First, informant interviewing is not always accurate and might not be complete. That is why this paper also utilizes literature background in order to support the raw data, which was in most cases supported. Furthermore, participant observation was performed in order to be tested against the "ideal patterns" that might be given in the interviews.

Second, there is the issue of archaeological visibility. Having organic material being the base for this analogy, it is important to take into account the possibility of no preservation, before suggesting their absence. In this case, tubers, especially potatoes, are ethnographically proven to be a major part in the natives' diet. The fact that no distinct tubers were found does not mean that the people of the past were not utilizing them. The presence of parenchyma, however, suggests their presence.

It is also important to consider the fact that only 16 samples were floated and analyzed out of a total of 108. And only the samples below 1 and 2mm were sorted. Also, not all the levels of each unit have been sorted yet. Thus, only four units and three excavation blocks are represented.

This paper is only considering a few seeds and remains than what was actually found in the floral remains of the site due to the lack of identification of the rest. Thus, complete interpretation of the diet cannot be made as of yet. Also, it looks like the unidentified seeds might not be agricultural in nature. However, the identified crops-quinoa and maize, and parenchyma- represent some of the most important cultigens of the Andes, allowing for a strong interpretation of the past.

Along these lines, the community of Huancarani can be seen as representing a cultural continuity with the Pirque Alto site, especially in agricultural terms, since their techniques have not changed since Incan times, when only the agricultural and social organizations were improved rather than the techniques. Also, their language, way of living, beliefs and food preparation has remained constant.

However, continuity only goes so far. It is important to remember that colonization brought drastic changes to the lives of the natives as well as to agricultural practices. New tools of iron were introduced, facilitating the agricultural process and cooking. New crops were introduced, changing their diet and cultivation techniques. Nowadays, technology also affects the way agriculture is done and plants are utilized. Tractors and chemical fertilizers are often used and the crops are cooked using different materials and different ingredients.

Finally, the unobserved behavior, due to the limited time of the ethnographic fieldwork, poses the issue of time. Even though I was not there to observe a complete agricultural cycle, the interviews and the literature provide this information.

Analogy

The following table shows the crops that were identified by the focus group as being native to Bolivia and the crops found in the floral remains of the Pirque Alto site.

Focus Group: Huancarani	*Pirque Alto Site*
Potato	Parenchyma?
Ulluco or Papa lisa	Parenchyma?
Oca	Parenchyma?
Maize	Maize
Quinoa	Quinoa
Kañahua	
Cucurbits: Zapallo, achojcha	Possible gourd: Morfo Especie #20
Beans: Purutus, Chuy	

Table 1: Comparison of crops

As shown, the major Andean cultigens of maize, quinoa and, perhaps, tubers, are all represented in the archaeological record. The lack of a definite presence of tubers can be accounted to their poor preservation. However, the presence of parenchyma, which is the fundamental plant cells found in roots, stems, etc. (Sengbusch 2003), might represent, at least in part, the presence of tubers. Their importance in today's Andean community as a basic food makes it almost certain that tubers were as important in the past as they are now. Potatoes are the most common tubers. Its different species can be found both in the valleys and the altiplano. However, other tubers such as *oca*, grown in the altiplano, are almost as popular and could have been traded with the valleys.

The presence of quinoa is of special interest, since the informants both from the focus group and several from the individual interviews assured me and stressed that quinoa did not grow in that area, but in higher altitudes. Cardenas writes that quinoa is grown in Cochabamba at an altitude of 2560m (1989). Sipe Sipe, where Huancarani is found, has an elevation of 2530m and Parotani, where Pirque Alto is found, of 2459m (Clavijo and Peredo 2006). Both have a lower elevation than what is required. Furthermore, Cardenas also says that the quinoa in Cochabamba, apart from being different, yields much less than in the altiplano (1989). Therefore, the presence of quinoa at the Pirque Alto site has a more than likely possibility of having been traded with the altiplano for, perhaps, maize, which is an important food most effectively grown in the valley.

Squashes are another crop grown by the people of Huancarani in the edges of potato fields as I observed. Thus, they were not massively produced and I did not see people eating them. Either if there is evidence of gourds, a possibility in the yet unidentified seeds, or if there is no evidence, the literature describes the zapallo as an ancient squash encountered by the Spanish (Cardenas 1989) and it is likely that it formed part of the past Andean diet as well. The zapallo was also mentioned both during participant observation and structured interviews.

Beans or purutus were also mentioned, but I never saw the people of Huancarani eat them. With the exception of nuñas, according to the literature, purutus are grown in lower regions and are hard to cook in the inter-mountainous valleys and the altiplano due to the difficulty of boiling the water (Cardenas 1989 and Popenoe et al.1989). Nuñas were not mentioned specifically by the informants. Also, beans seem to have been more popular in Peru.

Floral remains

The floral remains of the Pirque Alto site were floated, sorted and identified by Zulema Terceros in Cochabamba, Bolivia. In this paper, the floral remains are being analyzed by unit (there are four units analyzed), each of which belong to one of the five excavation blocks. In general, the excavation blocks can be placed in a time period, based mostly on the ceramic chronology. The periods can be divided as follows:

Block 1: Early Intermediate

Block 2: Middle Horizon

Block 3: Formative Period

Block 4: Middle Horizon/Formative Period

Block 5: Middle Horizon, some Early Intermediate

There are three excavations blocks and two periods of time represented in the four units:

Unit N291 E342: Block 5 (Middle Horizon)

Unit N291 E343:Block 5 (Middle Horizon)

Unit N284 E378:Block 3 (Formative Period)

Unit N301 E320:Block 4 (Middle Horizon/Formative Period)

This table shows the combined amounts of the remains per unit. The levels and size grading (below 1mm and 2mm) are combined. However, not all levels were sorted in each unit and in some units more levels were sorted than in others. All of these samples are carbonized, since, so far, only the *Morfo Especies* (unidentified species) were found uncarbonized.

	N284 E378 (Formative Period)	N301 E320 (Formative P. L.7)	N291 E342 (Middle Horizon)	N291 E343 (Middle Horizon)	N301 E320 (Middle Horizon)
Maize	0	0	40frags. 1e. 1c.	0	14frags.
Quinoa	6 (+2?)	2 (+1?)	0	0	0
Parenchyma	23	5	43	5(2 maize?)	15 (11 maize?)
Wood	0	0	+184	0	(L.5B)40%; (L.4)30%

Table 2: Floral remains per unit e=complete, c=cupola, f=fragment, L=level

As shown by the table, maize is found in great quantity in the Middle Horizon. Units N291 E342 and N291 E343 are part of the foundation uncovered in Block V. Unit N291 E342 has a high quantity of both maize and wood, suggesting maize's cooking and consumption, although, wood is found only in level 1 with no context of maize. Unit N291 E343 has no maize, suggesting that perhaps, the former unit is found closer to the food preparation-consumption area in the domestic structure.

Also dating to the Middle Horizon, unit N301 E320 has a high concentration of maize. The Tiwanaku occupation goes as deep as 65cm in stratum 6, after which, there is evidence of a Formative Period occupation. This unit is found in Block IV where a child burial, dating to Tiwanaku times, and an oven, dating to the Formative Period, were found. (Terceros 2007). The maize fragments in this unit are found in level 2B, dating to a later Middle Horizon time. A 30% of wood is found in level 4 and a 40% in level 5B, again with no context of maize.

Unit N284 E378, dating to the Formative Period, strangely enough, has no maize presence. Block III, where this unit is found, could have been a domestic structure, judging by the dense concentration of *manos* and *metates* as was found in the surface collection of Block V with the foundation (McAndrews 2007). The absence of maize is interesting, since it is a staple food and the basis of the Andean diet in the valleys. On the other hand, this unit has the highest presence of quinoa. And, as mentioned before, quinoa was very likely traded with the altiplano.

According to the literature, the Formative Period is marked by the beginning of an agropastoral adaptation with domesticated plants and animals (McAndrews 2005 and Moseley 2001). Also, it is during this period that the trade networks in the altiplano, later utilized by the Tiwanaku, were formed and consisted of llama caravans that transported goods to distant regions (McAndrews 2005). Moreover, the civilization of Wankarani has settlements near the Cochabamba Valley in order to exploit the temperate zones for maize production, representing an early example of Andean verticality (Moseley 2001). Several of my informants and Geffroy's informants also mention that exchange with higher altitudes is still practiced by the older women in Huancarani (2002).

The other unit in which quinoa is found is unit N301 E320. Two specimens are found in level 7 and a possible specimen in level 1. Due to the identification uncertainty of the latter, it will not be taken into consideration. Though, level 7 of this unit dates to the Formative Period occupation, reinforcing the use of quinoa in this period.

Therefore, the presence of quinoa in the Formative Period can be seen as clear evidence of contact between altiplano and valley populations. However, this does not explain the absence of maize in the Formative Period and the absence of quinoa in the Middle Horizon. Their absence could just be a matter of archaeological visibility, in which maize is not found in the same context as quinoa. If this is the case, it is possible that, quinoa, being an exchanged product, was more accessible during the Formative Period, during which, the socio-political organization in Cochabamba was fairly simple (Higueras 1996), making quinoa a mainstream crop. On the other hand, during the Middle Horizon, with the presence of an elite and a more complex organization, quinoa was more restricted in terms of general consumption and its exchange more controlled, giving the elite a privileged access to its consumption, and placing quinoa in special contexts in the archaeological record rather than in a domestic structure or a habitation site such as Pirque.

Moreover, if quinoa was a specially valued crop in the valley, specifically during the Middle Horizon, there is a less likely possibility that it was discarded, unless it was done as an accident. This would decrease the likelihood of being found in the archaeological record. However, it could simply be the fact that not all levels in each unit were sorted, thus, there is still the possibility that these specimens might be present in these periods.

Parenchyma being a fundamental tissue present in all plants could represent different plants, some of which are not identifiably present in the archaeological record. Parenchyma is consistent and present in high quantities throughout the periods, suggesting that a good portion of the floral remains were not preserved. These could include maize, quinoa, tubers and other plants that have not been identified yet. However, if maize and quinoa have been found in a consistent manner in the same units as parenchyma, what would explain the fact that some quinoa and maize seeds preserved while others did not? Therefore, it is possible that parenchyma is representing more degradable seeds or plants such as tubers. If this is the case, then tubers represent the largest portion of the crops. And this would be comparable to my participant observation in which potatoes and, sometimes *oca*, were used much more often that maize.

The presence of wood at the site can be seen as used primarily to make fire for cooking purposes. In my participant observation, I did not see the use of wood for any other purpose. Other alternatives are its use for construction and fire during winter. However, the houses in Huancarani are mostly constructed of adobe with a zinc roof, and wood is used in simple attributes. Winter in the Cochabamba Valley consists of warm days and moderately cold nights. Even if fire could have been used at night, the adobe houses conserve the heat very well, making a comfortable temperature. I experienced this, since the ethnographic fieldwork took place during winter and I had the chance to live in a cement house before moving to the adobe house. The cement house was extremely cold at night while the adobe house was significantly warmer.

Density

The densities shown in this table are the combined volumes of soil of each level that was sorted in each unit. In some units more levels were sorted than in others.

Densities (count per liter)	N284 E378(Formative)	N301E320 (Formative L.7)	N291 E342 (MH)	N291 E343 (MH)	N301E320(MH)
Total Liters	11.5L	2L	11L	4L	14L
Maize (fragments)	0	0	3.636	0	1
Quinoa	0.522	1	0	0	0
Parenchyma	2	2.5	3.909	1.25	1.071
Wood	0		16.727	0	L5B(40%); L4(30%)

Table 3: Density of floral remains per unit

The densities show the number of times a crop or plant appears in one liter, standardizing the difference in levels sorted in each unit. Maize has very high densities in the Middle Horizon, stressing its use and importance while quinoa also has a relatively high density, being present only in the Formative Period. Parenchyma has the highest density in each unit. This table reinforces the previous discussion by proving that the high quantities of a crop are, indeed, high when looked at in a standardized way.

Nutritional values

This table compares the nutritional values of the main cultigens found in the floral remains. These numbers are based on a 100grams portion.

	Maize(raw)	Maize(dried)	Quinoa(raw)	Quinoa(cooked)	Potato(raw)	Potato(cooked)
Calories	86kcal	386 kcal	360kcal	120kcal	77kcal	87kcal
Proteins	3.22g	9.88g	14.12g	4.40g	2.02g	1.87g
Fat	1.18g	5.22g	6.07g	1.92g	0.09g	0.10g
Fiber	2.7g	N/A	7g	2.8g	2.2g	1.8g

Table 4: Nutritional values of crops (Nutrient Data Laboratory 2009)
Raw maize: corn, sweet, white, raw
Dried maize: corn, dried (Navajo)
Raw potato: flesh and skin, raw
Cooked potato: boiled with skin, flesh, without salt

This table shows that quinoa has a very high nutritional value in all categories. Its high protein content has been said to replace meat (Popenoe et al. 1989). It is of great benefit in the altiplano, where high altitudes make tasks more intense and energy demanding. In its raw form, quinoa has a greater caloric intake than maize. In its cooked form, it seems that maize surpasses it by much. However, the presented form of cooked maize is dried, chosen for the comparison due to its multiple uses and storage capability. Dried maize, though, represents a greater quantity of the product, since its water content is absent. Therefore, maize, when not dried, has less protein and calories than quinoa. In comparison to potatoes, maize and quinoa have more nutritional value in these categories. However, potatoes are a complementary food to maize, since it acts as a neutralizer to the digestive acidity produced by maize (Popenoe et al.).

The exchange between quinoa and maize due to differing nutritional values is not necessarily the case. Even though quinoa does have a higher protein level, dried maize, which was often used, is comparable to quinoa. According to Cardenas, the flavor of the quinoa is not the best, being an acquired taste (1989) Thus, it is possible that the inhabitants of the highlands had a higher interest in exchanging quinoa for maize instead of the valley having a high demand of quinoa.

Unidentified Species

The following table shows the unidentified species (*Morfo Especies*) that occurred most often in the units.

	N284 E378 (Formative Period)	N291 E342 (Middle Horizon)	N291 E343 (Middle Horizon)	N301 E320 (Middle Horizon)
ME #1	16, 2frags.	11e 4frags.	2	2
ME #3	11, 14frags.	0	0	14, 3frags.
ME #9	6	1e, 1frag. 2	10	1
ME #13	3	0	0	0
ME #14	1	0	3	1, 2frags.
ME #20	0	4	0	0
ME #21	1	0	4?	0
ME #24	0	5	1	0

Table 5: Unidentified Species

Even though these species are not yet identified, their frequency and presence in each unit can show their evolution through time. ME #1 is found both in the Formative Period and the Middle Horizon in relatively high proportions. ME #3 and ME #9 have similar situations. Their consistency in presence and quantity throughout time can suggest that these plants belonged to the surrounding natural environment rather than being deliberately collected and concentrated in a few locations, as was seen with the food plants.

The rest occur in lesser quantity and consistency and could be interpreted as specific crops that, perhaps, were grown in specific time periods. They could also represent harvested plants found in the surrounding environment and collected as wild food, especially those present in the Formative Period. ME # 20, the possible gourd, occurs in the Middle Horizon.

Cultural Uses

The archaeological record cannot give us an idea of the specific ways a plant was utilized. That is why the ethnographic information serves to add cultural meaning to past remains. Culture continuity is an important aspect when meaning is being applied to the archaeological record based on present observations. And, in this case, culture continuity can be seen in the fact that the responses of my informants match the information given in the literature about the observations made by the Spanish at their arrival. Another good evidence is that most of the times, the processes and names of the foods have their original Quechua names.

Maize, as described in the literature and as my informants told me, is eaten green, as choclo, or dried, as corn. With choclo, lawa and humintas can be made. Tojori and phiri are also made. With dry maize, they make *tostado* and *mote*. From some kinds of maize, *chicha* can be fermented and bread can be made. As described by Garcilazo de la Vega, maize was grinded in stone (maran) with a half-moon stone called maran-uña (Cardenas 1989), matching what I observed Doña Oneida doing with her own *maran* to grind the dried kernels that she picked from the field when getting *chala* for the cows. *Chala* might not have been an important product, since there were no cows in the past and llamas and alpacas usually live at higher altitude, unless the *chala* of the maize grown in high altitudes were used for the camelids.

I was not able to observe the utilization of quinoa, but the literature describes it as been prepared as rice or popped like popcorn. It can also be made into *tostado* and fermented like *chicha*. The leaves of the plants served as food for the llamas and alpacas as well as salad, like spinach, for human consumption (Cardenas and Popenoe et al.1989).

Potatoes as I observed and as pointed out by Cardenas, are what give the people a sense of having a true meal (1989). As I observed, they are eaten in every meal, except breakfast, in soups and with rice and noodles. They are cooked by boiling. Potatoes are also made into chuño, a dehydrated potato, in the altiplano, made by soaking them in water, exposing them repeatedly to freezing temperatures at night and squeezing the water out by stamping on them (Popenoe 1989).

Conclusions

Limits of Archaeology

The archaeological record poses limits to interpretation that can be assessed through ethnographical data. In the case of plant utilization, archaeological visibility, if taken literally, can mislead conclusions about diet by assigning fewer crops than what was in reality utilized when these do not preserve. Also, archaeology, being part of anthropology looks to assign cultural meaning to the remains in order to portray an ancient way of life. Through ethnoarchaeology, meaning can be drawn with less bias in interpretation.

Maize and quinoa are the two main crops present in the archaeological record. And even though they are very important and make a great part of the diet, the use of tubers is as important, if not more. As I observed, potatoes are utilized in every meal except breakfast. *Oca* is also utilized to a lesser degree in the valley, since it is a highland crop. And as the literature describes, the Spanish encountered the potato at their arrival. Their poor preservation prevents them from being present in the archaeological record, although the presence of parenchyma might account for their representation as well as that of other plants. Therefore, their use can be included in the ancient Andean diet.

Trade

The presence of quinoa at the Pirque Alto site strongly suggests an exchange between the altiplano and valley populations. Quinoa, being found only in the Formative Period, may be just a matter of archaeological visibility, in which this crop is found in a different context in the Middle Horizon. It could be that quinoa was more accessible during Formative Period, when a simpler social organization was present, becoming more restricted and valued during the Middle Horizon, thus, been discarded less often. However, this remains to be tested once all the levels of the units under analysis and the rest of the Middle Horizon units are sorted.

Use of wood

The wood present at Pirque Alto can be seen as used primarily as wood for cooking. Other alternatives are that it was used in construction or for fire during winter. However, based on my participant observation, wood is present in construction in very simple attributes, since structures are primarily made of adobe (mudbrick), and nowadays have a zinc roof. Also, adobe houses are good retainers of heat and winter in the valleys are not as cold as in the altiplano.

Cultural Uses

Cultural continuity in Huancarani can be seen in the fact that the informants' responses and the literature description describe the cultural uses the same way. Also, most of the processes and foods are still called by their original Quechua names, not having changed since ancient times. Therefore, most of the ways in which maize, quinoa and potatoes are utilized nowadays can be applied to the archaeological record to add cultural meaning.

Future Research

In order to have a more complete picture of past ways of life and, specifically plant utilization, more research is needed. First, other aspects can be compared between the past and the present such as tools utilized in the process of agriculture and food preparation. Moreover, more ethnoarchaeological fieldwork in other communities is necessary to be compared to a wider range of floral remains from several archaeological sites in the area and beyond, to obtain a more complete and accurate interpretation. Furthermore, even if culture continuity is an important aspect in ethnoarchaeology, cross-cultural ethnoarchaeological research can teach us about how people adapt to the same environments differently or the similar adaptation in different environments.

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Appendix A

Ethnographic Results

In this section I will present a summary of the responses to the questions by section of both the ten individual interviews and the focus group. Also, I will comment on my experience based on participant observation.

Individual Interviews

Demographics. Three women and seven men were interviewed, whose ages ranged between the 40's and the 60's.

I. Personal Background

The participants have lived in Huancarani ranging from 6 months to 40 years and they have come from as close as the highway outside of Huancarani and as far as Potosi, but most of them have come from other provinces in the department of Cochabamba. They all identified either both Quechua and Spanish as their first languages or only Quechua, sometimes speaking, thus, a mixture, none of them not speaking Quechua. Only four of the participants confirmed that they work their own land. Two were clearly *peones*, meaning workers that work on other's lands. And the rest worked either in both their own land and another's land or in their extended family's land, sometimes referred to as their own land too.

Among those who work their own land, only Doña Oneida hires *peones* to work her land. For the rest, the marital couple and/or their extended and/or their immediate family work their land. The relationship between a *peon* and the landowner are clear from both the *peon*'s point of view and the landowners' point of view. It is consistent that the landowners provide the fields, the water and the seeds while the *peones* offer their work, having to sow, water the fields, take care of the growing plants and harvest. The pay for their job is half of the product from the harvest. In my experience, the landowner also was expected to serve drinks, either *chicha* or soda and, sometimes, offer food too. The *peones* had two responses as to how they plant. One said that he does it as the owner tells him and the other said he does it as he knows it.

Almost all of the participants learned how to do agriculture when they were very young through observation of their parents' work, coming from an agricultural tradition. An outlier learned from her husband. Also, there is consistency in the saying that before, they could be full time agriculturists, but now, they also need to work in other areas such as a bricklayer (*albail*), like three men answered. For the rest, agriculture is their main work. For the women, house chores and animal husbandry was included.

The last question in this section is what crops do they sow? Also when is each product sowed and harvested was included with this question and not in the Harvest section. The table that follows shows the individual responses.

Table 1: Seasonality of Products

Products	1	2	3	4	5	6	7	8	9	10
Potato	Starting July 15 (6 months.	July to May (8 months) Also December	July/August to December (4 months)	Aug to October/November (3 months)	August to November	August to November	August (4 mo)	February to June/May (6 mo); Jul/Aug to Nov/Dec.	1st August (4 mo)	November to April; also Jul/Aug to Dec
Corn (waltaco, jatun muju for choclo)	Starting August 15 to Christmas		Like the potato.	August to January		Sept to Christmas		August to November/ December	August (6 mo)	
Corn (juch'uy muju)	Starting in December				November to February		November/ December to May			December to May
Fava Beans (Haba)	April to Sept/Oct (6months)		August/Oct to Dec.	Aug to Sept/Oct (3 months)	June to Sept (3 mo)	Any time, (2-3 mo)	May/June to Sept/Oct	May to Sept/Oct	March/April (6 mo)	Dec to May
Onions			March/June (6 months)	June to Sept/Oct (3 months)	June/July to November	July (3 mo)	June/July to Oct/Nov/Jan (6 mo)	Anytime Feb and June (3 mo,white); May/April to Aug (6 mo red)	May (6 mo)	
Vegetable*	winter							June/July		
Vetch pea (arveja)					Like fava beans			May to Sept/Oct		Dec to May
Horseradish (rabano)			1 month, all year		1.5 mo, any time			June (3 mo)		
Green been (vainita)			August/Sept (2 months)							
Achojcha										
Turnip (nabo)	Starting in Aug, Sept and Oct									
Carrots				Feb/March/ April to end of July 4mo	4 mo, any time			4 mo		

Tomato					Sept-Nov (4 Mo)						
witerahua					4 mo, June						
Wheat		Nov-Aug						Jan/Feb to June		Dec to May/June	
Barley (cebada)					Nov-Aug			Jan/Feb to June		Dec to May/June	
Avena					Nov-June/Aug						
Pumpkins	July to April										

* includes onions, achojcha, green beans, carrots, horseradish, vetch pea, tomato, beet, *beteraba*, parsley, lettuce

II. The sowing process

In general, everybody agreed as to what the steps of sowing are. Here they are summarized:

1. To till the soil twice, if it is small it can be done by hand, if big, with a tractor or a "*yunta*". It should be tilled about 20cm deep.

2. To water the field, leaving it 2 days to absorb the humidity

3. Add fertilizer (*wano*) to the soil, most commonly from cows, but also, sheep, goats and chicken.

4. To weed out herbs

5. Next to sow either in furrows (*surcos*) or boxes (*cajones*) depending on the plant. Mostly it is done in furrows, except for the vegetables.

Potatoes, for example, in my experience, are sowed in furrows, placing a seed at every step, with a layer of *wano* on top, and then covered with soil. Onions, as known from the interviews, are sowed in box-like plots and the seeds are placed tightly together, to be replanted later. For other vegetables, the seeds are scattered.

The tools used in this process are the *picota* or *chujchuca*(pick-axe/pillory), *pala* (shovel) and *azadon*(mattock.hoe).

The fields must be watered ranging from once a week to three times a week or when the soil becomes dry. Others said it was only watered when it rained. The answers varied depending on whether the individual had access to the *sequia* (water canals) or not. In my experience, Doña Oneida watered her fields three times a week on the days that were appointed to her as having rights to the *sequia*. Some days, her turn was during the night, keeping her awake all night to shift the direction of the water.

Apart from watering the fields, when the plants start growing, they need *aporcar* or to hill, meaning to make borders around the plants so that they do not fall. In the case of the potato, it is done so that it does not come out of the ground, and in the case of maize, so that the wind does not make it fall. Also, the soil needs to be loosened (*aflojado*).

Some dangers to the crops are diseases and animals. In general, big animals like cows, dogs, etc, did not seem to be a threat to the crops. A specific bird was mentioned, *tojo*, which digs the potatoes, and another one that eats the maize when it is coming out. Rodents were not really mentioned unless I asked. What was always mentioned, however, are the diseases caused by insects (*bichos o gusanos*) of which one, called *polvillo* was consistent. *Polvillo* is some kind of white powder that falls on the leaves of the plants, burning them. It comes from *neblina* or mist. Don Rafael was the only one that gave me a different method other than fumigating the crops to clean them from the *polvillo*. He told me that, with a long rope, held by two people on each end, the mist can be scraped from the plants at dawn. Fumigating, thus, was an answer constantly given to combat the illnesses and no natural method was identified.

Don Rafael and Don Jose were the only ones that gave me specific diseases apart from *polvillo*. The rest just told me that the plants get insects that damage them.

1. tojto(tojtorillo): black stains on the leaves caused by a worm, which make the plants become ash. It mostly happens to the potato.
2. kashu: similar to tojto and it also happens in onions and other vegetables.
3. piki piki: small worms that make the leaves become yellow. It happens in maize. To get rid of this, Don Jose says that the plants and the tools should be washed with the detergent Ace.

As for fertilizers, apart from *wano*, there was one, Uria, which was repeatedly mentioned as a chemical fertilizer to help the plants grow and have a bigger harvest. However, Don Rafael also said that this kind of chemical fertilizer damages the soil and changes the flavor of the food, specifically the potato, not being worth its use. And that, before, when there was no fumigation to prevent or heal diseases, they just had to water the plants punctually as a way to prevent disease. He also said that bigger fields were more propane to diseases than smaller ones. Don Sebastian was the only one that told me about vegetal fertilizer, being the same as the animal's *wano*. This organic matter of the plant can be picked up in piles off the ground.

Genetic alterations were in most cases not even heard of. Don Sebastian, however, told me about an "*insierto*," which is the mix of different types of one fruit or different fruits, like for example, apples and pears.

III. Utilization

Almost all of the crops sowed are used for human consumption. Maize is used in two ways: as *choclo*, when it is still green, or as corn, when dry. It is the agriculturist's decision when they want to harvest it to get one or the other. Corn, since it is harder, is used for tostado. Corn can also be grinded as food for the dogs. The smallest grains can be given to the chickens and ducks. T'iki is made for the chicks from grinded corn too. *Choclo* is used for mote, to be grinded and to make *huminta* (Bolivian sweet tamales). *Huminta* is a food made from maize, a kind of dough (*masa*) cooked inside the leaves of the maize. *Huminta* is "*el mas alimaento pa' las personas*" ("the most food for people") says Don Sebastian, "*antes no habia fideos*," ("before, there were no noodles") referring to this food as an ancient one. From maize also lawa (a stew or thick broth) and phiri (dumplings) can be made. Bread can also be made. From some kinds of maize, *chicha* is made: uchuquilla, yellow maize chuspillo and wilcaparo. From white maize, *chicha* can not be made, for they would never ferment. Also, tojori is like an *api* (a meal mush, like cream of wheat) made out of granulated maize and boiled with cinnamon.

With the vegetables, salads are made. The leaves of the onion plants are used to be cooked in with other meals in order to give a certain flavor to the food. And potatoes are always eaten in every meal. From my experience, potatoes were never missing during the usual lunch soup or dinner. Raw onions were never missing from salad neither.

Some plants are used as food for animals. The remaining of the maize plant, when dried, is used to feed the cows and is called *chala*. *Chala* can be bought in great quantities by those who have cows to those who harvested corn. Also, alfalfa was always mentioned as a basic food for the cows and other animals. Although, alfalfa, I was rarely told, can also be used for human consumption as salad. Other plants are *avena*, as forage and as a soup/drink for breakfast, and the remaining of the plants after harvest, like wheat. Barley was also mentioned, but only when it is green, thus, it should be cut before it sprouts and it will grow green again. *Penca* (fleshy cactus leaf) or *tuna* (prickly pear fruit) are also commonly used plants for the cows. These plants last for a very long time once they have been planted. In my experience, alfalfa, *chala* and *penca* are highly demanded foods for the cows, and Doña Oneida was always in the look for them, having to carry enormous amounts of them from the place bought to the house in an awayo (a piece of fabric used for this purpose). In general, however, the dry plants after harvest cannot be used for anything else except for firewood. Also for firewood, trees like *molle*, thako and eucalyptus can be used. In my experience, firewood was obtained from dry branches found in the proximities, and even though, there were eucalyptus trees nearby, firewood was not taken from them.

IV. Harvest

In general, it is known that it is time to harvest a plant when the leaves start drying and turning yellow. In the case of the potato, their peel must be hard enough.

To harvest, *gangochos* or *sacos* (sacks, bags) are utilized along with *picotas* (pick-axe) to dig up the potatoes and awayos. Baskets were mentioned, but not often. In the case of maize, a small nail or sharp piece of wood is used to cut open the outer layer and take out the maize. Also ropes and animals are needed to carry the harvest back, if the fields are far away from the house.

The maize can either be taken green for *choclo*, or left to dry for corn. The corn must then be threshed (*desgranado*). The vegetables are usually washed. The potatoes are separated in four sizes and the seeds are picked from the smallest to medium. The bigger ones can be sold or used in the family. The smallest can be used for ch'uño or for seeds that are stored in the ground. The maize for the next year can be stored in the house. The wheat and barley are cleaned with the wind, letting it fall so that the wind takes all the extra "garbage" away; or in other words, separating the chafe.

Depending on how many people there are, harvesting can take one day, three or more. If the product is of high quality, many people will come to help in exchange for some of it.

After the harvest, most people answered that they sell their product to the merchants who will sell them in the market. Some answered that they will keep most of the product for themselves. And others said that it depends on the harvest, whether it is a lot and of good quality.

V. Wild Plants

Wild plants are not really a resource for the people. Alfalfa and *penca* were always mentioned as plants that only had to be sowed once in a very long time, since they grow again after being cut. Parsley was another plant identified as only having to be sowed once and then just watered. It is also used as a spice for human consumption. *Avena* was also mentioned. All of these are mostly used as animal food, but still had to be sowed at one point. Also *molle*, eucalyptus and sauce (willow) were wild trees mentioned to be used for firewood. Some medicinal plants mentioned as wild were *berros*, growing by the *sequia* and good for the kidneys, and *gongonas*, for ear pain. Don Rafael talked about a plant that has appeared about four years ago, similar to the fruit *tumbo*, called *locosti*. He believes that it was brought to Huancarani from other places through the birds' droppings. Also *pacallis*, similar to fava beans, was brought from Chapare, but grows smaller in Huancarani.

Fruits like grapes, apples and peaches were mentioned as having grown in the past as very easily, but not anymore. A lot of people told me this, remembering the better days when there was less contamination and more productivity. Some people simply said "mana kanchu", there are not any.

VI. Agricultural Fields

For those who owned their own land, the sizes of their fields range from 200m to 6000m or half a hectare. When they are small, they are usually located near their houses, otherwise they are found by the river. Doña Oneida is an example of this, having fields on the back and across her house while also farther towards the river.

The quantity of the product harvested can change every year depending on diseases, available water and other factors. But, in general, for example, in a 500m squared field, you can get about ten *cargas* or *gangochos* (charges or bags) worth of potatoes. In 1000m, someone else said they would get 30 *cargas* of each potatoes and onions.

Many products can be sowed in one field at the same time. However, it seemed that in potato fields, nothing else is sowed, even when the field is not in use.

When the fields are not in use, they usually just leave them how they are, until the time to sow comes again and preparation starts. To let the soil rest, alfalfa can be grown and left for several years. Also, pasture can be let to grow for animal use. I also observed, and only a few people told me, that chicken feathers are scattered over the fields as a fertilizer to the soil, taken from the chicken slaughter houses nearby.

VII. Cosmovision

The belief in the Pachamama is still alive. The actions of ch'allar and q'oar were always mentioned in this section by those who believe in it. Only a few people expressed that they were Christians and, thus, did not believe in the Pachamama. However, in my experience most people were Christians and still believed in it. The q'oa consists of a bundle of paper containing ritual symbols that are burned. They can be bought at the market and the symbols can change, depending on the purpose to be achieved. It is done the first Friday of every month, although not everybody does it. The 1st of August is also a big date to q'oar. This is done to assure good harvests and prevent disasters. But it is not only applied in agriculture, as I observed. It can be done in any event or life situation for good luck, health, etc. It is also done at the start of every sowing and harvesting, although I did not experience this in my participant observation. If the q'oa burns white, then is used as a prediction of a good harvest, if the smoke is black, then the opposite is predicted. Ch'allar, the act of pouring *chicha* on the ground, or an alcoholic beverage and, sometimes soda, is also widely in use. Like the q'oa, it is done at any time as an offering to Pachamama to assure good things in ones life and prevent bad ones.

VIII. Medicinal Plants

Molle and eucalyptus were always identified in this section as being good for stomachache and cough in the form of tea or mate. Also, the eucalyptus can be used to wash the feet for pneumatics (*neumatismo*). Others mentioned were *jauco*, waych'a, *salvia*, *coror*, *munitas*, *unumalla*, *altamesa*, *apio* and *diente de leon* for stomachache. Also, *manzanilla* tea; *paeco* (or *payco*) for colic; *malba* for fever and pregnant women; *sabila*, for hair lost; parsley, *uri-uri* and coca for stomach-ache; avocado leaves for the kidneys; and *muni*, for coughing. Some of these grow in the wild, usually in the rainy season.

IX. Archaeology

Almost everyone answered that they have not found any ancient artifacts around. One person mentioned some findings in another place. One person, however, mentioned the discovery of a burial along with ceramics near the church. Another person, digging mud for adobes, found coins dating to about 1768, seemingly made of silver. In general, everyone seemed very skeptical about this question, either thinking that I was interested in purchasing ancient artifacts, as one of them offered me, or that I just simply wanted to look for them myself.

Focus Group

I. Epochs/Seasons

The different seasons of the year are as follows:

1. Winter: June 21 to September 21. It is characterized by a humid cold.
2. Spring: September 21 to December 21
3. Fall/autumn: April 21 to June 21. The time of harvest.
4. Summer: from the above information it should be from December 21 to April 21, but summer was not clearly identified, and was mixed with the rainy season which can start as early as November and go until March. Sometimes it is delayed, sometimes it comes faster, said several people. These are according to the official times.

Other specific times of the year are in August, characterized as windy and October and November characterized by the fall of hailing (*granizo*).

II. Crops

In this section, the two types of maize were clarified. The maize for *choclo* (waltaco) is sowed in August to be harvested in December, also called "jatun muju". And the "maize of the year" or "juch'uy muju" is the one sowed in December to be harvested in May.

The crops identified as native to Bolivia were: potatoes, maize, *oca*, *papalisa*, *calabazas*(pumpkins), *porotos*(beans), *chuy*, some tomato varieties, achojcha, chard (*acelga*), green beans, alfalfa and parsley. Most of these were given by Don Rolando, who is, academically, an expert in agriculture. Some of the crops grown in the Altiplano that can not be grown in a valley because of the climate are *oca*, *quinoa*, *carwi* and *canawa*.

There were four varieties of potato identified as being grown in Huancarani. These are: the *holandesa*, imilla, waych'a and runa. These were also identified by Don Rafael in the individual interview. Many more varieties of corn were identified. Some are: white, yellow and purple maize, Cuban white maize for *choclo*, gray maize for *tostado*, waltaco, chispillo, uchuquilla, wacasoco, chischisara, wilcaparo.

III. Seeds

It depends on the person whether they want to keep seeds for the next year or buy them when the time comes. In my experience, Doña Oneida went to the market several times to buy potato seeds. She did not give any explanation to why she did not keep seeds from the year before. The seed market consists of other agriculturists selling their seeds.

IV. Water

The *sequia* or water canals are owned by only a few people in Huancarani. Approximately 15 families have access or turns to use this water, which comes from a spring. The rest can only count on the rain, since there are no wells either.

This is due to the fact that after the *Reforma Agraria* (Agrarian Reform), when agricultural fields were divided, they were already sold with the right to water, which has been passed through generations. In Sorata, a nearby community, there are wells and a cooperative system based on a stockholding system.

V. Soil

The members of Huancarani consider their soil fertile, but with the need of fertilizers to keep it producing, since the fields are not really left to rest in Huancarani. According to the group, they rest when there is no water.

The soil was compared to that of Parotani, which is more sandy. Also, in Parotani, there are bigger fields for a more commercial form of agriculture, with the products being taken to Oruro. Also, they have the advantage of two rivers, the Tapacari and the Rocha, having a year round of agricultural production and being able to rotate the crops. The crops are the same as in Huancarani.

After harvesting potato, the soil is good for any other crop, since it is already fertilized. Each crop has a different demand of nutrients from the soil.

After being used in agriculture once, the soil does no really change, except for the fact that it has been prepared specifically for agriculture. It is very clear whether a field is good or not for sowing. If it has rocks or if it is hard inside, then it is not good. The soil is also naturally darker when it is good for agriculture.

VI. Gender roles

The participants of the focus group did not identify a clear gender division of roles in agriculture. Although Don Rolando said that usually the women spread the seeds, with the thinking that they will have better harvests. In my experience, the men make the *surcos* (furrows) using the pick-axe while the women spread the seeds and the *wano* (cow fertilizer). The children usually help the women. And the men finish by covering the *surcos* with soil.

Someone is called a <u>wawalli</u>, if the seeds turn out not to be enough for the whole field, meaning that this person "*no tiene buena mano*" ("doesn't have good hand").

VII. Drought

In times of drought, Huancaranenos have no choice but to try to survive with what they have and buy from places where there are wells. Two years ago there was a drought and people and animals suffered, the people said. They buy waste from the factories to feed the animals. But lately, they said, "*ha llovido bien*" ("it has rained well").

Individual Interviews

Background

- How long have you lived in Huancarani?
- Where have you come from or were you born here?
- What is your first language? What other languages do you speak?
- Do you work your own land or someone else's?

Someone else's land

- Do you utilize your own methods or what the owner tells you?
- What is your job? How do you contribute?
- Do you take care of the plantation everyday or does the owner do that?

Own land

- Who work on your land? Family, peones or both?
- What do you provide besides the land? (if there are peones)

- How are the earnings divided?

- Who taught you how to sow/plant? Or how have you learned?
- Did your family do agriculture before? Do you come from an agricultural tradition?
- How long have you been doing agriculture?
- What else do you do or have done for subsistence?
- Are you a full time agriculturalist?

- What are the principal crops sowed in your family? When are they sowed and when are they harvested?

The sowing process

- What is the sowing process in general and depending on the crop? Describe step by step.
- What tools are used in this process and for each crop/activity?

- How often do you water the fields?
- What other care methods are needed?
- How many times are they applied?

- What do you use as pesticide? Is it natural or artificial?
- What are the threats to the crops?

- What fertilizers do you utilize? Natural or artificial?
- Where do you get them?
- Where do you apply it?

- Are there any genetic alterations done to the crops?

- Is there any other method or product utilized?

Utilization

- What is each crop used for? For example, human or animal consumption, etc.
- What foods can you make with each crop?
- How is the rest of the plant utilized after harvest? For animals, construction, fire, etc.

Harvest

- How do you harvest each crop? What are the steps in general?

- How long does it take?
- What are the next steps after harvest? How are the crops prepared? Where do you store them?
- What do you do with the quantity of the harvest? Sell, use, etc.

Wild Plants

- What wild plants do you utilize or gather? And what are they used for?
- What crops do not require a lot of care?

Terrain/Fields

- What is the size of your land/field? How many do you have?
- How much of a crop does your field yields?
- Can you sow more than one crop in the same field?
- What do you do with the field when it is not in use? How do you take care of it?
- What are the steps to using it again?

Cosmovision

- What are the views about Pachamama?
- What rituals, if any, are done in honor of Pachamama? When do you do it? What do they mean?
-

Medicinal Plants

- Do you use medicinal plants?
- Which are these and what are they used for?
- Do you sow them or are they wild?
- Are they native plants?

Archaeology

- By chance, have you ever found any objects or human remains that you tink were ancient?
- What was it exactly?
- How did you find it? Where?

Focus Group

Seasons

- What is sowed in each season of the year?
- Which are the seasons or epochs? How are they characterized?

Products/Crops

- What are the principal crops sowed in Bolivia? Which are native?
- In this valley, what can you sow?
- What varieties of a crop are there/you can sow here?

Seeds

- Where do you get the seeds?
- Do you buy them every year or do you store them from the harvest?
- Are they expensive? Or, how do you store them?

Water

- How does the irrigation system works?
- What are the times and rules for its use?
- Who is in charge?
- From where does the water come?
- How do you water the fields? How often?

Soil

- After harvest, how much time does the field need to be sowed again?
- How do you prepare the fields?
- What kind of soil is in Huancarani?
- How does the soil changes after being sowed?
- When does it become infertile and why?
- How have the soil and plants in Huancarani changed over time?

Gender

- What do the women usually do? And the men?

Drought

- What do you do when there is a drought? Or if the crops are destroyed naturally?
- Have you ever experienced anything like that? What have you done?

Apendix B

Informe Preliminar de Flotación y Análisis de muestras recolectadas en la temporada de campo 2007 Proyecto Parotani

Zulema Terceros Céspedes

I. Anexos

Anexo 1 Lista de Macrorestos botánicos encontrados.

Muestras carbonizadas identificadas

Sea mays

Chenopodium quinoa

Anexo 2 Tablas de las muestras analizadas de acuerdo a las unidades excavadas y los niveles

Como se dijo anteriormente, las muestras fueron analizadas de acuerdo a las unidades arqueológicas excavadas y los niveles, a continuación cuadros separados por tamaño de muestra y por si están o no carbonizadas, de cada unidad analizada hasta el momento:

Unidad N 291 E342

Muestras carbonizadas >1mm

N° Flota-cion	Unidad	Nivel	Ma-dera	Paren quima	Sea mayz	Chenopo dium quinoa	ME 1	ME 2	ME 3	ME 4	ME 5	ME 6	ME 7	ME 8	ME 9	ME 10	Otros
F-0001	N291 E342	1	+184	14	-	-	4e 2f	1	--	--	--	--	--	--	1e 1f	--	2
F-0028	N291 E342	2		12	2f	--	--	--	--	--	--	--	1	--	--	1	1
F-0008	N291 E342	3?		17	30 f	--	4e 1f	--	--	--	--	--	--	--	2	--	5

Muestras carbonizadas >2mm

N° Flota-cion	Unidad	Nivel	Ma-dera	Paren quima	Sea mayz	Chenopo dium quinoa	ME 1	ME 2	ME 3	ME 4	ME 5	ME 6	ME 7	ME 8	ME 9	ME 10	Otros
F-0001	N291 E342	1		--	--	--	--	--	--	--	--	--	--	--	--	--	--
F-0028	N291 E342	2		--	--	--	3e 1f*	--	--	--	--	--	1	--	--	--	3 sin 1
F-0008	N291 E342	3?		--	1e8f1 c	--	--	--	1	--	--	--	--	--	--	--	--

Muestras no carbonizadas >1mm

N° Flota-cion	Unidad	Nivel	ME 11	ME 12	ME 13	ME 14	ME 15	ME 16	ME 17	ME 18	ME 19	ME 20	ME 21	ME 22	ME 23	ME 24	Otros
F-0001	N291 E342	1	--	1	--	2	--	--	1	--	1	1	--	--	--	1	1
F-0028	N291 E342	2	--	8	--	--	--	--	--	--	--	1, 2	--	--	--	3	1 pl,3h1,1porosa
F-0008	N291 E342	3?	--	10	--	4	--	3	--	--	--	--	--	--	--	--	6e 1f

Muestras no carbonizadas >2mm

N° Flota-cion	Unidad	Nivel	ME 11	ME 12	ME 13	ME 14	ME 15	ME 16	ME 17	ME 18	ME 19	ME 20	ME 21	ME 22	ME 23	ME 24	Otros
F-0001	N291 E342	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
F-0028	N291 E342	2	--	--	--	--	--	--	--	--	--	--	--	--	--	1	
F-0008	N291 E342	3?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	

Unidad N 291 E 343

Muestras carbonizadas >1mm

N° Flota-cion	Unidad	Nivel	Ma-dera	Paren quima	Sea mayz	Chenopo dium quinoa	ME 1	ME 2	ME 3	ME 4	ME 5	ME 6	ME 7	ME 8	ME 9	ME 10	Otros
F-0012	N291 E343	1		1	--	--	--	--	--	-	--	--	--	--	7	--	--
F-0017	N291 E343	2		4	--	--	1	--	--	1	1	--	--	--	3	--	--

Muestras carbonizadas >2mm

N° Flotacion	Unidad	Nivel	Madera	Parenquima	Sea mayz	Chenopodium quinoa	ME 1	ME 2	ME 3	ME 4	ME 5	ME 6	ME 7	ME 8	ME 9	ME 10	Otros
F-0012	N291 E343	1		--	--	--	--	--	--	--	--	--	--	--	--	--	--
F-0017	N291 E343	2		2(maiz?)	--	--	--	--	--	--	--	--	--	--	--	--	--

Muestras no carbonizadas >1mm

N° Flotacion	Unidad	Nivel	ME 11	ME 12	ME 13	ME 14	ME 15	ME 16	ME 17	ME 18	ME 19	ME 20	ME 21	ME 22	ME 23	ME 24	Otros
F-0012	N291 E343	1	--	--	--	3	1	--	--	1	--	--	4?	1	1	--	
F-0017	N291 E343	2	--	1	--	--	--	--	--	--	--	--	--	--	--	--	

Muestras no carbonizadas >2mm

N° Flotacion	Unidad	Nivel	ME 11	ME 12	ME 13	ME 14	ME 15	ME 16	ME 17	ME 18	ME 19	ME 20	ME 21	ME 22	ME 23	ME 24	Otros
F-0012	N291 E343	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
F-0017	N291 E343	2	--	--	--	--	--	--	--	--	--	--	--	--	--	1	

Unidad N 284 E378

Muestras carbonizadas >1mm

N° Flotacion	Unidad	Nivel	Madera	Parenquima	Sea mayz	Chenopodium quinoa	ME 1	ME 2	ME 3	ME 4	ME 5	ME 6	ME 7	ME 8	ME 9	ME 10	Otros
F-0016	N284 E378	2		5	--	--	5e 2f	--	--	-	--	--	--	1	6	--	5
F-0010	N284 E378	3		--	--	1	1	--	3f	--	--	--	--	1?	--	--	--
F-0032	N284 E378	4		3	--	3 +2?	2	--	9 f	--	--	--	--	--	--	--	1 +1cs
F-0024	N284 E378	5/6		11	--	2	8	--	6	--	--	1?	--	--	--	--	2

Muestras carbonizadas >2mm

N° Flotacion	Unidad	Nivel	Madera	Parenquima	Sea mayz	Chenopodium quinoa	ME 1	ME 2	ME 3	ME 4	ME 5	ME 6	ME 7	ME 8	ME 9	ME 10	Otros
F-0016	N284 E378	2		--	--	--	--	--	--	--	--	--	--	--	--	--	--
F-0010	N284 E378	3		2	--	--	--	--	--	--	--	--	--	--	--	--	--

F-0032	N284 E378	4		2	--	--	--	--	1e 1f	--	- -	--	--	--	--	--	--
F-0024	N284 E378	5/6		--	--	--	--	--	4e 1f	--	- -	--	--	--	--	--	--

Muestras no carbonizadas >1mm

N° Flota-cion	Unidad	Nivel	M E 11	M E 12	M E 13	M E 14	M E 15	M E 16	M E 17	M E 18	M E 19	M E 20	M E 21	M E 22	M E 23	M E 24	Otros
F-0016	N284 E378	2	--	--	--	1	--	--	--	--	1	--	--	--	1	--	2
F-0010	N284 E378	3	1	--	3	--	--	--	--	--	--	--	1	--	--	--	2
F-0032	N284 E378	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
F-0024	N284 E378	5/6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Muestras no carbonizadas >2mm

N° Flota-cion	Unidad	Nivel	M E 11	M E 12	M E 13	M E 14	M E 15	M E 16	M E 17	M E 18	M E 19	M E 20	M E 21	M E 22	M E 23	M E 24	Otros
F-0016	N284 E378	2	--	--	--	--	--	--	--	--	--	--	--	1	--	--	3 otros
F-0010	N284 E378	3	1	--	--	--	--	1	--	--	--	--	--	--	--	--	
F-0032	N284 E378	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1 otros
F-0024	N284 E378	5/6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1 otros

Unidad N 301 E320

Muestras carbonizadas >1mm

N° Flota-cion	Unidad	Nivel	Ma-dera	Paren quima	Sea mayz	Chenopo dium quinoa	M E 1	M E 2	M E 3	M E 4	M E 5	M E 6	M E 7	M E 8	M E 9	M E 10	Otros
F-0034	N 301 E 320	2B		11(maíz ?)	11 f	1?	--	--	--	- -	--	1	--	--	--	--	10 NI
F-0031	N 301 E 320	4		2	--	--	--	--	--	- -	--	--	--	--	--	--	--
F-0075	N 301 E 320	4B		1	--	--	--	--	--	- -	--	--	--	--	1	--	--
F-0090	N301 E 320	5		4	--	--	1	--	2f	- -	--	--	--	--	--	--	--
f-0087	N 301 E 320	5B	40%	--	--	--	--	--	--	- -	--	--	--	--	--	--	--
F-0102	N 301 E 320	6		--	--	--	--	--	3	- -	--	--	--	--	--	--	--
F-0039	N 301 E 320	7		5	--	2	1	--	9	- -	--	--	--	--	--	--	1

Muestras carbonizadas >2mm

N° Flota-cion	Unidad	Nivel	Ma-dera	Paren quima	Sea mayz	Chenopo dium quinoa	M E 1	M E 2	M E 3	M E 4	M E 5	M E 6	M E 7	M E 8	M E 9	M E 10	Otros
F-0034	N 301 E 320	2B		--	3f	--	--	--	--	1	- -	--	--	--	--	--	--
F-0031	N 301 E 320	4	30%	--	--	--	--	--	--	--	- -	--	--	--	--	--	--
F-0075	N 301 E 320	4B		--	--	--	--	--	--	--	- -	--	--	--	--	--	--
F-0090	N301 E 320	5		--	--	--	--	--	1f	--	- -	--	--	--	--	--	--
f-0087	N 301	5B		1	--	--	--	--	--	--	-	--	--	--	--	--	--

	E 320										~						
F-0102	N 301 E 320	6		7	~~	~~	~~	~~	1	~~	~ ~	~~	~~	~~	~~	~~	~~
F-0039	N 301 E 320	7		~~	~~	~~	~~	~~	1	~~	~ ~	~~	~~	~~	~~	~~	~~

Muestras no carbonizadas >1mm

N° Flota-cion	Unidad	Nivel	M E 11	M E 12	M E 13	M E 14	M E 15	M E 16	M E 17	M E 18	M E 19	M E 20	M E 21	M E 22	M E 23	M E 24	Otros
F-0034	N 301 E 320	2B	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	3
F-0031	N 301 E 320	4	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	4
F-0075	N 301 E 320	4B	~~	1	~~	2f	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
F-0090	N301 E 320	5	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	1
f-0087	N 301 E 320	5B	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
F-0102	N 301 E 320	6	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~
F-0039	N 301 E 320	7	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~

Muestras no carbonizadas >2mm

N° Flota-cion	Unidad	Nivel	M E 11	M E 12	M E 13	M E 14	M E 15	M E 16	M E 17	M E 18	M E 19	M E 20	M E 21	M E 22	M E 23	M E 24	Otros
F-0034	N 301 E 320	2B	~~	~~	~~	1	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
F-0031	N 301 E 320	4	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
F-0075	N 301 E 320	4B	~~	1f	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
F-0090	N301 E 320	5	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
f-0087	N 301 E 320	5B	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	1cs**
F-0102	N 301 E 320	6	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	
F-0039	N 301 E 320	7	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	~~	

Nota: en esta Unidad aun faltan niveles por analizar.

Anexo 3. Ubicuidad

Categoria	Numero de muestras	Ubicuidad
Madera	16	100%
Parenquima	16	100%
Sea Mayz	3	18.75%
Chenopodium Quinua	5	31.25%
Morfo Especie 1	10	40%
Morfo Especie 2	1	6.25%
Morfo Especie 3	4	25%
Morfo Especie 4	2	12.5%
Morfo Especie 5	1	6.25%
Morfo Especie 6	1	6.25%
Morfo Especie 7	1	6.25%
Morfo Especie 8	2	12.5%
Morfo Especie 9	5	31.25%

Morfo Especie 10	1	6.25%
Morfo Especie 11	1	6.25%
Morfo Especie 12	6	37.5%
Morfo Especie 13	3	18.75%
Morfo Especie 14	7	43.75%
Morfo Especie 15	1	6.25%
Morfo Especie 16	3	18.75%
Morfo Especie 17	1	6.25%
Morfo Especie 18	1	6.25%
Morfo Especie 19	2	12.5%
Morfo Especie 20	2	12.5%
Morfo Especie 21	3	18.75%
Morfo Especie 22	3	18.75%
Morfo Especie 23	2	12.5%
Morfo Especie 24	3	18.75%

Nota: Es el porcentaje en que los macrorestos se presentan en las muestras analizadas, a esto se le llama Ubicuidad (Popper.1988)