Agrobiodiversity Conservation as a Coping Strategy: Adapting to Climate Change in the Northern Highlands of Bolivia

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Abstract

This article is the result of my observations in two Aymara communities of the Northern Bolivian Altiplano, where I am collecting data for my PhD thesis. My thesis aims to explore the connections between on-farm conservation of local crop varieties and migration of Aymara people away from their communities of origin in the Altiplano to urban areas. While studying the conservation of agrobiodiversity performed by Bolivian farmers, I investigated the use of different crop varieties, conserved by indigenous people, in response to climate change. The consequences of climate change are evident in the rural areas of the Altiplano Norte: prolonged droughts, followed by heavy precipitations and floods. Agriculture is severely affected by such extreme climatic events and the response of the farmers varies. In this article, I focus on a possible adaptation approach enabled by a strategic use of the numerous crop varieties that many Aymara farmers still own. Although the relevant knowledge is slowly being lost, some agrobiodiversity "champions" still hold it and use it to adapt sustainably to new climatic conditions. Research about the agronomic characteristics and the use of local varieties is still needed to provide indigenous farmers with further options to face environmental and climatic change in the Altiplano Norte.

Author's Note

Conservation and sustainable use of biodiversity for food and agriculture are sponsored in a number of international agendas and supported by strategies including ex situ and in situ conservation initiatives all over the world. In situ on-farm conservation practices, performed by farmers in locations where varieties are encountered, maintain natural genetic interactions between crops, their wild relatives and the local environment. They are, therefore, particularly valuable for the conservation of agrobiodiversity and farming systems. In the Andes, traditional farming techniques and the existence of indigenous food systems make on farm in situ conservation activities successful and grant the preservation of crop diversity. During my fieldwork in the Northern Highlands of Bolivia, I observed how indigenous farmers adapt to climate change through their strategic use of local crop varieties. In other words, the richness that Aymara small-scale farmers own, in terms of both agricultural varieties and traditional knowledge, is used to adapt to rapidly shifting climatic patterns.

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Keywords: agrobiodiversity, climate change, indigenous farmers, adaptation, Bolivia

Since August 2012, I have been carrying out my fieldwork in the Northern Altiplano of Bolivia, collecting data for my PhD research on the connections between indigenous farmers' rural-urban migration and on farm agrobiodiversity conservation. While studying the phenomenon of the conservation of agricultural varieties performed by Aymara smallholder farmers in some communities of the Altiplano Norte, I observed the way different crop varieties are used in response to climatic variability, such as new precipitation patterns, prolonged periods of drought, and harsh frosts during the wet season. The central Andes is one of the major centers of origin and biodiversity in the world (Gade, 1999; Amend et al., 2008). Aymara small-scale farmers in the Bolivian Andes grow and consume crops such as numerous varieties of potato, oca, isaño, papalisa, quinoa, cañahua and tarwi. This is an expression of their lifestyle, traditional knowledge and cultural identity (Alarcon Vicente, 2011; Mamani et al., 2010).



Figure 1: Some of the potato varieties owned by Doña Viviana Herrera from Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz, Bolivia. September 2012.

Agrobiodiversity can be defined as "the variety and variability of animals, plants, and micro-organisms on earth that are important to food and agriculture which result from the interaction between the environment, genetic resources and the management systems and practices used by people" (FAO, 1999). The concept of agrobiodiversity not only takes into account genetic and agroecosystem diversity, but also values cultural diversity.

Indigenous farmers all over the world conserve numerous varieties of crops, which are often "neglected and underutilized", due to the past and present

efforts to increase high yields and productivity of a narrow set of crops, suited to high-input farming, rather than protect and use diversity (PAR & FAO, 2011).

"Neglected and underutilized" crops have traditionally been excluded by agricultural research and conservation carried out in developed countries, which has focused on a few staple crops that produce most food supply on a global scale: rice, wheat and maize, for example, produce more than half of the global food energy needs (Global Facilitation Unit for Underutilized Species, 2007). However, many "neglected and underutilized" crops are adapted to marginal growing conditions, such as those of the Andean Altiplano. Although they are neglected at the global level, these crops are often staples at the national or regional level and contribute to a nutritionally rich and well-balanced diet for those who harvest them (Hermann & Heller, 1997).



Figure 2: The flower of the potato variety Luki. Comunidad Coromata Media, municipio Huarina, provincia Omasuyos, departamento La Paz. February 2012.



Figure 3: The flower of the potato variety Waycha. Comunidad Coromata Media, municipio Huarina, provincia Omasuyos, departamento La Paz. February 2012.



Figure 4: The flower of two oca varieties Warichuchulla and Keni. Comunidad Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. February 2012.

Indigenous smallholder farmers' conservation activities are crucial for the preservation of agrobiodiversity, the promotion of sustainable food systems, and the resilience of local farming (Deruyttere, 1997; PAR, 2010). Indigenous people have rich traditional ecological knowledge systems, including ecosystem management, adaptation to changing environmental conditions, and biodiversity conservation (Berkes et al., 2000). Their value system is based on a close relationship with natural resources for subsistence as well as for spiritual reasons and, as a consequence, they play a crucial role in the stewardship of natural resources and biodiversity (IUCN Inter-Commission Task Force on Indigenous Peoples, 1997).

In recent decades, international attention has focused not only on the call to increase global food production for a growing population, but also on the need to make this increase sustainable—in order to prevent environmental degradation, climate change, and excessive simplification of agro-ecosystems (PAR & FAO, 2011). It was also recognised that "a wide food crop base is crucial for supporting local economies, traditions, and cultures and, above all, for being able to provide farmers with options for dealing with whatever agricultural problems may emerge in the future" (Global Facilitation Unit for Underutilized Species, 2007). Agricultural problems that can be easily caused by climate change constitute a challenge that farmers, fishers, herders, and indigenous peoples have to deal with more than anybody else.



Figure 5: An *apthapi* (traditional Aymara shared meal). The most important staple is potato, consumed in different varieties and transformed in *chuño* and *tunta* (freeze-dried products). Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. September 2012.

In the Andes, the indigenous cosmovision implies such a strong connection between "*lo andino*" and nature, that it has been defined an "agroecologic vision" of the world (Lozada Pereira, 2006).

Nature is personified by the Pachamama, the Mother Earth, a "living dynamic system made up of the undivided community of all living beings, who are all interconnected, interdependent and complementary, sharing a common destiny" (Art.3, Asamblea Legislativa Plurinacional de Bolivia, Ley de Derechos de la Madre Tierra, December 2010). Bolivia, under the guide of its indigenous president Evo Morales, approved the first Law on the Rights of Mother Earth, which considers nature a subject of legal rights and promotes the model of "vivir bien" (living well) that should shape production and consumption behaviors, as an alternative to capitalism (Wessendorf, 2011). This implies an "ecological reorientation of Bolivia's economy and society, requiring all existing and future laws to adapt to the Mother Earth law and accept the ecological limits set by nature" (Buxton, 2011). Despite this apparently favorable framework, however, indigenous farmers must face a series of both anthropic and natural challenges, such as the rise of industrial farming, land dispossession, out-migration from rural areas, water scarcity, or, last but not least, climate change (Velásquez-Milla et al., 2011).



Figure 6: Drought on the shores of Lake Titicaca, due to a late beginning of the rain season. Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. October 2012.

Climate change is severely affecting agricultural activities in the Northern Highlands of Bolivia. Precipitations have become irregular and unpredictable and the traditional agricultural calendar has changed.

The dry season, which should last until October, stretches now until late November, making Aymara smallholder farmers postpone the sowing because of the lack of rain which keeps the soil dry and unsuitable for production.



Figure 7: A flooded plot of papa in the community of Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. February 2012

During the wet season, on the contrary, precipitations are often too intense and cause floods especially around Lake Titicaca. For example, between February and March, in the community of Cachilaya, on the Northern side of the lake, large portions of the plots situated on the shore were entirely submerged with water.



Figure 7: Doña Viviana Herrera, a farmer of the community of Cachilaya, is taking out a plant of papa, since the last furrows of her plot, which are close to the lake, have been flooded by water. Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. February 2012.

Farmers are forced to harvest part of their production before its time, in order to save it from complete rot and destruction.

However, since this is done before harvest time, the growing process of the cultivations is interrupted, and, in the case of potato, tubers are still very small when they are taken out of the soil and they have not yet reached complete maturation.



Figure 8: A farmer gathers the potatoes which have just been taken out of the soil because of a flood. Tubers are still small and not yet mature. Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. February 2012.

The same happens in the plots of quinoa. Large portions of the plots situated on the shores of Lake Titicaca end up under the water, as it has happened in this agricultural year 2012-2013. Quinoa, as well as cañahua, is an Andean grain that doesn't need too much water. On the contrary, it is resistant to drought and to frost, while in case of excessive precipitations or hail the harvest is easily lost.



Figure 9: A flooded quinoa plot on the shores of Lake Titicaca. Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. February 2012.



Figure 10a: A flooded haba bean plot on the shores of Lake Titicaca. Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. February 2012.



Figure 10b: A flooded haba bean plot on the shores of Lake Titicaca. Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. February 2012.

While many farmers in the Bolivian Northern Highlands prefer to harvest high-yielding easy-to-sell varieties, some agrobiodiversity "champions" still conserve a large number of local varieties, together with the traditional knowledge related to their agronomic characteristics, their use and their resistance to climatic agents.

Local traditional knowledge, which has been passed down through generations and is still owned by Bolivian Aymara farmers, makes it possible for them to choose, at the moment of the sowing, the varieties that can respond better to the climatic challenges that they foresee. Furthermore, distributing the risk among different crops and crop varieties is proved to be a winning strategy.

In the case of papa, according to the farmers of the community Coromata Media, municipio Huarina, provincia Omasuyos, the variety Sakampaya is precocious and it is resistant to frost. The varieties Luki and Ajahuiri are resistant to drought and frost and are good for making *chuño* and *tunta*, dehydrated products which are also staple in the Andean diet.

In the case of quinoa, the indigenous varieties Choquepito, Wila Jupha - red quinoa, and Junqu Jupha - white quinoa are the most productive and suited to the Northern Highlands' climate. Cañahua is resistant to frost and can endure long periods without much water.



Figure 11: In a potato plot burnt by a heavy frost, the variety Luki is the only one that has survived. Cachilaya, municipio Puerto Pérez, provincia Los Andes, departamento La Paz. March 2012.

Traditional knowledge concerning the characteristics and use of different crop varieties is going lost, due to the substitution of local varieties with high-yielding non-native varieties and to rural-urban migration, especially of young people.

Research about the agronomic characteristics and the use of local varieties is needed, in order to provide indigenous farmers with further options to face environmental and climatic change.

There are initiatives like the project NUS IFAD, funded by IFAD and implemented in Bolivia under the supervision of the Fundación PROINPA, that aim at recuperating traditional knowledge, promoting the documentation and the monitoring of locally-conserved crop varieties and identifying the main threats to smallholder indigenous farmers generated by climate change. Bolivian researchers, such as the agronomists of the Fundación PROINPA, have been working for years in this direction, obtaining good results in rural communities such as Cachilaya, municipio Puerto Pérez and Coromata Media, Municipio Huarina.

However, much scientific and practical work still needs to be done, in order to help a larger number of indigenous farmers to recuperate their self esteem, their traditional knowledge and, ultimately, the agricultural varieties that they have gradually lost, as these are crucial means for them to respond effectively to the consequences of climate change.



Figure 12: Doña Rufina Torrez, of the community of Coromata Media, showcases her varieties of cañahua. March 2012.

Bibliography

- Alarcon Vicente, V. P. (2011). Inventariación de la agrobiodiversidad en la comunidad Coromata Media Provincia de Omasuyos. Tesis de grado. La Paz.
- Amend, T., Brown, J., Kothari, A., Phillips, A., & Stolton, S. (2008). Protected Landscapes and Agrobiodiversity Values. *National Wildlife*.
- Asamblea Legislativa Plurinacional de Bolivia Ley de Derechos de la Madre Tierra (2010).
- Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10(5), 1251–1262.
- Buxton, N. (2011). The law of Mother Nature: behind Bolivia's historic bill. Global Alliance for the Rights of Nature. Retrieved from http://therightsofnature.org/bolivia-law-of-mother-earth/
- Deruyttere, A. (1997). Indigenous Peoples and Sustainable Development: The Role of the Inter-American Development Bank. Washington, D.C.: IDB Forum of the Americas.
- FAO. (1999). Agricultural Biodiversity. Agriculture. Maastricht.
- Gade, D. W. (1999). *Nature and culture in the Andes*. Madison, Wisconsin: The University of Wisconsin Press.
- Global Facilitation Unit for Underutilized Species. (2007). Inviting all the world's crops to the table. Supporting traditional crops to supply future needs.
- Hermann, M., & Heller, J. (1997). Andean roots and tubers: Ahipa, arracacha, maca and yacon. Promoting the conservation and use of underutilized and neglected crops. Rome: Institute of Plant Genetics and Crop Plant Research (IPGRI).
- IUCN Inter-Commission Task Force on Indigenous Peoples. (1997). *Indigenous Peoples and Sustainability. Cases and Actions*. Utrecht: IUCN Indigenous Peoples and Conservation Initiative International Books.
- Lozada Pereira, B. (2006). Cosmovisión, historia y política en los Andes. La Paz: Producciones CIMA.
- Mamani, E., Mamani, R., & Rojas, W. (2010). Conocimientos tradicionales en la conservación in situ de la agrobiodiversidad. La Paz.
- PAR. (2010). The use of agrobiodiversity by indigenous and traditional agricultural communities in: Adapting to climate change. Synthesis paper.
- PAR, & FAO. (2011). Biodiversity for Food and Agriculture. Contributing to food security and sustainability in a changing world. Outcomes of an expert workshop held by FAO and the Platform on Agrobiodiversity Research from 14-16 April 2010 in Rome, Italy.

Rome: Food and Agriculture Organization of the United Nations and Platform for Agrobiodiversity Research.

- Velásquez-Milla, D., Casas, A., Torres-Guevara, J., & Cruz-Soriano, A. (2011). Ecological and socio-cultural factors influencing in situ conservation of crop diversity by traditional Andean households in Peru. *Journal of Ethnobiology and Ethnomedicine*, 7(40).
- Wessendorf, K. (2011). *The Indigenous World 2011*. Copenhagen: International Work Group for Indigenous Affairs.