



**Indigenous
peasant
agriculture of
the Andes
in the face of
climate
change**

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I. Introduction

In a few more months, the “Paris Climat 2015” conference (COP 21 Paris, where Bolivia will participate) will be held in Paris, whose main objective is to reach agreements that reduce greenhouse gas emissions and try to limit heating to 2 °C from here to 2100.

While some States are showing signs of advancing in limiting their gas emissions (France, the EU and USA recently) and adapting to Climate Change (CC), the problem depends not only of the States but also of other actors such as private companies that have a model of intensive development in carbon emissions.

In this sector, there are very few companies (for example General Motors, Google, Ikea) that are considering reducing their emissions and their energy consumption, promoting technological innovation and considering climate risks.

For the above, one might think that there is a take of international business awareness about climate change, however in the agricultural sector, happens quite the opposite. Transnational agribusinesses (Du Pont, Monsanto among others and their national subsidiaries) have not considered that initiative or taken that example. With their model of intensive commercial agriculture (production of monocultures, transgenics, intensive use of agrochemicals, proliferation of supermarket chains, mass transport of food, food waste and others), they are degrading and salinizing the land. They have excessively extracted groundwater, increase pesticide resistance and erode biodiversity, have increased deforestation and logically exhaust natural resources and increase the Emission of Greenhouse Gases (EGG).

According to FAO data, this type of commercial agriculture, which in Latin America is characterized by its high production / export of commodities (soy) and livestock (from Brazil, Argentina, Paraguay) has doubled its greenhouse gas emissions in the last decades. It currently constitutes 25% internationally, well above Africa (15%), Europe (12%) and Oceania (4%). “The net conversion of forests to other uses was the main source of EGG in the region: between 2001 and 2010 it generated 1.9 billion tonnes of CO₂ on average” (www.fao.org/news/story/es/item/41351/ icode). This report also highlights the excessive use of agrochemicals “...The application of synthetic fertilizers generated 13% of total EGG (725 million MT) in 2011”.

This information is corroborated by other international reports that indicate that the global agri-food system contributes between 44% and 57% of EGG emissions; not only for agricultural production (between 11% and 15%); but also due to changes in land use and increasing deforestation of large wooded areas (between 15-18%); for the transport of food / processing

/ refrigeration that uses excessive energy (between 15 and 20%) and for the alarming food waste (between 3 and 4%) (GRAIN 2014).

Despite these data, the type of commercial agriculture is presented as the only option to increase food production whose world demand is increasing, without questioning the effects generated by this type of agriculture for the environment.

II. Another option is possible.

Given this problem, in several countries of the world they propose some alternatives. FAO, for example, proposes to continue producing with agrochemicals and also with the system they call SIAP (Sustainable Intensification of Agricultural Production)¹.

Very little attention is given to other options, such as that practiced by peasants and indigenous peoples of the Andean region (Peru, Bolivia and Ecuador) related to sustainable development, biodiversity and climate change.

This agricultural development option is based on several aspects² that are necessary and illustrative to mention due to its “integral” approach, its “environmental management”³ and its adaptation and mitigation to climate change.

1. Soil / land recovery.

The intensive exploitation of crops, the erosion, the overuse of agrochemicals and deforestation among others, has largely damaged agricultural lands and ecosystems.

In Bolivia, for example, a study on chromatography carried out by the ISALP⁴ reveals that all of the agricultural land of the North and Center of Potosí is damaged / contaminated / depleted by the excessive use of agrochemicals, which is why the productive yields of any Product are very low.

For this reason, the first task that peasant farmers in several regions⁵ have set themselves is the recovery of their lands with natural fertilizers. To do this, they have even created fertilizer processing plants.

It should also be mentioned that there are several peasant initiatives for the habilitation / recovery of land for crops through the enclosure of areas (during years) and its natural recovery and growth of the forest with native and fruit species (for example, the enclosure of the town of Santa Bárbara, Municipality of San Lorenzo /Tarija (www.iiccatarija.org) and pasturage guard / maintenance for livestock (pasturage rotation in Itatiqui and Cuevo for

¹ Predominantly ecosystem approach

² Systematized and summarized from the diverse experiences of monitoring and evaluation of rural development projects carried out by the author in different high and subtropical areas of the Andean region (Peru, Bolivia, Ecuador), in recent years.

³ Referred to all actions aimed at the administration, use and management of natural resources and the conservation, maintenance, improvement and monitoring of the environment

⁴ SEMTA/ Bolivia. La Paz, 2015. (Study of soils and practices (in their areas of coverage), in the framework of the “Training Workshop on Sustainable Agriculture and Food Security” promoted by Multiple Services of Appropriate Technologies (SEMTA / Bolivia). La Paz, 2015.

⁵ Regions of the North and Center of Potosí; of the Commonwealth of Heroes of Independence Municipalities / MMHI in Tarija; in Cajamarca/Peru; in Pillaro / Ecuador among others.

example, in the Chaco de Santa Cruz and silvopastoral implantation in the Chaco of the Chuquisaca/Luis Calvo province).

In the North of Potosí, the villagers build the so-called slow-formation patachas or terraces associated with live contour and protection fences (valuing the technology of their grandparents), recovering and enabling new lands for growing vegetables, shrubs and medicinal species that favor the health and the environment.

It is part of this soil recovery, the reforestation undertaken in several regions, for which they are reproducing fruit seedlings and various species, with nurseries garden specialized in seed / seedling production (piloneras).

2. Harvest and water management.

For the search of water sources, the rural inhabitants travel great distances on foot in the heights of the mountain ranges, identifying water sources, springs, water eyes, water reservoirs and natural lagoons, recording and systematizing the distances, the flows, the dimensions, latitudes and others (In this regard, see the work carried out in the districts of Chuschi, Paras, the Tapacchocho lagoon and others in Ayacucho / Peru. www.ABA.com).

Water harvesting (q'ocha) through the construction of shortcuts⁶, ponds, and small and medium-sized family / group reservoir in the emerging microbasins; and the transfer of water from one region to another, through underground conduits, open channels, pipes, constitute other strategies employed by the inhabitants.

Water capture, especially based on traditional knowledge and practices of each region, proves to be very useful. In the region of Ayacucho / Peru, for example, they are recovering and reproducing plants and / or forest species such as the Putaja plant (*Rumex peruvians*), which is characterized by attracting water to their surroundings (used to increase flow rates in the sources of water), or the recovery and promotion of the use of Aliso (*Alnus acuminata*) in the municipality of Huánuco / Peru, which increases water flow several times.

In the Bolivian Chiquitanía (Community San Lucas and Carmencita in the Velasco province) techniques for water retention (capture) are implemented through infiltration ditches with organic fertilizer⁷, practice applied to the cultivation of coffee and others (see www.minga), with substantial benefits in the productive increase (of 275% with respect to the Bolivian average)⁸, which improves the quality of the product achieving a greater homogeneity (improvement of the quality of the product because the production is more homogeneous at the time of flowering) and, above all, conservation of moisture and water in times of drought.

⁶ With vegetation covered around the cut-offs (small reservoirs to grab water) for a more adequate conservation of the soils due to the humidity of the water, generating a decrease in erosion, winds and the increase of birds and biodiversity

⁷ Channels 40 cm deep by 30 cm wide, up to 100m long, where they place bran and / or guano, storing water (and humidity) up to 3 times their volume.

⁸ Community Carmencita/Chiquitanía. Proyect Geñoi (www.programaecoclima.org)



The proper management of the reservoir (encerramiento)⁹, not only by closing their areas and declaring ecological and conservation reserves, but above all by reforesting them with traditional species, conserving their biodiversity, investing in their conservation and maintenance.

An excellent example of this management is the experience of the water reserve in the Los Llanganates National Park, in the region of Píllaro / Ecuador, and the creation of a Patrimonial Fund for its maintenance, with projections for the next 50 years. (See www.cesa.org.ec)

Regarding the use of irrigation water by farmers themselves, it is done through pressurized irrigation systems, with control and supervision of water distribution among users, with a cadastre, frequency of irrigation, determination of type and number of sprinklers, flows, type of pipes, maintenance of works and others (Píllaro / Ecuador, www.cesa.org.ec).

They also capture rainwater (runoff) through the construction of embankments that filter and store water that is then redistributed through canals (thus preventing flooding and river overflows, having water, generating moisture and fertility of the soil www.iccatarija.org). In the Paraguayan Chaco they build elevated "Australian" tanks of land (land extracted from perforations) to retain the accumulated water.

The capture of water and its efficient use have ecological and environmental effects such as the appearance of slopes or puquiales, increased flows, generation of more humid microclimates in the environment of the q'ochas, favorable for wildlife, appearance of plant species appetizing for livestock, among others¹⁰.

3. Rescue and conservation of seeds.

In many rural areas there is a massive loss of agrobiodiversity caused by production based on agrochemicals, agroindustrial monocultures and unsustainable natural resource management that has resulted in the loss of Creole seeds.

FAO studies (FAO 2011) indicate that "... during the last century about 75% of plant genetic resources disappeared, while one third of the diversity that exists today could disappear by 2050". Therefore, the harvest, conservation and use of plant genetic resources is essential.

The peasant/farmers not only know about these losses, but also know that seeds are fundamental to food security and constitute a fundamental component of their culture, their

⁹ Practice that has also been implemented in the Chaco / Chuquisaca / Bolivia region, through the Geñoi program funded by the European Union and implemented by Action Against Hunger (ACH) / CARE International / Assistance in Action (AeA) and FAO / Bolivia

¹⁰ It also generates the enable of new farmland and exploitation of the entire extension of the plots, obtaining two or more agricultural crops per year, stabilizing production, increasing agricultural production and productive diversification (vegetables and grains, including pastures and forage for livestock and production of milk and derivatives).

productive systems and the food sovereignty of their people. That is why they emphasize the need to provide a genetically diverse set of improved crop varieties. Therefore, they are in the process of recovering the group or communal fairs of Creole seeds where rescue and conservation are encouraged on the farm, and the exchange of the great diversity of seeds of traditional products among themselves¹¹.

These fairs are usually organized by groups of women producers who not only pursue the recovery of native and Creole seeds, but share their ancestral knowledge about production, management and conservation practices; and also create conscience about the environment by showing their different local experiences with lessons in the management of agroecological systems to face the consequences of CC in different ecological floors (cold, medium and warm).

In this regard, several food security and sovereignty distinguish in different regions: for example in the region of the municipality of Caraparí/Chaco Boliviano, organized by the Association of Women Producers of Sustainable Agro - AIMPAS (www.agrecolandes.asocio) and also the great ecological fairs in the municipality of Huánuco/Peru (www.idmaperu.org) the Huancaró fair in Cusco/Peru, the fair in the municipality of Alcalá/Chuquisaca (www.pasosbolivia.org) which are held every month/week, with ample levels of participation and dissemination, regional and national.



These fairs are fundamental for the rescue and exchange of traditional seeds (germplasm) but also for the environment¹² since they avoid the use of fuels in the transport of food, thus reducing the emission of greenhouse gases.

Similarly, the free movement of seeds is a way to prevent their privatization, the expansion of corporate agriculture and GM crops, which menace the biodiversity.

¹¹ Distributed at the precise time for planting and adapted to their environment (they have their communal records and their own local banks) which in turn generates the conservation of their plant genetic resources.

¹² Also to prevent fluctuations in market prices and reductions due to speculation in the supply of food.

4. Integrated pest management and phytosanitary protection.

They complement soil recovery, water harvesting and seed rescue, integrated pest management (based on a healthy agroecological system) and phytosanitary protection; all this through the elaboration and use of biopesticides, the foliar fertilizer, mineral broths, biocides, bocashi¹³ (usually with local materials), and compost (fermentation of various elements plus ashes, cup, herbs and others mixed with water). (www.iiccatarija.org).

On the other hand, it should also be added that other conservation practices are added - according to the different regions and with different intensity - such as curves level, windbreak curtains, terraces, living barriers, plant cover, infiltration trench and other techniques such as crop rotation and the use of stubble and others.

It should also be mentioned that in several communities a flow of vegetable cultivation called "transition" (or clean production) towards the previous system is being consolidated, reducing the use of pesticides by adopting conservationist cultural practices to move from a highly cultivated crop intensive in agrochemicals to one more friendly with nature, such as the cultivation of vegetables and fruits in the Río Chico valley in Sucre / Bolivia (www.pasosbolivia.org).

5. The Productive diversity and training.

When practicing the recovery and multiplication of seeds of native varieties, they emphasize productive diversity with the rotation of crops such as legumes, cereals, tubers, various vegetables, fruit seedlings, also highlighting the search and choice of varieties more resistant to drought and sickness¹⁴.

The rotation of crops with the complementation of training activities is also very important both in the plain (Chiquitanía / Bolivia) and in the heights (Chuschi / Tuco in Ayacucho / Peru) and valleys (Churubamba/Tuco in Huánuco / Peru): Family / group / school gardens are combined with training and agro-ecological practices (rotation, association and diversification) with crops short term (vegetables, vegetables), medium term (corn, cassava, beans, potatoes) and long term (coffee, fruit trees) (www.ABA.com; www.minga.com; www.idmaperú.com). Mixed crops with cover crops improve soil biodiversity and accumulate more organic matter in the soil¹⁵, which affects the products to achieve higher productive yields.

There is also the breeding and management of livestock in plots (beef, guinea pigs (cuy), sheep and goats), combined with agricultural production for the recovery of the farm (chacra) based on complementarity.

6. The creation of food reserves and conservation techniques

¹³ Bocashi = biofertilizer based on the fermentation of yeast, fruit vinegar, molasses, distilled panela, cane juice and others. Biocides = vegetables (root, stem, leaves, flowers, seeds) that help control pests and crop diseases. Biol = liquid fertilizer

¹⁴ A good example of this is the "Sustainable Agriculture Programs for Adaptation to Climate Change in vulnerable regions of Bolivia and Peru"(SAM 1010) and "Adaptation to climate change of family production systems in Andean regions of Peru and Ecuador"(SAM 1011) implemented by German Agro Action (Welthungerhilfe).

¹⁵ As also confirm the studies of the University of Wageningen/Holland biodiversity.htm <http://www.wageningenur.nl/en/newsarticle/Does-mixed-cropping-with-cover-crops-improve-soil->

An essential (and complementary) aspect that is carried out in various regions is that of traditional practices of storage, rescue and conservation of food, practices that were being lost in families, such as the rescue of the Hualusa (Chiquitania); corn, potatoes, goose, mashua and others in the so-called "tockosh" (storage in jutes, soaking inside flowing water) or corn in "huaylluncas" (inside and outside the house, strung and hung) in the mountains range (Ayacucho) and valleys (Huánuco, Píllaro), which preserve the products better for many months, with all their properties and quality conditions, and reduce losses due to weevils and moths (Huánuco / Peru).



All this begins to generate a sense of revaluation and rescue of biodiversity.

There is also the storage of grains at the level of trojes and huaylluncas improved for the conservation of group management seeds, a practice that is implemented in areas of Chiquitania and Chaco / Bolivia.

In the same way, they highlight the techniques of food transformation to preserve them better as is the case of vegetables in noodles, making confitures of vegetables such as anco, beet and sweet potato (www.agrecolandes.asocio) and the traditional transformation of milk into chakichipa (cheese), meat in aycha charki, joco bread, and potato in cocopa or chuño (Ayacucho /Peru www.abaayacucho.org), which ensures food for times of scarcity.

This series of techniques reduce energy expenditure in food preservation and transformation.

7. Disaster prevention systems.

A fundamental issue that accompanies the previous aspects is that related to the emphasis placed on the recovery of sagesness and indigenous peasant worldview, which includes the transmission of ancestral knowledge about agriculture and the environment.

Andean peasant have knowledge through their own understanding, practices and conceptions for the use and conservation of resources and biodiversity. For example, the territory is considered as a place of life and protection, a place of upbringing that enables the constant flow of life in community, interconnected ritual and geographically by agricultural systems and their own modes of use and complementarity of agroclimatic diversity .

In that sense, various strategies for harmonizing with the climate and the environment are implemented and emphasize the rescue of traditional knowledge for risk management. In that way, they identify the bioindicators that can serve and counteract the main menaces. For example, they revalue and put into practice, the abigeo (shouts and sahumeros) for the hail away (Community of Chuschi / Ayacucho). Or they classify the songs of the birds and the appearance of others (frogs, ants, worms) through which they determine the rains, cold,

drought (Santa Rosa / Chaco Bolivia Community). Thus, they culturally reaffirm the existence of a particular way of life and the important role of indigenous knowledge in the conservation of natural resources¹⁶.

Finally, it should be noted that all of the above is complemented by a fundamental aspect for indigenous and rural peoples, such as education, training and education on disaster prevention, climate change, early warning systems, risk management, recycling and others, not only through schoolchildren (youth ecological brigades; student brigades) but also to residents in general, making them partakers in various actions (making vulnerable maps for example).

III. Problems.

. They do not have the necessary financial resources to implement / disseminate these practices, in general. Likewise, not all residents have access to natural inputs, and doing so implies training and resources.

. Absence of support in technological research to deepen the rescued knowledge and intensify these or to expand others, and for the transfer of that technology.

. There is no support to distribute / sell the natural products free of agrochemicals obtained being that they usually fall into the hands of intermediaries who do not value organic and clean products, and mix them with others. The few rural experiences of commercialization of organic products (for example the Integral Association of Organized Producers of the Municipality of Chayanta (AIPROMCHA-Potosí) have problems of accumulation, transporting to nearby towns, of location for sale within the markets established in intermediate cities (Llallagua / Potosí), among others.

. The products obtained are not sold at a fair price or reasonable because the other type of production sells food at lower prices. Therefore, it is necessary to include in the production costs of commercial products, the costs of replenishing the contamination of water and contaminated air, of replacing the land, of replacing damaged biodiversity, among others.

. Regional projects prioritize the use of water for mining and the extraction of hydrocarbons (oil and gas) before than their use in agriculture, creating socio-environmental conflicts and not respecting rural and indigenous communities.

. The deviation of water sources carried out by some enterprise farms (of livestock/wine and other) and also dam construction projects in the Amazon, creates damage to the environment, to the forests, to the biodiversity and organic agriculture.

. The population settlements and the expansion of the agricultural frontier in protected areas and in areas of indigenous peoples; (which dismantle large areas of forests as well as forest predators) affect communal lands and traditional irrigation canals.

¹⁶ Although with climate change even birds and other animals are disoriented so that these bio indicators are being reviewed.

IV. Brief Conclusions

. These concrete practices may seem to some governments and institutions somewhat unrealistic ("... it would be unrealistic to expect farmers to adopt sustainable practices only because they are more respectful of the environment ..." FAO 2011) however for many peasant farmers it is a matter of survival, the future of their children, and the preservation of their resources ("... we have to recover our land because it is the only thing we have ... if the land is not going to produce, of what are we going to live ... what are we going to eat?" Ms. Apolinaria Choque V / 2015, Belén Urmiri / Chayanta / Potosí Community. www.ISALP.org.bo).

. The approach of the described production system is suitable for food production not only because of its impact on the reduction of EGG in all phases (production, transformation, distribution, conservation, sustainability of natural resources) but also because it contributes to strengthening of resilience in the communities, allows to fight against poverty, generates healthy food for the achievement of food security and sovereignty, and also generates employment¹⁷; unlike the system based on the extractivism of natural resources, which only focuses on the market and the commodification of goods, which contribute to increasing EGG.

. This series of practices and actions carried out by peasants and indigenous peoples respond to an active participation and organization that fight to guarantee, as a community, to satisfy their most basic needs within their culture and worldview, also emphasizing that they are inserted in a logic non-mercantilist - which rather responds to Good Living - which contrasts with the system organized around consumerism, profit and the maximum profit.

. We hope that the "Paris Climat 2015" conference (COP 21 Paris) determines mandatory measures for countries to stop the agricultural production system of commodities, because if it continues this will increase EGG emissions, which will mean droughts, floods, hurricanes will be more frequent affecting the countryside and cities, many species that will be extinguished and also the production of staple foods.

. Emphasized in pointing out specific places and types of experiences so that they are concretely supported and appropriated for dissemination. National governments must understand that the CC is a real crisis, so radical measures must be implemented.

. In that sense, clean energy production systems should be financed and emphasize that the other "commercial" system begins its transition to the clean and healthy system, with a specific calendar of activities and precise goals to be achieved, highlighting that the dichotomies that pose (lack of resources or extractivism; zero production or agrochemicals; hunger or genetically modified / transgenic foods among others) are false.

¹⁷ "Conservation agriculture can reduce the necessary agricultural energy by up to 60% compared to conventional agriculture that uses machinery. Energy savings also benefit small farmers who employ labor or animal traction" (FAO 2011).

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