

Plants, people and a portfolio approach to the conservation of biodiversity: the case of potatoes in Peru

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Abstract

Biodiversity is of growing concern in many developing countries. It is of particular interest in Peru where the potato is one of the country's most spectacular examples of biodiversity. Given the number of ecologies, varieties, and production centers, no single law, program, organization, business or project is capable by itself of sustaining the potato's biodiversity. Rather, different activities, actors and alliances may well be not only necessary but desirable in an overall effort to sustain biodiversity of the crop. This paper outlines a portfolio approach to sustaining biodiversity in which diverse actors with diverse goals each play an important and complementary role. The Peruvian experience may well be of interest to other developing countries seeking to sustain the biodiversity of their tropical roots and tubers, but lack a comprehensive framework to address the problems and promise such biodiversity represents.

Keywords: *Ex situ, In situ*, marketing, environmental services.

Introduction

Environmental conservation encompasses the entire world and touches a constellation of issues. Among the most complicated, if not controversial, is biodiversity. The issue is of particular interest in Peru where the potato is perhaps the most spectacular example of Peru's mega biodiversity. According to Alberto Salas, taxonomist at the International Potato Center (CIP), Peru is home to between 2,000 and 2,500 native varieties. Given the number of ecologies, varieties, production centers and pressures on the potato sector, no single law, program, organization, business or project is capable by itself of sustaining the potato's biodiversity. Rather, different activities, actors and alliances may well be not only necessary but desirable in an overall effort to sustain biodiversity of the potato.

This paper outlines a portfolio approach to sustaining biodiversity in which diverse goals and diverse organizations each play an important and complementary role. The Peruvian experience may well be of interest to other developing countries seeking to sustain the biodiversity of their tropical roots and tubers, but lack a comprehensive framework to address the problem and promise such biodiversity represents. In so doing, the paper also seeks to promote greater synergies among actors and secondary objectives with the intent of making the principal goal of sustaining biodiversity easier and more rewarding for all involved.

Why think of the collective efforts to sustain biodiversity from a portfolio perspective? One reason is that an investment portfolio typically encompasses multiple objectives like total return on investment, preservation of capital and, increasingly, concern over social responsibility. In analogous fashion, sustaining biodiversity also entails multiple objectives such as food security, food production/economic growth and poverty alleviation/corporate social responsibility. Like different investments in a portfolio, each aiming to give priority to a particular goal, each being based on a different time horizon (from long to short-term), and each having a different risk/ reward ratio, recent years has seen a variety of mechanisms utilized to sustain the biodiversity of the potato. Prior to optimizing the composition of an investment portfolio, one first needs to understand the different investment instruments represented.

Conservation in situ and ex situ

For centuries, small farmers have maintained the biodiversity of the potato in their own fields, or *in situ*, utilizing an array of strategies as crop rotation, seed rotation, or exchange of potato varieties with other farmers in their own or nearby communities (Brush et al., 1992). The principal objective of these farmers was preserving their annual source of food as well as the cultural traditions and beliefs that potato cultivation represents for them. Maintaining a diverse collection of varieties—some more resistant to certain biotic or abiotic constraints than others—was their way of pursuing those objectives.

Beginning in the second half of the last century, various organizations in Peru—public, private, national, international—have employed different techniques or strategies to help maintain the biodiversity of native potato varieties both on and off (i.e., *ex situ*) the farm. Conservation *ex situ* can be done either *in vivo*, *in vitro* or both. *In vivo* conservation involves planting the same native varieties year after year in experimental plots managed by trained professionals. *In vitro* conservation entails maintaining the native potato varieties in the form of plant cuttings growing in test tubes in a controlled laboratory environment. Said cuttings are done in such fashion so as to ensure they are sufficient to reproduce each and every variety.

These efforts have focused largely on identifying, then ensuring secure and continuous access to the genes of these varieties in an accelerated process to develop new and improved varieties. In order to guarantee the continuity of this work and in the process simultaneously avoid the possibility that one or other native potato variety might disappear forever due to a severe frost, drought or landslide in a particular farmer's field, collections of native potato varieties were established to conserve these potatoes *ex situ*. At the macro level, these potato breeding efforts have sought to respond to the growing demand for food resulting from continued population growth and accelerating rural-to-urban migration in the developing world.

In Peru, several different public organizations maintain collections of native potatoes and in different forms. The National Institute for Agrarian Innovation (Instituto Nacional de Innovación Agraria (INIA) has collections at its Experiment Stations in Ayacucho (Canaan), Cajamarca (Baños del Inca), Cusco (Andenes), Huancayo (Santa Ana) and Puno (Ilpo). In addition, several universities and NGOs have collections. For example, the NGO IDEAS in Cajamarca is working with over 130 native varieties. Many of these organizations—INIA, Universities, NGOs work with local growers "*conservacionistas*", i.e., producers dedicated to plant and in so conserve their own personal/family collections of native potato varieties. INIA is in the process of creating a unified national data base containing information about the native potato varieties that are in the collections of its Experiment Stations, the different Universities and the NGOs, among other reasons, to reduce the number of duplicate accessions where possible and the cost of maintaining the various collections. However, it should be pointed out that this is not a quick and easy undertaking.

The International Potato Center (CIP) maintains the world potato collection that includes not only the native potato varieties of Peru, but also those of other countries, e.g. Bolivia, as well. CIP's system of maintenance of the world germplasm collection for potatoes includes four different components. In Peru, CIP maintains the collection both in the field (*in vivo*) and in the laboratory (*in vitro*). In addition, CIP coordinates the maintenance of the same collection at the new "doomsday" germplasm bank located in a cave in the ice on the island of Svalbard, Norway near the Arctic Circle (See <http://www.scientificamerican.com/blog/60-second-science/post.cfm?id=doomsday-vault-aims-to-save-the-wor-2009-02-27>). A second complete collection sits in a so-called "black box"—the entire collection is held under lock and key, not be opened except under emergency conditions, with the National Institute for Agricultural Technology (Instituto Nacional de Tecnología Agropecuaria, INTA) in Argentina.

Conservation via the market

Concern over maintaining biodiversity in Peru began to receive greater attention in recent years partly due to the growing recognition of the link between the cultivation of native potato varieties and the incidence of severe poverty. A review of government statistics on the incidence of poverty showed that while nationwide the percentage of people living in poverty was declining, poverty—in particular the poorest of the poor, or severe poverty, was still prevalent in the countryside as opposed to the cities. Furthermore, severe poverty was particularly acute in the rural highlands. A mapping exercise intended to explore the relation, if any, between severe poverty and potato production, in fact, found a high correlation between those districts with a high incidence of severe poverty and production of potatoes. Follow-up, ground-truthing research found that many

of these areas were isolated communities with cropping areas above 3,500 m where little else but native potato varieties could be grown.

For decades, potato producers in Peru—even those commercial growers that cultivate almost exclusively improved varieties given their higher yields—have maintained production of some native potato varieties for their own consumption given their superior culinary and nutritional traits. In recent years, however, many growers—even small growers that heretofore produced potatoes almost entirely for their own use, have expressed an interest in marketing native potatoes. Simultaneously, growing interest on the part of chefs in the New Andean cuisine combined with a resurgent demand on the part of the general public for traditional food commodities produced in the highlands has generated greater effective demand for native potatoes in major urban markets. This coincidence of wants led to a growing number of activities, organizations and enterprises offering monetary incentives to producers to continue planting native potato varieties as a form of conservation *in situ* through marketing.

One of the oldest forms of conservation through the market has been the wholesale marketing of native yellow potatoes in Lima. That activity has gone on for over half a century (Scott, 1985). Nevertheless, the traditional sale of yellow potatoes started to change in 1996 when a small, Lima-based produce business launched a new form of packaging yellow potatoes for retail sale: washed, graded and bagged in small, plastic mesh bags (Alarcon & Ordinola, 2002). Improved packaging for yellow native potatoes fit well with the concept of retail innovation in the form of superior quality and service—even for a product as basic as potatoes—being put forward by the growing number of supermarkets that up to that time no one had thought of doing. These firms were looking to lure tradition-bound Lima consumers away from established food-purchasing practices tied to frequenting municipal stall markets to do their shopping based largely on price. It is noteworthy that this innovative form of packaging is now standard practice for all types of potatoes as well for other vegetables.

Innovation in the packaging of yellow potatoes led to a wave of other new and/or improved potato products based on native varieties in which the link to sustaining biodiversity of the potato was much more explicit. In many instances, the launching of these products was the result of strategic alliances between private entrepreneurs, community-based producer associations, and research and development organizations. Most, if not all, of these varieties had not been sold before in any appreciable quantities in major urban markets. These products include: a variety of potato chips; skin creams and lotions; improved white *chuño* (or *tunta*), a traditional processed product; and, small, plastic bags containing a mix of native varieties and a mini recipe booklet sold in supermarkets (Anonymous, 2008; Ordinola *et al.*, 2007a, 2007b). Other products in various stages of development include instant mashed potatoes from native, yellow flesh potatoes (Cortez, 2008) and community-based restaurants and cooking festivals as part of promoting gastronomic or experiential tourism. Selling points for nearly all these products are that the native varieties are organically produced; they have superior culinary and nutritional traits including anti-oxidants, and they are grown by poor, small farmers in threatened ecologies.

Conservation via payment for environmental services

Not all producers in the vast, rugged highlands of Peru can participate in the types of programs outlined above. Some growers whether for geographic isolation or other reasons will fall outside established safety nets for conserving biodiversity. Under these circumstances, and for the purpose of both alleviating severe poverty and sustaining biodiversity, a third option comes up for consideration. It consists of an evaluation of the economic and social feasibility of paying for environmental services as a mechanism to sustain cultivation of native potato varieties.

The idea of offering payment for environmental services is something entirely new in Peru. Hence, it raises a whole series of questions about who (or whom) would pay for such services? How, where, in what form, to how many producers, and for how long could one envision such payments form part, albeit limited and experimental, of an overall portfolio of activities intended to sustain the biodiversity of native potatoes in Peru?

In summary, a whole series of activities, actors and alliances are engaged in sustaining the biodiversity of native potato varieties in Peru. The array of initiatives in their totality constitutes, *de facto*, a portfolio of investments—public, private, national, international. Among the unfinished tasks at hand to sustain the overall effort are: 1) legally registering of Peru's native potato varieties before the recognized, official authority in that domain; said registration is independent of that done with National Service of Agrarian Health (SENASA) in order to become

eligible for multiplication as certified seed; 2) continuing to evaluate—not only the technical, but also the economic feasibility of new and/or improved products using native potato varieties; 3) publicize more extensively the results achieved to date in order to, among other things, facilitate greater synergies among both actual and potential participants in the aforementioned activities; and, 4) in the context of these developments and the series of existing and about-to-be-signed trade agreements, aggressively seek out ways to institutionalize the process as part of an overall strategy aimed developing the potato sector in the years ahead— and as have already done the neighboring countries (See, for example, IICA-MADR, 1998).

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