Background

Many developing countries face a major challenge today: how to safeguard the biodiversity maintained in the fields of the rural poor - which constitute a national and global public good - whilst meeting those same people’s development needs and rights?

For some crop varieties, with a particular culinary or cultural appeal for example, it is possible to develop marketing strategies, so that the farmer benefits from increased income and is motivated to maintain them. But not all genetic diversity has market potential. For those without, a different type of incentive mechanism is required, which can reward farmers for providing a conservation service to society and compensate them for their efforts.

A novel solution to this dilemma uses Payments for Ecosystem Services (PES) concepts and uniquely applies them to agrobiodiversity, using a competitive tender approach to generate and select community level conservation service offers. The approach results in a Payments for Agrobiodiversity Conservation Services (PACS) Research for Development platform, which not only provides farmer incentives but also undertakes a wide range of conservation and use management activities, such as: prioritization, conservation target setting, accounting for social equity, monitoring and facilitating value chain development, while supporting de facto implementation of Farmers’ Rights.

The platform facilitates the involvement of a strategic range of stakeholders (e.g. farmers and their organizations, NGOs, extension services, universities, genebanks, local and provincial governments, Ministries of Environment, Economy and Agriculture, private sector entities, international agencies, etc.), with a view to enhancing common pool genetic resources governance capacities.

Overall, successful small-scale applications in Peru (quinoa), amaranth (potato), Ecuador (maize), Guatemala (beans and maize), Bolivia (quinoa), Zambia (crop wild relatives), India and Nepal (minor millets) have revealed that such incentive mechanism platforms are capable of promoting the cost-effective and socially equitable conservation of agrobiodiversity and its sustainable use at modest cost.

In Peru in particular, the Directorate of Biological Diversity, Ministry of Environment has, under its Euro EcoTrade Programme with the Ministry of Economy and Finance, shown strong support for the implementation of such PACS platforms. It has voiced interest in scaling future interventions to cover 15-20 crops, which are important for climate change adaptation and food security.
but whose infra-specific diversity appears at risk. PACS is a means of meeting regulatory commitments under the Convention for Biological Diversity, the International Treaty for Plant Genetic Resources for Food and Agriculture and national legislation (e.g. National Biodiversity Strategic Action Plan, Retributions for Ecosystem Services Law, etc.). The private sector has also demonstrated support for such mechanisms.

One such crop is amaranth (*Amaranthus caudatus* L), an Andean grain known for its high nutritional values. Below we present a brief case study of a PACS amaranth application that represents the first time that a government agency has both adopted PACS and funded the farmer rewards directly itself.

**Case study results**

*Intervention design and implementation*

Following a number of field visits by the project coordinators and Regional Government of Cusco technical staff, no coloured varieties of amaranth could be identified *in situ* on farm. Seemingly, these have now been replaced entirely by two improved white varieties, *Oscar Blanco* and *Centenario*. Fortunately, the genebank at the Andean Crops Research Centre, Faculty of Agrarian Sciences, University of Saint Anthony of Abad, (CICA-FCA-UNSAAC) was able to provide 250g of seed for each of 54 accessions (total = 13.5kg) of coloured amaranth that had been originally collected some decades ago from the districts of Anta, Calca, Cusco, Paruro and Paucartambo in the Region (State) of Cusco.

Using a PACS competitive tender approach and following the realization of a farmer training workshop, conservation service offers were received in November 2017 from 25 communities, covering 11 hectares and 416 farmers (260 men and 156 women). Bid offers totalled PEN185,000 (US$56,950) and varied between PEN0.25–2.0/m² (US$770–6,150/hectare). Such a wide range indicates significant heterogeneity in farmer willingness to participate and hence potential for cost savings through the use of a competitive tender approach.

Given that the total budget for farmer community group in-kind rewards/payments that had been assigned by the Department of Agricultural Competitiveness, Regional Government of Cusco, was PEN30,000 and that seed availability was limited (planting density was recommended at 3.9kg/hectare, so total seed available was sufficient for only 3.5 hectares), a linear programming model was applied with a view to identifying a cost-effective intervention strategy with maximum community participation. The budget was shown to be the binding constraint, allowing for only 16 of the 25 communities to be selected (involving 223 farmers, of which approximately 40% were women).

Seed was distributed to the selected communities, and extension advice, monitoring and verification visits were subsequently made by regional government extension agents to ensure that the contracted conservation service had been duly provided. Upon successful completion, a post-harvest rewards hand-over ceremony took place in July 2018. The rewards requested by the farmers, which the project stipulated had to be in-kind and are paid at a farmer group level, were largely related to farm inputs (including for irrigation) and construction materials.

*Follow-up*

In December 2018 a follow-up and status monitoring visit was realized, covering 13 of the communities...
Interviews were realized with 135 farmers (58.2% of the total), of whom 76.8% (43/56) of those with seed also intended to share them (not necessarily for free) with family members, neighbours and others (81.3% of the total) that had participated in the PACS scheme. Total yield was 631kg in total, equivalent to 686kg per hectare and an average of 4.7kg per farmer.

76.8% (43/56) of the farmers who responded to follow-up questions stated that they had not experienced any problems with the cultivation of the crop, while the remainder noted problems arising from receiving the seeds only late in the planting season, slowness to mature, high labour requirements, pests and diseases (birds and fungus) and frost damage. Promisingly, 82.5% (47/57) stated that they had saved some of their seed and intended to replant during the following agricultural season even in the absence of further reward payments; with the remainder noting that reseeding had occurred naturally (3.5%, 2/57) and 14% (8/57) stating that they had no seed to save. 44.4% (24/54) of those with seed also intended to share them (not necessarily for free) with family members or neighbours.

47.4% (27/57) intended to or had used part of their harvest for home consumption, particularly at breakfast time. By contrast, 42.1% (24/57) stated they had not consumed any of the harvested crop, which in part may be related to certain households being unaccustomed to consuming amaranth. Other benefits associated with participation in the project by those who had submitted offers could be invited to participate. As with previous PACS experiences, seed availability issues mean that conservation goals (e.g. based on minimum areas and farmer numbers) cannot be achieved during the first year but with continued regional government support, the different re-introduced amaranth varieties could eventually reach a ‘not at risk’ status. Assuming that under a larger project initiative, sufficient areas and numbers of farmers could be identified at the lower end of the costs identified above (US$770/ha), then achieving a five-hectare conservation target spread across 50-100 farmers for each of 306 amaranth varieties, would cost the equivalent of PEN83,000–100,000 (US$25–30,000) p.a. in total for the 30 varieties.

We note, however, that such calculations are particularly sensitive not only to the number of varieties that require intervention and the size of the conservation target, but also the degree of varietal persistence before requiring a further round of intervention (all of which remain to be determined more precisely). PACS seeks to ensure that such persistence rates are high and thus re-intervention costs low, by selecting to work with those communities that already have high socioeconomic and cultural preferences for traditional variety cultivation (as reflected by their bid offers).
Recommendations for action for upcoming agricultural seasons include:

- Establishment of a systematic conventional and participatory monitoring system with the specific objectives of:
  - Permitting continued documentation and characterization of the reintroduced varieties. This includes arriving at a consensus regarding local names, as farmers are essentially now working with ‘morphotypes’ and the (taxonomic) unit of conservation needs to be clearly established for associated conservation targets to be articulated.
  - Allowing for degrees of persistence to be established (both in terms of farmer numbers, as well as specific varieties and areas) and to thus inform the varietal focus, timing and resource requirements of future interventions.
  - Permitting the characterization of farm household traditional variety use (e.g. for sale, exchange, home consumption, replanting) and allowing exchange networks to be mapped and supported.

- Support for threatened variety seed multiplication, purification, storage and dissemination/exchange.
  - Seed quantities available from CICA were limited to 250g per accession, with accessions sometimes being shared between 10 or more farmers, resulting in just a bottlecap-full each. Given that amaranth production generates a high number of seeds, it is important to now take advantage of the seed that the project retained (5% of harvest) and that farmers have kept themselves for replanting, so as to ensure it can be multiplied and disseminated more widely. CICA and the National Institute for Agrarian Research (INIA) could support multiplication and purification activities (as farmers currently working with morphotypes), as well as using the reintroduced materials as a source of future accessions. With regard to storage, elsewhere, in similar contexts, community seedbanks have been shown to be capable of providing a critical platform around which community-based conservation incentive mechanisms may be developed, while simultaneously addressing the current scarcity of (high public value) traditional species/variety seed availability and post-harvest storage.
  - PACS rewards could also be given not only for the provision of conservation farming activities, but also to reward the provisioning of monitoring data (including by mobile phone) and undertaking seed sharing (e.g. farmers who share seed with at least two other farmers).

- Support for initiatives that can promote levels of consumption that are at least sufficient to support the stated conservation target over the long-term. Such initiatives could include:
  - Continued genetic and nutritional characterization of native amaranth. Amaranth energy values, protein content and amino acids are greater than that of other cereals. The grains contain calcium, phosphorus, iron, potassium, zinc, vitamin E and vitamin B complex. Amaranth, particularly varieties with high iron and protein content, have a potentially important role to play in combatting significant public health challenges, such as iron deficiency anaemia. Characterization can be used to identify high potential native varieties in this context.
  - Enhancing farm household diets: Household training in nutritional and dietary qualities of amaranth and its different varieties, as well as in the preparation of a range of amaranth-based traditional food products. Key local community members with amaranth culinary expertise could be used as trainers in other communities.
  - Integrating traditional crop varieties into existing social programmes for mass consumption (as done in India for minor millets). Public food procurement programs, such as Qaliwarma and regional/local initiatives, to include traditional amaranth varieties in their local food purchases for schools, universities, hospitals, the armed forces, prisons, etc. Private sector companies with large cafeterias (e.g. mining companies) could also be
encouraged to participate. Such procurement could simultaneously encourage more sustainable and healthy eating habits, as well as generating sufficient demand to support the attainment of conservation targets.

- Exploration of value chain development opportunities, including in collaboration with the private sector (e.g. marketing of premium ‘diversity-friendly’ products, as being done for quinoa milk by Kai Pacha Foods®. Private sector collaboration is also possible through engagement with their corporate social responsibility programmes (e.g. Aje Group case).

- Continued support for the development of an agrobiodiversity-related green public investment project (PIP-Verde), as a longer-term PACS funding mechanism. Project could include expansion to other crops of importance in the Cusco region, including those already identified as a priority by the Ministry of Environment.

Conclusions

Upscaling challenges relate to the need to establish a systematic monitoring/early warning system, generating a sustainable demand for threatened crop varieties (potentially through enhancing farmer household consumption, engagement with government food procurement programmes, as well as more conventional value chain development), and ensuring long-term sources of support (for example, through further regulatory development that explicitly recognizes the public good ecosystem services associated with agrobiodiversity, and the elaboration of agrobiodiversity-related green public investment projects). An additional challenge relates to the difficulty of accessing threatened variety seed in sufficient quantities and quality during the first years of intervention to ultimately be able to reach agreed varietal conservation targets.

Acknowledgements

This work has been carried out as part of Bioversity International’s Economics of Genetic Resources Conservation and Sustainable Use programme of work and in collaboration with the Directorate of Agricultural Competitiveness, Regional Government of Cusco and the Directorate of Biological Diversity, Ministry of Environment. This research was undertaken as part of, and funded by, the CGIAR Research Program on Roots, Tubers and Bananas (RTB) and supported by CGIAR Trust Fund contributors.

For further information

PACS Video: www.bioversityinternational.org/pacs
Full list of publications and briefs: www.bioversityinternational.org/pacs-related-publications/
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Endnotes

1. US$1 = PEN3.25 at time of survey
3. Remainder of seed distributed associated with farmers who were not available for interview in the 13 communities covered or who were located in the remaining three communities.
4. Total number of responses differs between questions, as not all farmers answered all questions.
5. At an institutional level, CICA benefited from its participation in the project as a source of the threatened variety amaranth seed by receiving machinery (i.e. a dryer) to assist it when regenerating accessions.
6. Not every accession corresponds to a distinct variety.
7. Assuming a 5-15 year time horizon and a 5 hectare/variety conservation target (to be spread across 50-100 farmers), with persistence rates of 40% and repeat interventions necessary every 5 years, a 20% monitoring and administration cost overhead and a 5% discount rate (adapted from Drucker et al, 2017).


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