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Biocultural Heritage Innovations in the Potato Park

SIFOR Qualitative Baseline Study, Peru

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Asociación ANDES

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Asociacion ANDES and the Potato Park

About the organisations

Asociacion ANDES is a small international non-profit indigenous organisation that works to support indigenous peoples in their struggles for community-controlled and biodiversity-based food systems. ANDES' support takes the form of independent action-research and analysis, networking at local, regional and international levels, and fostering new forms of inter-community co-operation and alliance building. A key mission is the participatory development of methods, tools and processes for establishing holistic landscapes that conserve and protect the local (agro) biodiversity; foster ecological food production; protect indigenous rights and their biocultural heritage; promote local co-ordination and cooperation; foster innovations that build resilience, low-carbon economies and sustainable livelihoods; and protect and restore local habitats and ecosystems (Argumedo and Stenner, 2008).

The Potato Park is a community-managed Biocultural Heritage Territory established by six Quechua communities in Pisaq, Cusco, Peru in 2000. It celebrates and protects a unique traditional mountain agroecosystem, its indigenous biocultural heritage and institutions, and one of the richest areas of native potato diversity in the world. The potato, an Andean biocultural expression, was chosen as a 'flagship species' and placed at the forefront to implement a holistic landscape management approach based on *sumaq kausay*, or *buen vivir*, the Andean paradigm of development or 'well-being'.

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Acronyms

BCH	biocultural heritage
BCHI	biocultural heritage innovation
BCHT	Biocultural Heritage Territory
CBD	Convention on Biological Diversity
CIP	International Potato Centre
ICT	information and communication technology
IIED	International Institute for Environment and Development
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
FAO	Food and Agriculture Organization
FG	focus group
FGD	focus group discussion
FPIC	free, prior and informed consent
GMO	genetically modified organism
IPCC	Intergovernmental Panel on Climate Change
ILO	International Labour Organization
masl	metres above sea level
MINAGRI	Multisectoral Commission on Food Security
NGO	non-governmental organisation
PAR	participatory action-research
SENAMHI	Peruvian National Service for Meteorology and Hydrology
SIFOR	Smallholder Innovation for Resilience
TK	traditional knowledge
WIPO	World Intellectual Property Organization

Summary

This report presents the results of a qualitative baseline study on biocultural heritage-based innovations for food security and climate resilience. It was conducted in four Quechua communities in the Potato Park, Cusco, Peru, from January to August 2013, as part of the Smallholder Innovation for Resilience (SIFOR) project. The study defined Quechua biocultural innovations as the practical use of new knowledge. These could be endogenous innovations, emerging from the interactions of elements of biocultural heritage – traditional knowledge, biodiversity, landscapes, cultural and spiritual values and customary laws – or collaborative innovations, emerging from the links between traditional knowledge and science. Information about innovations was collected through focus groups, in-depth interviews and participatory action-research combined with indigenous research methods, involving a total of 60 households. Community researchers facilitated the focus groups and interviews following customary protocols. They used ICTs to collect data in oral formats, and analyse it in both Quechua and Spanish to enable their active participation.

The research used a 'decolonising methodology', allowing indigenous communities develop their own strategic approach to knowledge production based on their own concepts and worldview. Seven local community researchers, representing each participating community, worked with ANDES to design the research methods and tools. The starting point was the Andean holistic worldview expressed in the *Ayllu* system. In order to achieve *sumaq causay* (ie. holistic living or well-being), there must be harmony between the three *ayllus*: the *runa ayllu* (humans and domesticated species), *sallka ayllu* (wild and semi-domesticated species), and *auki ayllu* (the sacred and the ancestors). This provided a useful conceptual framework for understanding biocultural heritage-based innovations, classifying them as *runa* (market innovations), *sallka* (technological innovations) and *auki* (institutional innovations).

The study began by exploring community perceptions of climate change. Farmers in the Potato Park identified three climate-related threats. Erratic weather, warming temperatures, and late and unpredictable rains have resulted in a shorter growing season. These weather changes have reduced the number of potato varieties they can grow, and the resulting yield. Increased temperatures and erratic weather have increased pests and diseases such as late blight, potato tuber moth and Andean potato weevil.

The Potato Park communities also face significant socioeconomic challenges. They live below the national poverty line, with high food insecurity, high illiteracy particularly amongst women, and very poor agricultural extension, training and financial services. Women have taken on additional responsibilities to enable their husbands to migrate to seek temporary work. In addition, the biodiversity and culture of the region are under strain from resource extraction industries, industrial agriculture and globalisation.

The study identified 30 technological, market and institutional biocultural innovations developed by the Potato Park communities in response to these challenges. The technological innovations serve to spread risk across space (e.g. the expansion of traditional crops to higher elevations), across time (e.g. the establishment of a community seed bank), across diverse assets (e.g. the reintroduction of traditional potato varieties into farmers' fields), and across households and communities (e.g. sharing traditional knowledge and seed exchanges).

A number of market innovations have been developed collaboratively by the communities with ANDES. For example, microenterprises bring together different communities especially women, for capacity development and income generation based on biocultural heritage, including gastronomy, handicrafts, tourism and natural products collectives. An informal Potato Park trademark has been developed as well as a 'culinary sanctuary' to protect the park's rich culinary heritage, including a restaurant dedicated to the native potato.

In terms of institutional innovations, the Potato Park itself is an innovation. It is managed by indigenous communities rather than governments, and is governed collectively by the Association of Potato Park communities, using the *ayllu* system as a model. The communities have also developed an inter-community benefit-sharing agreement based on customary laws, a biocultural community protocol which establishes claims to a range of rights in domestic and international law. The inter-community Potato Guardians group plays a key role in the stewardship of the Park's potato diversity and

collaborative research with scientists. Another significant innovation is the Park's repatriation agreement with the International Potato Centre, which has returned 410 native potato varieties to the communities and prohibits the patenting of these varieties and related knowledge.

The great majority of the biocultural innovations identified have been adopted in all four of the communities studied, suggesting a wide dissemination of innovations within the Park. Many of the technological innovations were developed endogenously by individuals and transmitted from farmer to farmer. Elders who are recognised and respected in their communities are considered key to developing and sharing innovations. The firmly held beliefs and practices related to customary laws and institutions seem to support the development of biocultural innovations and their diffusion, because these beliefs link indigenous communities with their land, water, flora and fauna and because they encourage oral transmission from generation to generation.

On the other hand, most of the market and institutional innovations were developed collaboratively by community groups working with innovative outside institutions such as ANDES and CIP. Community assemblies are important for sharing knowledge, group decision making and problem solving. Inter-community groups have supported innovation by bringing together like-minded people to solve problems. Participation in networks and events can support wider dissemination of innovations to farmers, policy makers and scientists. The adaptation of the project's conceptual framework and research methodologies to the context of the communities in the Park was very useful for facilitating reflection and conversation on types of innovations and factors influencing innovation development and diffusion.

Biocultural products of the Potato Park. Credit: ANDES

1. Introduction

Smallholder Innovation for Resilience: Strengthening Innovation Systems for Food Security in the face of Climate Change (SIFOR) is a research project involving partners from China, India, Kenya and Peru, co-ordinated by the International Institute for Environment and Development (IIED) based in the UK. The research aims to identify and explore local innovations – i.e. practices and technologies – that significantly improve the food security of local people, to disseminate these innovations among the participating communities and to strengthen local innovation systems based on traditional knowledge and biocultural heritage.

SIFOR partners from China, India, Kenya and Peru collaborated on developing a common framework and research tools. Questionnaires for a qualitative survey were developed together by all partners, and were adapted and applied to local conditions by each partner. The project partners in Peru are Asociacion ANDES and the Potato Park.

The Potato Park is located in the Sacred Valley of the Incas, at altitudes ranging between 3,400 and 4,600 metres above sea level, and spanning a territory of over 9,000 hectares. It contains a vast diversity of domesticated and wild potato varieties, and is considered a secondary centre of origin of the potato (CIP, 2008). The Park has around 1,344 different varieties of potato, according to the communities' traditional knowledge-based classification, as these are morphologically different and come from different sources – the Potato Park communities, the International Potato Centre (CIP), neighbouring communities and Cusco University. According to western scientific classification, the Potato Park has about 650 different varieties (as some of the 1,344 are thought to be duplicates).

In addition to potatoes, other native Andean crops such as olluco, beans, maize, quinoa, tarwi, and oca are produced. Agriculture is also responsible for producing wool, medicine and fuel. Complementary economic activities include animal husbandry, handicrafts, ecotourism, gastronomy and the production of natural products based on the local biocultural heritage (ANDES, Potato Park and IIED, 2012). Other important functions of the local agrobiodiversity include maintaining ecosystem services. These provide critical inputs to the local agriculture, such as soil fertility, pest and disease control, water use efficiency, and pollination. The Potato Park seeks to contribute to creating a more resilient, sustainable, socially just, and secure global food system.

This report presents the results of the qualitative baseline study carried out in four of the five communities that make up the Potato Park. From January to August 2013, researchers from ANDES and the communities of Amaru, Chawaytire, Pampallaqta and Paru Paru applied a participatory methodology to carry out the study, which included the identification and description of biocultural innovations practised by the farmers of the Potato Park. They also explored the factors that influence the development of local biocultural innovations. The research began by exploring climate trends in the region. A literature review provided an overview of the conditions and trends in the local climate, while focus groups and interviews gathered community perceptions of current and past climate conditions, and the impacts of climate change on agriculture, livelihoods, and wild species and agrobiodiversity. The study also explored trends in livelihoods, farming systems, food security and crop diversity in the four communities.

This report contains a short background section, providing the biocultural and climatic context of the study area. Section 3 outlines the participatory methodology and details of how innovations were discussed, identified, organised and documented. Section 4 presents the findings on climate trends, drawing on the literature review and qualitative survey, as well as socioeconomic trends in the Potato Park, drawing on initial results of the quantitative survey. Section 5 describes each of the biocultural heritage innovations that were identified, categorised into technological, market and institutional innovations. Section 6 provides an overview of the factors supporting innovations. Section 7 discusses the next steps and the conclusions.

2. Background: biocultural heritage and climate change in the Cusco region

The Southern Peruvian Andes are a centre of biocultural diversity, one of the cradles of agriculture and a region that is highly sensitive to climatic variability (Chepstow-Lusty, 2011). Cusco's biocultural landscapes hold an immense wealth of indigenous knowledge and practices, and an innovation system with agricultural and ecosystem diversity that has developed and endured through time. It has been the centre of much of the socioeconomic and technological development that took place in the Andes over the past thousand years.

Over the last millennium, Cusco witnessed a sustained period of significant cultural turnover and societal evolution, which culminated in the rise to power of the Incas (AD 1400-1533), with Cusco serving as the capital (Chepstow-Lusty, 2011). The Incas represent the largest and most sophisticated indigenous civilisation ever to develop in the Americas.

This phase of dynamic Incan social and technological development took place during a period of major environmental change on a global scale (Sterken *et al.*, 2006). The first four centuries of the last millennium were characterised by a sustained period of higher than average temperatures (known in the northern hemisphere as the Medieval Warm Period), followed by an interval of lower than average temperatures (the Little Ice Age), lasting until the mid-to-late 1800s (Sterken *et al.*, 2006).

The causes of the success and demise of the Incas civilisation are not always clear; however it is widely accepted that a combination of socio-political and environmental factors ultimately played a major role in determining its failure. Colonisation was a well-known factor in the demise of the empire. The Andean environment is another key factor, in that successful agricultural practices were based on technologically, economically and institutionally innovative practices (such as land-use systems, terracing, or barter markets), but which were highly susceptible to any decline in conditions (Sterken *et al.*, 2006).

Today, the headwaters of the Amazon, despite diminishing glaciers, continue to flow from Cusco's sacred mountains down to tropical rainforests, passing through diverse flora and fauna and through villages with thousands of years of continuous human habitation and domestication.

The effect of climate change is already being felt in the villages' farms and is transforming indigenous agricultural practices and crop systems across the Cusco region. Farmers in the Potato Park, especially elders, note gradual warming conditions, causing cultivated and wild species to migrate upwards to cooler temperatures. They also note a decrease in the amount and number of days of snow cover on mountain peaks, increasing extreme events such as heavy rains or drought, late onset of rains, as well as increased rainfall outside the rainy season (see Section 4).

The Potato Park of Cusco is thus an ideal place to study the factors driving the success and/or demise of adaptation of the local indigenous peoples to current environmental and socio-political change. It provides a situation where, on the one hand knowledge, culture, biodiversity and landscapes are under strain from the rapid development of resource extraction industries, industrial agriculture, globalisation and climate change impacts in the local area. On the other hand, the resilience of indigenous peoples and their wealth of indigenous knowledge, practices, innovations and agricultural and ecosystem diversity may provide viable responses to adapt to this new environmental change which is happening on a global scale.

3. Methodology

The research used a 'decolonising methodology' to enable indigenous and peasant communities to form their own strategic approach for the process of knowledge production based on their own indigenous concepts and worldview (Argumedo, 2012). The methodology combines participatory action-research (PAR) and indigenous research methods such as storytelling, allowing for the creation of spaces for collective action that ensure place-based, participatory enquiry, and accountability to the communities participating in the research. To that end, local experts representing each of the participating communities worked with ANDES staff in all stages of the research process, including the design of the research tools, data gathering and analysis. The process supported farmers' endogenous capacity development for enquiry and analysis, promoting local ownership of the research process and strengthening the capacity of farmers to conduct their own research and negotiate with external actors.

3.1 Free, prior and informed consent

The Code of Ethics of the International Society of Ethnobiology (ISE, 2006) was used as a guide throughout the process to ensure respect for local laws, values and institutions, and to obtain the free, prior and informed consent (FPIC) of the communities. ANDES staff and local researchers conducted consultations on the proposed research with community members at village assemblies, and with local authorities in focus group meetings. As a result, collaboration agreements were signed and work plans and research tools were adjusted according to suggestions arising from these consultations. Community researchers carried out an FPIC process before each research activity (focus group discussion and semi-structured interviews). The facilitators followed customary etiquette and protocols used in traditional social gatherings to communicate the objectives and scope of the project and request FPIC. This included the sharing of coca leaves with interviewees and a recall of the network of cultural values of the communities.

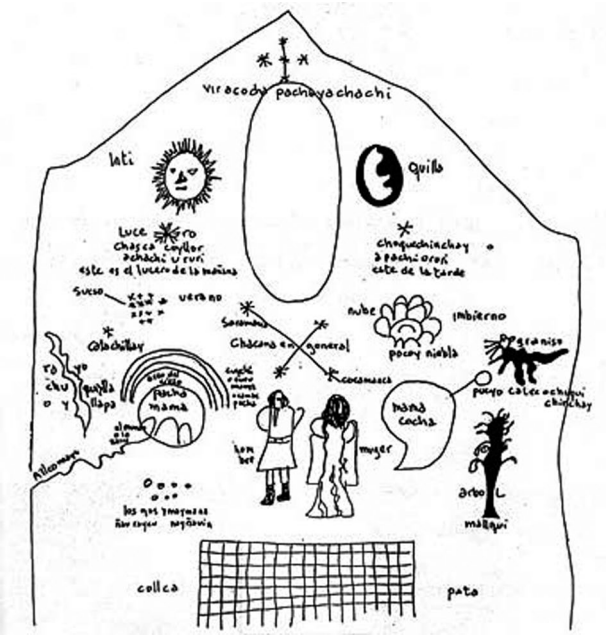
3.2 Establishing a team of local experts

Early in the project, a team was formed of seven local researchers representing the four participating Potato Park communities. The researchers were appointed by their own communities, based on criteria defined by the project. Training workshops were held on PAR techniques, exploration of key concepts, and facilitation techniques for leading focus groups and carrying out in-depth interviews. The training included the use of information and communication technology (ICT) for qualitative research, including tablets, smart phones, survey applications, video cameras and audio recorders. The capacity development of local experts in research methods strengthened their abilities as local leaders, ensuring a community-led research process.

3.3 Conceptual framework

The conceptual framework for the research was based on a pre-Hispanic conceptual graphic representing the cosmology of the Incas, based on a picture in the Sun Temple Qorikancha in Cusco. The conceptual graphic in Figure 1, by the native chronicler Juan de Santa Cruz Pachacuti Yamqui Salcamayhua in 1613, illustrates how the Incas spatially and socially ordered their environment.

Figure 1: Santa Cruz Pachakuti conceptual graphic representing the world as a complex system



Source: Cabrera, G. (2012)

The graphic pulls together and visually represents the logically coherent interpretation of the holistic Andean worldview and experience expressed in the Andean *Ayllu* system. It embodies the three interconnected and interdependent communities that form the *ayllu*: the *runa ayllu* (the community of humans and domesticated species), the *sallka ayllu* (the community of the 'wild' and semi-domesticated species), and the *auki ayllu* (the community of the sacred and the ancestors). The goal of the *ayllu* is to achieve *sumaq kausay*[1] which requires collective exploration and creation of the material and spiritual conditions to build and maintain harmony among these three *ayllus*. Therefore, the graphic was found to be a unique source of native Quechua concepts about biocultural heritage, and a useful conceptual framework for studying biocultural heritage-based innovations. As well as explaining graphically the main elements of the Andean Biocultural Heritage System – namely the cosmology, religion, philosophy, social structure, occupations and individuals, techniques, taxonomic classification of animals and plants, and appropriate times for various activities – the graphic also details the presumed relationships among them.

The SIFOR project considers biocultural innovation as a novelty; this translates into considering that all new things that are done, or old things that are done in new ways, must result in new practices, products, markets, institutions and organisations, which are improved and more efficient in their biocultural contexts than the former ones. A similar approach to innovation in agriculture has been practised in the Andes for millennia through the application of indigenous institutional and human resources to productive processes. As a result, communities have achieved new and better technologies, markets, and institutions that enhanced production and social organisation. The Andean *ayllu* system is one such biocultural innovation. To this day, in spite of the promotion of exclusively scientific methods in agricultural research and development in the region, for indigenous peoples, their indigenous knowledge and the models of organisation embedded in the *ayllu* system continue to be a major source of new knowledge and practices.

1 *Sumaq kausay* (holistic living), is a local concept of self- determined development; it refers to the indigenous culture of nurturing life. *Sumaq kausay* is achieved when the relationship of reciprocity among the three *ayllus* is in balance. The basic exchange value of *sumaq kausay* is *ayni*, or sacred reciprocity. *Ayni* defines the relations of production, reproduction and co-operation within and between all the members of the communities. *Ayni* therefore provides the ethical and spiritual norms that regulate all exchanges between people and their environment, promoting the preservation of the integrity of ecological processes, which in turn ensure energy flows and the availability of biodiversity and ecosystem goods and services

This conceptual framework was used to identify, analyse and prioritise themes related to biocultural innovations. The key features of the SIFOR approach to innovations – new technologies, markets and institutions – converges with the Andean *ayllu* system, where the *runa*, *sallka* and *auki* contain culturally-designed technological, market and institutional components. The *ayllu* system represented in the graphic provided the basis of a classification framework for local innovations based on the subsets *runa* (for markets), *sallka* (technologies) and *auki* (institutions). The relationships between the elements of the *ayllu* also served to identify and categorise the factors supporting or hindering such innovations, by illuminating where challenges might occur within the local climatic and biocultural system. This conceptual framework thus provides an endogenous approach to studying biocultural innovations which are themselves rooted in the materials, values and creativity of Quechua communities and which support sustainable livelihoods and respond to current climatic variability.

By having the Quechua system of concepts, values, assumptions, expectations and beliefs expressed in the graphic as a conceptual framework, the project team was able to develop concepts and tools tailored to the Potato Park, such as a Biocultural Innovation Framework (see Figure 2 on p.30). An attempt was also made to use it to measure the influence of different factors enhancing or hindering innovations. The framework also provided a unique way to reach out to a broad spectrum of other community members, including elders, women, youth and individuals living in remote areas of the communities, as well as members of community organisations. To facilitate the participation of these individuals and groups in the research process, the team used the conceptual framework to adjust the research approach and identified a strategy for engaging them in the process.

3.4 Qualitative methods and tools

The research used qualitative methodologies to explore biocultural innovations as interpreted by indigenous farmers within the mountain biocultural landscape where their social reality is constructed. The objective was to understand the state of biocultural innovations in the Potato Park and the factors that influence or hinder their development (individual, institutional, network and community factors, see Section 6). To this end, the qualitative study focused on the identification and description of traditional knowledge-based innovations using questionnaires, focus groups, in-depth interviews and PAR tools that facilitated collective inquiry grounded in the experience of the community members who participated as community researchers. The study focused on biocultural innovations developed solely by the communities (endogenous innovations) and those developed in partnership with external actors (collaborative innovations), and explored their key features including their importance for climate resilience (see Section 4.1).

The research developed a strategy for 'cross-language use' in the study. Firstly, Quechua was identified as the dominant language for the research. However, as the research required specialised skills usually found in experts that do not speak the native language, the research team was ultimately formed of some people who were and some who were not fluent in Quechua. Because those who facilitated the research spoke Quechua, interpreters were not needed for conducting the survey. Interviews were made in Quechua and voice recorded; recordings provided the primary data was used in the analysis. The analysis was done primarily in Quechua and involved the community and ANDES researchers; Spanish was used to compile and to keep written records of results. The use of this strategy enabled the primary data analysis to be done in Quechua or in both Quechua and Spanish, rather than just in Spanish

The use of ICT for qualitative research was also tested. During the focus groups, tablet and smart-phone applications were used to collect qualitative data in oral formats, rather than forcing respondents to select from a predefined list of options. These apps enabled the collection of multimodal data (e.g. textual, visual, audio, spatial and temporal) and their use required only basic training and support. The experience shows that ICT can offer reliable data collection methods enabling cross-language use in data collection and analysis.

Qualitative data sources included focus groups and key informant interviews. Additional sources included discussions at meetings, interpersonal communication, and specialised literature. Data records were kept in electronic format (i.e. data files, audio and video recordings) and printed

copies. The analysis identified biocultural innovations, describing the relations between the various elements, and synthesising the resulting knowledge and information.

3.5 Pilot testing the methodology

Prior to the implementation of focus group and in-depth interviews, a pilot was carried out in the community of Ccachin, in the district of Lares, where ANDES is advancing action-research focused on scaling up the Potato Park model. The purpose of the pilot was to validate the research methods and tools and evaluate the consistency of measurement tools. It was also used to determine if there were flaws, limitations or other weaknesses within the design in order to make necessary revisions prior to the implementation of the study and assisted the team with the refinement of research questions. The pilot allowed community researchers to test their data-gathering and facilitation skills. Challenges identified in the pilot testing included the difficulty in translating questions and concepts to Quechua without altering the core content of the questions, and the weak data-gathering and facilitation skills among local researchers. In response to these concerns, questions were reworked or simplified and community researchers underwent training to reinforce their leadership and action-research skills.

3.6 Focus group discussions

Twelve focus groups (FGs) were carried out with the aim of understanding the attitudes to and views on biocultural innovations using an interactive format, where community members defined the methods and terms used in the discussion. The use of the conceptual graphic and open and non-directive discussions provided participants with the flexibility to explore topics not previously covered and the freedom to respond to any issues raised. Each FG was recorded with an audio recorder, and facilitators took notes, using a common format prepared for this purpose. ANDES field staff collected all the audio recordings and notes, and all the information was organised and stored systematically for future analysis. Local experts were assigned to be facilitators and co-facilitators, responsible for convening the participants, leading the discussion groups and preparing the report of the information collected.

The FGs involved over 10 per cent of the registered households in the participating communities, selected using random sampling. Each focus group consisted of 5 or 6 participants, excluding the facilitators and the duration of each FG was intended to be approximately 90 minutes. In total, 60 participants took part in 12 FGs. Gender equity and age diversity of the participants was a consideration in the formation of focus groups in order to obtain a wide range of perceptions in each of the communities in the study. Each FG included men and women, young and old, as well as traditional knowledge holders with expertise in a wide range of areas of interest to the project..

The focus groups were used to identify innovations and explore the factors that foster or hinder biocultural innovations in smallholder agriculture in response to climate change. The key informants for interviews were chosen using opinion-based intentional sampling during the FGs . Focus group participants identified community members, particularly elders, known for their wealth of traditional knowledge about the local ecosystem, their role as recognised leaders in fostering innovations, their capacity to contribute to the body of knowledge, and their willingness to participate. The individuals chosen were invited for face-to-face in-depth interviews.

3.7 In-depth interviews

Face-to-face in-depth interviews were carried out with key informants to learn about their individual experiences and perspectives on biocultural innovations. The interviews elicited information about the meaning of biocultural innovations, factors supporting or hindering local innovations, interactions amongst innovators, examples of innovations, and social practices associated with their diffusion; questions emerged over time as the research team learned about key issues.

A semi-structured interview approach was used, alternating spontaneous questions with structured ones. As with the FGs, the community researchers acted as facilitators and co-facilitators, and carried out the interviews. They also served as teachers, mentors and commentators for the research team,

interpreted the rich descriptions provided by the interviewees and participated in the analysis of the results.

A total of 23 participants were selected for interviews. These included: the official head of each community, former Potato Park leaders, leaders of local collectives, youth representatives, traditional customary authorities (*Varayoc*), a community economic development manager and an irrigation committee leader. The interviews lasted approximately 45 minutes and interviews were documented through audio recording and note taking, using a common format designed for this purpose.

3.8 Data processing and analysis

The FGs and in-depth interviews were stored in audio mp3 format, reinforced by field notes based on common reporting format. Attendance lists and summary sheets were also collected. The data were processed and analysed in accordance with the outline laid down in the research plan. Quechua was the main language used to collect the data. Bilingual field staff and facilitators from ANDES and the Potato Park edited, coded, classified and tabulated collected data into forms amenable to analysis. Spanish translations were stored in digital format (Word documents).

Data analysis was carried out progressively, beginning in the early stages of data gathering and while the information was being organised and classified. Data were separated into categories for spatial and thematic analysis using the categories previously defined in the conceptual framework (see Figure 2, Section 6). As a result, structured summaries, diagrams, and tables were created; data were compared and contrasted within and between categories; and patterns and emerging themes were identified. One important result is the list of biocultural innovations developed in the Potato Park, and the state of the individual, institutional, community and network factors which influence the development of these innovations (see Section 6).

4. Trends in climate, farming systems and livelihoods

4.1 Trends in climate, biodiversity and livelihoods in the Cusco region

The Peruvian Andes is an important centre of plant domestication and diversity, where agriculture began 9,000 years ago (Vera, 2001). In pre-Hispanic times at least 160 species were cultivated for food, medicines, fabrics, housing and tools; of these, 22 food crops, including tubers, roots, grains, legumes and cucurbits, and 7 fruits that originate in the region are still cultivated by Andean communities (Tapia and de la Torre, 1998: p. 11). Domesticated species include potatoes, maize (*Zea mays*), lima beans, peppers, yucca or manioc, cotton, squashes and gourds, pineapples, avocado and coca, as well as many varieties of fruits and other products (Vera, 2001; Tapia and De la Torre, 1998: p. 11).

The impact of climate change on the biological diversity of Andean ecosystems includes the loss of the coolest climatic zones toward the peaks of the mountains and the shifting of remaining vegetation belts upslope, which is resulting in a net decrease in biodiversity (IPCC, 2014). The Fifth Assessment Report of the Intergovernmental Planet on Climate Change suggests that climate-related pressures in the Andes present a major threat to agrobiodiversity and sustainable farming in the Andes due to warming and drying trends, and extreme temperature and precipitation (IPCC, 2014). Possible impacts include increase in weed-crop competition, expansion of pathogens and insect pest ranges and seasons, and other alterations in crop agro-ecosystems (IPCC, 2014). Movement of vegetation and altered hydrological patterns are already having major implications for the use and conservation of the remarkable diversity of native crops and unique traditional knowledge and farming systems of Andean peoples (PACC Peru, 2012).

Indigenous knowledge and intricate production systems have helped farmers to cope, adapt and reorganise to meet climate uncertainty and risk, but the predicted effects, rates and variability of current climate change may push them beyond their range of adaptability (Perez *et al.*, 2010). Therefore, it is expected that the net effect of climate change will demand modifications in land use, production systems, indigenous knowledge systems, coping mechanisms and livelihood strategies (Perez *et al.*, 2010). In this scenario, the conservation and sustainable use of the remarkable diversity of local Andean genotypes has become critical for their continued evolution in response to climatic changes and for the development of new crop varieties for adaptation both locally and in other areas of the world.

Cusco is amongst the most culturally rich and biologically diverse regions of Peru, while at the same time one the most vulnerable to climate change (PACC Peru, 2012). The Peruvian National Service for Meteorology and Hydrology (SENAMHI) report for Cusco region, and current forecast models for the region over the past 40 years, indicate a trend of increasing temperatures and annual rainfall, including increases in rain during both rainy and dry seasons and later onset of rains during the growing season (SENAMHI, 2012; IPCC, 2014). Maximum and minimum temperatures are also showing increases over that 40-year period, while the number of days with frost has decreased by as much as 15 days per year. They also indicate more extreme droughts associated with El Niño conditions, and more moderate to extreme rainfall events in the last decade (SENAMHI and PACC Peru, 2012; SENAMHI, 2012; IPCC, 2014). These changes associated with shifts in crop and rangeland elevation belts are already affecting food production and increasing food insecurity (PACC Peru, 2012; GOREC, 2012).

According to research carried out by the Tyndall Centre for Climate Change Research in the UK, Peru is one of the most vulnerable countries in the world to climate change (Andersen et al., 2009). Future climate change in Peru is estimated to cause a reduction in average life expectancy and incomes, and increased poverty, particularly amongst Andean farming communities (Andersen et al., 2009). The landscapes and livelihoods of smallholder farmers are already changing in the context of new rural conditions, with increased livelihood diversification and migration amid growing climate variability, and expansion of non- and off-farm livelihood activities and peri-urban influences (Anderson et al., 2009). These include working in tourism as porters in the Inca Trail, construction, commerce in city markets (selling food and handicrafts), transport (taxi services) and government (municipal) services (e.g. road maintenance).

Climate change is predicted to produce complex and locally specific impacts on small-scale farmers; with particularly negative consequences for crops (Bellon and van Etten, 2014), including the potato and centres of potato crop diversity such as the Cusco area – one of the most diverse areas in the world (CIP, 2009).

4.2 Socioeconomic conditions and climatic trends in the Potato Park

The Potato Park of Cusco is a pioneering community- led project, which epitomises these centres of potato diversity. Here the rich potato diversity has deeply influenced the spiritual and physical landscapes and the resilience of indigenous peoples and their wealth of indigenous knowledge, practices and agricultural and ecosystem diversity. Nonetheless, rural poverty and economic and social marginalisation continue to be the main challenges facing the Potato Park communities, in spite of Peru having become a middle-income country with a growing gross domestic product.

The initial results of the quantitative baseline study in the Potato Park indicate that the communities of the park live below the national poverty line. The main cause of migration to urban centres, where non-farm work offers greater livelihood options, is the lack of opportunities in the area. Food insecurity is high, as most smallholder farmers produce basic food crops at a subsistence level. Illiteracy is high, particularly among women, although essential services such as education and electrical power have improved recently. Agricultural extension, training and financial services are very poor and animal and plant health services non-existent. Transportation infrastructure and marketing systems are poor and there is a lack of well-defined territorial organisation and planning.

Women are poor or extremely poor; nonetheless, they play a critical role in the maintenance of crop genetic resources and the subsistence economy. Women in the Potato Park represent a large percentage of a family's labour force, working in agriculture, taking care of the livestock and engaging in income-generating activities. Along with traditional household tasks and childcare, women take on additional responsibilities to make it possible for their husbands to migrate in search of temporary work in activities such as tourism or construction work in Cusco and other nearby cities.

In the Potato Park small-scale indigenous farmers also face great climate change challenges which poses an existential threat to community livelihoods, sustainable farming and to the future of Andean crop diversity and culture (ANDES, 2014). Climate change threats in the Potato Park reflect those described for the Cusco Region above, and can be summarised as: 1) erratic weather and temperature changes that are altering the growing season; 2) changes in potato yields and varieties; and 3) pests and diseases that are intensifying with rising temperatures.

Erratic weather, temperature changes, and late and unpredictable rains. Weather changes are resulting in a shorter potato-growing season. Forty years ago, in the mid altitude zone, rain was recorded from September to October, while for the past years; the rainy season has only started in November. In the highlands region, the first potato planting is determined by the onset of the rainy season; therefore, changes in the start of the rainy season mean changes in the growing calendar. Farmers in the Potato Park note that a generation back, when their parents were farming, they would plant potatoes in September; now they plant them later, in October or November. Similarly, they used to harvest potatoes in June; now, the harvest happens earlier in April or May to avoid the frosts. These observations show a reduction at both ends of the growing calendar, resulting in a shorter season overall.

Changes in crop yields and number of varieties. The increase in both mean temperature and erratic weather events resulting from climate change has affected which varieties of native potatoes can be successfully planted as well as the season's yield. In the highlands, farming families plant around one hundred or more varieties of potatoes. Lino Mamani Huarka, a farmer in the Potato Park plants between 120 and 140 native potato varieties. Such a great variety of potatoes means unexpected weather events such as frost are less detrimental because there is a higher likelihood that a different variety will be more resistant. Climate change has affected the number of varieties planted in several ways. Some varieties, which only are able to grow at lower altitudes, have disappeared completely, due to the increase in temperature and presence of pests. Climate change is also causing erratic weather events

such as hailstorms, and rains that come out of the typical season; together these changes can be detrimental to the potato yield.

Increase in pests and diseases. In the Potato Park, farmers are already seeing an increase in the occurrence of potato diseases such as late blight due to increasing temperatures from climate change. As potato late blight becomes more rampant, farmers are moving their fields higher up the mountain to find colder temperatures. Planting at higher altitudes requires farmers to climb higher and for more hours in order to tend to their potato crops. Other potato pests such as the potato tuber moth and the Andean potato weevil have also increased.

5. Biocultural innovations

5.1 Defining key concepts

Defining key project concepts was one of the foundation tasks of the research. The development of a common understanding of the concept of biocultural heritage innovations underpinned all subsequent work in the project and set out the concrete scope of ANDES' work. Key concepts and definitions developed by the team included 'Quechua biocultural innovations' and 'biocultural heritage innovations'. These are the central assumptions upon which further project work could be based. They will continue to be revisited and revised throughout the project. They build on the concept of biocultural heritage, which is composed of interlinked and interdependent elements, including the knowledge, biodiversity, landscapes, cultural and spiritual values, and customary laws of indigenous peoples and traditional communities.

The basic premise of the initiative is that indigenous Quechua people are innovators with knowledge, values and skills based on the complex structure of interconnections of their biocultural system. This system is continually redefined in a dynamic process involving multiple points of observation and explanation. Quechua people have responded to this complexity with approaches and strategies that seek to maintain the traditional cognitive universe on the one hand, and on the other hand are open and willing to discover and learn from others. This has provided Quechua people with the ability to continue using their biocultural heritage as a primary source of innovations while interacting with other distinct knowledge systems to expand their own knowledge to adapt to changing circumstances. In this way, they seize on the opportunities offered by new knowledge and technologies to enrich their practices and pursue their aspirations of endogenous development and their vision of a just and sustainable social, cultural, economic and environmental future known as *sumaq kausay*.

In order to build a concept of Quechua biocultural innovations based on this premise, the research team used the Santa Cruz Pachakuti conceptual graphic (see Figure 1) to undertake a preliminary scan of the main elements of the Andean Biocultural Heritage System. The next step was to identify the relationships and combinations among the *runa*, *sallka* and *auki* components of the a*yllu* and analyse how those are being used as the source of local innovations, including how the combination of traditional knowledge and scientific knowledge may have fostered the development of new solutions. The innovations were then categorised according to the three *ayllus* illustrated in the conceptual graphic: 1) *sallka ayllu* for technologies that act to manage risks in the face of climate change, 2) *runa ayllu*, for new products and services (i.e. market innovations), and 3) *auki ayllu*, for new institutions and policies which are based upon rules, norms and protocols associated with customary laws. Some innovation covered more than one category.

Based on these notions, 'Quechua biocultural innovations' were defined as *musuq yachay* / *musuq ruway* (translated into English as new knowledge or new practices), understood as the practical use of new knowledge. This knowledge could emerge from interactions between the elements of biocultural heritage (endogenous innovation), or from the links between traditional knowledge and science (collaborative innovation), which meets individual and community needs and objectives contributing ultimately to *sumaq kausay*.

The concept of biocultural heritage innovations was formulated at a SIFOR partners' meeting in Cusco, Peru, as follows:

"Biocultural Heritage Innovations (BCHIs) are new knowledge, resources, skills and practices, or new combinations of these, which serve to: (a) strengthen and sustain the agro-biodiversity, particularly local seed systems, livelihoods and material and spiritual well-being of communities; (b) adapt to and mitigate risks due to global impacts, especially those of climate change. They are practical, sustainable, and are locally and globally relevant."

"BCHIs have their basis in a people or community's BCH but may incorporate external elements. They integrate daily practices with traditional knowledge, spiritual values and customary norms. As such, they are dynamic, continuous, open, adaptive, and gender-sensitive, integrating the creativity of people and nature". (IIED and ANDES, SIFOR methodology workshop, 2013: p.14)

Finally, based on the above definitions, a research framework with key questions for gathering information on biocultural innovations was developed (see Box 1).

Box 1. Biocultural heritage innovation research framework

- Name of the innovation
- Name of the innovator
- Description (why is it important for the communities? livelihood activity where it is being applied; goals; components; functions; what agroecological/climatic problems does it help to solve?)
- Association to cultural/spiritual practices and traditional knowledge
- Rules, norms and protocols on how to apply the innovation (linkages to customary laws/local institutions)
- What role has traditional knowledge /native language played in the development of the innovation?
- How does tradition influence the new practices?
- Role of customary laws
- Introduced concepts/ideas
- Applying observed natural phenomena and biocultural indicators
- Role of memory and ritual
- Collaboration with scientists
- How long did it take for the new practice to take its current form
- Geographic location (household; community where the innovation is being used)
- Agro-ecological zone (according to indigenous ecoclimatic typology)
- How useful is the innovation? What kind of impacts and climatic variables does it respond to? (e.g. type of extreme event or vulnerability such as rainfall, drought, temperature or modification in the agro-ecological zoning)
- How does it work (how does it mitigate risks or lower vulnerability?)
- Requirements for upscaling and maintenance (local government investment, ANDES investment, technical support needed)
- Potential for adaptation/mitigation (coherence with biocultural heritage system, production system, upscaling potential)
- Importance for resilience
- Limitations for upscaling (at the household/community level)
- Nature of the influence of 1) individual (or 'people') factors, 2) institutional factors, 3) network factors, and 4) community factors

ANDES and Potato Park researchers used the above research framework in focus groups and in-depth interviews.

5.2 Biocultural innovations in the Potato Park

Facing a situation of uncertainty, Potato Park communities are experimenting with biocultural heritage innovations, which are based on 1) the use of ancient agricultural technologies and developing new technologies; 2) developing strategies to cope with socioeconomic disturbances through new products and services; and 3) developing new institutions and policies which are based upon rules, norms and protocols associated to customary laws. These strategies contribute to agricultural productivity as well as livelihood resilience[2] in the face of climate change.

A total of 30 biocultural innovations were recorded in the Potato Park, including 18 technological innovations, 4 market innovations, and 8 institutional and policy innovations. A brief presentation of the main innovations developed by the communities follows. Although all of the innovations identified are new ways of doing things, some have not yet become part of the fabric of society and hence strictly speaking they are changes in practice rather than 'innovations'.

5.3 Technological innovations

The team considered technological innovations primarily as being the practical use of new knowledge derived from the interaction of the components of biocultural heritage, as expressed in the *ayllu* system. These new technologies help farmers to cope with environmental disturbances by managing risk. We used Agrawal and Perrin's (2008) framework on strategies for adaptation to climate change to classify technological innovations into four categories: spreading risk across space (mobility), time (storage), asset classes (diversification), and households or communities (sharing and pooling).

5.3.1 Technologies that spread risk across space

Understood as the practical use of new knowledge to help farmers extend their spatial range of action, including taking advantage of new climatic conditions at higher elevations, and using resources that are spread across larger areas. These innovations include:

1. **Shifting the range of potato cultivation** (endogenous innovation). This has been done by expanding the range of established varieties to higher elevations. Potato yields in the area are decreasing, mostly due to increased pest and diseases and changes in water and temperature regimes. Shifting potato production areas to higher elevations aims to avoid these problems; however, competition for land between potato crops and other land uses, such as pasture, is increasing. Farmers have been practising this strategy for over 25 years.
2. **Expanding the cultivation of new crops into higher areas** (endogenous innovation). This has included experimenting with high-quality produce (for sale) in small plots to find where the practical limits lie. New crops and cropping systems have been added to the traditional agricultural production, including the introduction of vegetables such as carrots, tomatoes, lettuce and peppers, and crops such as quinoa, corn, wheat, barley and beans, as well as white and red clover, alfafa and oats to support livestock production. This practice is combined with the use of traditional terraces for soil conservation and pond construction for water reserves. The introduction of value-added crops has multiple benefits including generating complementary marketing opportunities.
3. **Experimenting with local cultivars in different areas to adapt to changing conditions** (endogenous innovation). Adaptation methods are based on indigenous knowledge. For example, if one cultivar is not highly pest resistant, but does well in cold frosts, farmers plant such variety at a higher altitude. Each potato cultivar does not need to be resistant to all climate effects; rather, the farmers use a selection of varieties that include resistance to different effects, to increase the chance of survival overall. Examples are: 1) cultivars that have the ability to maintain tuber growth

2 Resilience refers to multi-scale processes of persistence and change, transition and transformation, in complex adaptive systems. History and socio-ecological memory are sources of resilience and the capacity for renewal and innovation (Feola, 2014; Feola and Nunes, 2014; Olsson *et al*., 2014).

and initiation under higher/lower temperatures (including Ruki, bitter and kusi potatoes); 2) cultivars with drought tolerance (including Ruki, Qonpis, kanchalli, patallaqta, puqachillcas varieties); 3) local cultivars with early maturation (including Suwamanchachi); and 4) disease and pest tolerant cultivars (including Kusi, bolis, cuchillo paqui, amakaya varieties).

4. **Changing the time and location for *chuño* production** (endogenous innovation). The production of this freeze-dried potato for food storage has been moved to higher and colder areas and times where the climate allows the freeze-drying method used by local farmers. *Chuño* is a product traditionally made by Quechua and Aymara communities of Peru by exposing a frost-resistant variety of potatoes to the very low night temperatures, freezing them, and subsequently exposing them to the intense sunlight of the day. *Chuño* production takes place from May to July and the process can take up to 50 days. As the process needs temperature far below zero, the monitoring of the weather and forecasting of freezing days is done by the use of meteorological, astronomical or biological indicators (e.g. moon phases, behaviour of plant /animals, wind and soil texture). In the last few years, *chuño* has been produced at about 4,000 metres above sea level mostly during the months of June and July.

5.3.2 Technologies that spread risks across time

Understood as the practical use of new knowledge for reducing risks across time, mainly to address seed, food and water scarcities.

1. **Establishing a community seed bank** (collaborative innovation). The community seed bank offers a collective approach to the maintenance of potato genetic diversity, which provides multiple services to develop livelihood strategies. The seed storage facility is a building designed using a combination of traditional and organic architecture,[3] through a collaborative process involving Quechua farmers and CIP scientists. It uses water and air flows to provide an effective cooling system which does not require electricity. The seed bank serves as a backup for local seed self-sufficiency by providing local farmers with access to a wide diversity of local potato seeds and thus a reliable source of planting material year round. It also plays a key role in developing Potato Park products such as specialised dishes based on potatoes served in the Park's communal restaurant, and the production of quality potato-based natural products for personal care, thus enabling communities to improve their income. It also serves as a repository of local potato diversity including climate-related desirable characteristics adapted to local conditions.
2. **Reducing the traditional potato fallow period** (endogenous innovation). The traditional potato fallow period (*muyuys*) has been reduced from seven to four years, without losing the benefits of the longer period (e.g. reducing pests and diseases, regenerating the soil, and supporting the adaptation of varieties to different ecological zones). The new four-year integrated rotation system combines traditional elements with new tools and agro-ecological practices for the management of fertility, humidity and soil erosion.
3. **Using net houses (tents) for clean potato seed production throughout the year** (collaborative innovation). Mini-tuber seeds are produced from] *in vitro* plants under net houses which keep out disease vectors. This technique prevents infection by viruses, bacteria, fungi and other pests and enhances physiological characteristics such as turgidity and firmness. The technique was introduced by the CIP and adapted by local farmers; net house facilities were built by Quechua farmers in collaboration with the CIP and ANDES .

3 Organic architecture is a philosophy of architecture which promotes harmony between human habitation and the natural world.

Potato Park farmers and scientists in a net house. Credit: ANDES

4. **Improving water capture through the construction of family and community micro-reservoirs** (collaborative innovation). These reservoirs combine the traditional water harvest technology (*aruna*) and the use of modern materials and techniques to ensure water availability for irrigation and consumption. This innovation also combines ancestral weather forecasting with science-based scenario development and ensures good crop yields without putting undue stress on water supplies. This new practice was established in collaboration with government institutions and ANDES.

5.3.3 Technologies that spread risks across diverse assets

Understood as the practical use of new knowledge aimed chiefly at diversifying productive and non-productive assets, consumption strategies, and livelihood activities. Diversification spreads risk across space and time by enhancing the range of household and community assets and resources,[4] thereby reducing overall exposure to shocks and economic loss, and enhancing options for recovery. It is considered a reliable risk-management strategy against adverse environmental and economic shocks because the security provided by diversification is greater than the returns foregone by investing in diversification (Reyes-Garcıa et al., 2013).

1. **Reintroduction of potato diversity into farmers' fields** (collaborative innovation). This has ensured an increase of potato diversity in the Park, from around 600 different types in 2000 to around 1,344 in 2014, of which about 650 are scientifically distinct varieties. The increase in diversity has reduced vulnerability to pests and diseases and enabled the conservation of a large genetic diversity of native potatoes *in situ*. This ensures the ongoing evolution of a diverse pool of native potato varieties that may hold natural resistance in their genes. This genetic diversity is critical for adapting to climate change. From the large Potato Park gene pool, farmers select for varieties that are more resistant to higher temperatures, pests and unexpected frosts. Sources of reintroduced material include the CIP Gene Bank, exchange with other communities, Cusco University, and farmers' organisations. The Potato Park has been working for over 15 years hand-in-hand with ANDES to implement this strategy.
2. **Community gene reserve** (collaborative innovation). This was established as an on-farm "living gene bank" for the continued cultivation and management of the Park collection of 1,344 potato cultivars and 7 potato wild relatives, as well as its biocultural system and the agroecosystem where potatoes evolved. The model integrates Agricultural Landscape approaches (Sayer *et al* 2013) with

4 Diversification is a universal risk spreading strategy that can be adopted in relation to a wide variety of productive and non-productive assets, consumption strategies, or livelihood activities (Turner *et al*., 2003); cited in Reyes-Garcıa *et al*. (2013).

biodiversity conservation in a centre of crop domestication. Each year, the Potato Park authorities design a different area for the reserve; the area is selected to match landraces to a particular environmental niche for optimising production, enhancing adaptation and reducing risk. Over the last 10 years, the Potato Park and ANDES have been testing and adjusting the communal reserve model using the indigenous territoriality model of the *ayllu* to integrate the *muyuy* system of crop rotation, the *sallka* concept to manage wild relatives and landraces, and science-based *in situ* conservation and gene reserve approaches. The result is a landscape-based model, which is effective in the conservation and evolution of crop intra-specific diversity and their wild relatives, while also providing farmers with diverse goods and services, for both production and consumption.

3. **Improving organic farming techniques** (collaborative innovation). These have been achieved through training courses provided by ANDES and other partners such as CIP, and university and government institutions. This has led to the diversification of faming inputs such as the development and production of locally made natural fertilisers and pesticides. The communities have developed new natural pesticides such as *Biol*, which is made with local medicinal plants; and new composting techniques in which farmers set up a pile of garden waste and 'walk' it down a bed or row as they turn it. These techniques support improved pest control, soil and water management.

5.3.4 Technologies that spread risks across households or communities

Understood as the practical use of old and new knowledge to develop technologies and institutions to enhance collective action in order to help community households to share risk in the face of a large shock, such as climate change, which is affecting the whole of Peruvian society. The innovations described below are the result of the sharing of biocultural heritage and traditional knowledge, which allows the communities to use their collective memory about how to manage their biocultural resources, thereby allowing them to protect against covariant shocks (such as droughts, floods) which affect groups of household and communities.

1. **Development of '*wiri*', a new ploughing technique for potato cultivation** (endogenous innovation). This technique was developed through the pooling of knowledge of a farmers' group in the Potato Park, the *Papa Arariwa* (Potato Guardians), who are experts in traditional knowledge related to potato farming. The technique uses a modified *chaquitaccla*, the traditional Andean foot-plough, which makes digging up the sod less strenuous since it produces smaller clumps of soil, which are easier to move. The smaller clumps also become soaked more quickly, and allow denser planting patterns. The number of people required to perform this kind of ploughing is reduced from three to one or two. It is also easier for women to participate in this ploughing method, helping to maximise the use of the family and community labour available.

Adaptive management in the Potato Park. Credit: ANDES

2. **Exchanges of climate-resilient varieties and associated knowledge and practices among farming communities** (collaborative innovation). The Potato Park and ANDES have been promoting a new approach of a multi-scale network that exchanges seeds as traditional technologies – biological entities with associated traditional knowledge about their reproduction, maintenance, quality and preservation, including cultural and spiritual values associated with their welfare. Such exchanges spread risk across households and communities in the Cusco region, the Andean region and mountain communities across the world. Thus, at the heart of the seed exchange is the exchange of traditional technology, knowledge and practices. The approach draws from indigenous farmers' traditional practices of saving and sharing seeds; such practices are embedded in traditional network structures that connect farmers and landraces within and across environments.
3. **Revival of the tradition of offering gifts to the spirit of the potato** (endogenous innovation). This practice had been abandoned by the communities of the Potato Park but was revived following the repatriation of potatoes from CIP in 2004 (see Section 5.5.2). The return of 'lost relatives' has revived this ritual, which ties up the spirit of the potato in the heart of Pacha Mama to impede it from leaving. This practice intertwines elements that are ecological, biological and social, as well as empirical and spiritual allowing the sharing of knowledge amongst participants about the environment and culture of the potato. During this ceremony a spiritual leader locates a special ritual segment in the middle of a potato field where a special ceremony takes place. The observance of this ritual practice has enhanced the maintenance of potato intra-specific diversity in the Potato Park, also bringing empirically sound ways of coping with environmental problems. Technologies and tools used in potato farming are informed and shaped by such rituals. Follow-up meals use special ritual varieties of native potatoes, which also strengthen social ties, institutionalising customary rules and social organisations, and strengthen the shared knowledge and traditions of the communities.
4. **Biocultural descriptors for local potato varieties with culinary virtues** (collaborative innovation). These descriptors are based on Quechua women's ancestral knowledge of the culinary uses of potatoes. They are used for: varietal selection; the Park's Restaurant; for the selling, bartering and storage of seeds; and for exchanges to diversify stocks. This tool was developed by the Park's gastronomy collective and ANDES, and is based on the exchange of knowledge with the Park's women about the uses, shapes, sizes, colours and phenological characteristics of the hundreds of potato cultivars they use for cooking. The sharing of this biocultural heritage has allowed the women to use their collective memory about how to manage their biocultural resources, thereby helping their communities to protect against shocks associated with climate change including drought, floods, crop failure or changes in food prices.
5. **The 'Khipu' Biocultural Heritage Register** (collaborative innovation). The Register is an open-source database based on the *khipu*, a pre-Hispanic Andean record-keeping system that uses knots tied on strings. The *khipu* served as the knowledge framework which was used to organise the information in the database; it also guided the identification of key features of each field of the database and provided specific terminology and concepts to shape each field. ANDES and the Park communities developed the database tool for documenting their biocultural heritage, particularly the resources vulnerable to biopiracy. The Park communities pooled their knowledge and stored it as collective memory of how to manage their biocultural resources, which is shared through the register. The register includes knowledge on how to use resources such as potato and other native crop varieties, medicinal plants, traditional knowledge, and other communal resources deemed relevant by the communities of the Potato Park. The information is used for promoting the transmission and use of traditional knowledge, to stem the loss of biocultural resources, to identify threatened resources, to improve monitoring and management, to identify useful knowledge for improving productivity in the face of climate change, and for developing new biocultural products.
6. **Dynamic conservation** (collaborative innovation). This integrates complementary *ex situ* and *in situ* conservation strategies in which repatriated material from CIP *ex situ* collections is maintained in its natural environment in the Potato Park and the Potato Park collection is stored *ex situ* in CIP's gene bank. This collaborative approach was developed jointly by the Potato Park, ANDES and the CIP, using as a principle the Andean concept of *ayni* (reciprocity). *Ayni* in this context is understood as the complementarity of *in situ* and *ex situ* approaches and the dialectical relationship between traditional knowledge and science, where each supports on the other. Therefore, all the actors are

engaged in a dynamic, interdependent relationship, which nurtures mutuality by fostering respect and collaboration between Potato Park farmers, ANDES and CIP scientists. These relationships allow the pooling and sharing of knowledge and information, and establish a mechanism for social learning. The model is generating an integrated approach for the cross-fertilisation between traditional and scientific knowledge in participatory research, creating evidence through multiple evidence-based platforms, leading to enhanced understanding and capacity to strengthen food security in the face of climate change.

5.4 Market innovations

Market innovations were considered as being innovative farm and non-farm based and biocultural heritage-derived livelihood options and business opportunities for products and services that support socioeconomically viable and climate resilient livelihood options. These include market linkages, use of collective trademarks, microenterprises and value chain development. Innovations engage multiple stakeholders such as the private sector, universities, research institutes, government, and community organisations. Market innovations identified include:

1. **Development of microenterprises for producing and marketing biocultural products** (collaborative innovation). The business model for microenterprises in the Potato Park is the economic collective. These collectives are in charge of the production of biocultural products and market linkages, which facilitate trade relationships between the microenterprises and the external market. The collectives were developed jointly by the Potato Park and ANDES using Andean economic principles such as *ayni* (reciprocity) and *chaninchay* (balance). The microenterprises bring together members of the different communities in the Park and specifically target women for capacity development and income-generating opportunities. They have been developed in co-ordination with NGOs (non-governmental organisations) and influenced by international institutions that promote gender equity and gender analysis within their programmes.

Handicrafts Collective, the Potato Park. Credit: ANDES

The current economic collectives engage in gastronomy, handicrafts, tourism and the development of natural products. The collectives function as producers and brokers connecting directly with buyers, avoiding intermediaries and fees. Biocultural products add value to the links between cultural and biological diversity and use collective trademarks based on indigenous names and symbols. Some biocultural products developed in the Park include:

1) Creams, ointments, tinctures and teas for maintaining health and treating conditions such as digestive problems, skin conditions, *soroche* (altitude sickness) and joint pain.
2) Personal care products such as shampoos and soaps based on wild and cultivated plants.
3) New potato-based dishes (served in a traditional restaurant or the 'culinary sanctuary' – see below).
4) New food products such as Chocopapa (potato chocolate), made from a combination of dark potatoes and chocolate.
5) Innovations in traditional textile designs and styles (including weavings with potato-themed designs; use of local iconography; and new styles of bags, belts, scarves and hats).
6) Tourism programme that increases biological and cultural diversity by adding value to the biocultural heritage of the Potato Park. This community enterprise offers visits focused on gastronomy, conservation, culture, education, interpretation, and alternative business models and opportunities. Visits and interpretation are based on traditional knowledge of the local biocultural heritage.

These microenterprises facilitate collective experimentation and risk management by promoting social cohesion in the face of disturbance and crises contributing to the resilience and sustainability of the Potato Park. Also, they facilitate resource management, economic co-operation, and income diversification. The organisational model of the collectives facilitates innovation, alternative patterns of communication and relational connections between communities. Dispute mediation is done though an inter-community benefit sharing agreement (see Section 5.5.1).

2. **Informal collective trademark** (collaborative innovation). The communities of the Potato Park use an informal collective trademark to protect and promote a range of biocultural heritage-based products and services. This informal 'soft' intellectual property rights tool is collectively owned, and linked to the Park as a conservation area and to the Park's diverse biocultural products and services. It has incorporated rules in line with the customary laws that promote indigenous product development and innovation. The Park communities and ANDES established it jointly .
3. **Development of the potato culinary heritage** (collaborative innovation). The Potato Park's rich culinary heritage is protected through a 'culinary sanctuary'. The culinary sanctuary model was developed by the gastronomy collective Hachun Huaccachi and ANDES, using the concept of 'biocultural refugia'.[5] This concept enabled the articulation of the local potato landscape with local concepts of food and associated potato ritual practices, and the Parks' rich culinary heritage. The model is nurturing the creation of new gastronomic trends and innovations based on the native potato and the traditional culinary knowledge and the creativity and talent of the local women. It is also developing new food textures and new ways of preserving and cooking, and has established a restaurant dedicated to the native potato. The sanctuary also offers schools and visitors educational courses and 'walking workshops' about potato biocultural systems, the politics of food and potato culinary art. The Potato Park communities proactively market the model in specialised markets in Cusco as a unique tourism product based on biocultural diversity, to capture benefits derived from the local biocultural heritage.
4. **Marketing strategies that link monetary markets and barter techniques based on reciprocity** (collaborative innovation). Barter techniques based on the exchange of comparable goods or services are being revived as part of an on-going cycle of reciprocity, and adapted and used for exchanges in formal or monetary markets of Pisaq and Cusco. Potato Park goods or services

5 'Biocultural refugia' are the physical places that not only shelter on-farm biodiversity, but also carry knowledge and experiences about practical management of how to produce food while stewarding biodiversity and ecosystem services (Barthel *et al.*, 2013)

– such as tourism and visitation programmes, crops and biocultural products – are exchanged for goods or services such basic provisions, training and other health, education, or economic development support. *Ayni* is being revived in such a way that it is possible to access goods or services that would not otherwise be accessible to community members, especially to the poorest. This change strengthens social relations and networks within and between communities, promotes traditional economic values and holds the Park communities together as a relatively autonomous group of communities. This in turn helps to nurture a strong sense of interdependence amongst the communities and is fostering reciprocity among diversely situated citizens of the society. The exchanges also provide a safety next in case of climate-related problems with food production or boom and bust cycles of tourism, the main economic activity of the region.

5.5 Institutional innovations

Institutional innovations were considered as being new institutions and policies which support the use of indigenous knowledge and the effective functioning of the traditional and formal local institutions for reducing their vulnerability to climate change. The criteria for selecting the institutions were that these institutions are able to regulate the implementation and use of the innovations and strategies developed in the Potato Park and carry out periodical readjustments. Also, new institutions and policies would have to promote recognition of indigenous peoples' traditional resource rights and address conflict resolution based on rules, norms and protocols associated with customary laws. One common feature the innovative local institutions and policies share is the fact that they have been able to tap into the customary institutions and laws embedded in the biocultural heritage of the Potato Park to develop frameworks, norms and strategies that support the adaptive capacity of the communities for food security in the face of climate change. These innovations include:

5.5.1 Community governance of biocultural heritage

1. **The Potato Park Biocultural Heritage Territory model** (collaborative innovation). The Potato Park is an innovation in itself, as it brings together five previously separate communities to lead a collective process of endogenous development and conservation. Unlike a 'national park', it is run by the communities instead of governments, on the basis of customary laws. The Potato Park epitomises the Biocultural Heritage Territory (BCHT) model, characterised as a mosaic of land uses, especially ritual uses, which are the backbone of local economies and critical repositories of genetic resources for food and agriculture. The Park was established in 2000 by an association of six communities (one community is currently 'resting') and ANDES using the Andean *ayllu* system as a model. The resulting model is deeply linked to local culture and knowledge, having emerged from indigenous peoples' memories and lived experiences with the *ayllu* system,[6] which continues to nurture the local culture, worldviews, customary laws, institutions, knowledge and stewardship practices. As with the *ayllu*, the Park's goal is to protect the indivisibility and interconnectedness of culture and agrobiodiversity with the territory. The maintenance of intra-specific crop diversity in a centre of crop domestication is central to its goal of developing an adaptive strategy that helps communities to cope with the current climate crisis and the uncertain socioeconomic environment. The novelty of the Potato Park is in its method of merging *in situ* and *ex situ* conservation strategies. While on one hand the Park seeks to maintain the biocultural landscapes and habitats and the co-evolutionary processes that have created the great potato diversity it harbours, on the other hand, its well-established community seed bank effectively provides an *ex situ* conservation system that is probably more dynamic than a conventional gene bank because it is actively used by farmers.

   The Park depends on the leadership of new inter-community institutions for its collective governance: the Association of Communities of the Potato Park (discussed below) and locally evolved institutions that are active at various levels of its governance. These institutions have been effective in fostering local innovations based on their deep knowledge of the local environment and

6 Its three elements, *auqi* (the sacred), *sallqa* (the wild) and *runa* (the domesticated) are bound together through reciprocal relationships known as *ayni*. *Ayllu* and *ayni* celebrate ecological systems that support agricultural activity (Dávalos, 2008). See Section 3.3 for more detail of the *ayllu* system.

the application of customary rules, norms and protocols. Livelihood and income generation from crop diversity has been achieved by fostering local microenterprises; the generation of benefits through these microenterprises has gone hand in hand with the promotion of the maintenance of crop diversity on farms. While the Potato Park, as a BCHT, draws upon traditional knowledge, customary laws and institutions it also uses a variety of internationally recognised concepts – in particular, prior informed consent and equitable benefit sharing of the Convention on Biodiversity (CBD) article 8(j), the International Union for the Conservation of Nature (IUCN) Category V Protected Area approach, the Food and Agriculture Organization (FAO) farmers' rights concept, and the indigenous rights framework of the International Labour Organization (ILO) Convention 169.

2. **The Association of Communities of the Potato Park** (endogenous innovation). The Association has emerged as a community-owned model for the governance of biocultural heritage. It is a unified collective decision-making body for the five communities with shared values, goals, structures and arrangements. The Association was formally registered in 2002 and was established using existing community structures and processes, which has strengthened ownership and the organisational capacity of member communities to further their economic and social goals. It is one of the few community institutions focused on the maintenance of an emblematic crop species and its associated biocultural heritage. While ANDES supported the process of its establishment, the communities themselves defined its structure and operations. It is an independent body with a council where the elected leader of each of the five communities is represented. The council has revenue-raising powers. Each leader also plays an active brokerage role between his/her community and the council.

   The Association has brought cohesion to the five communities based on mutuality and reciprocity, as well as the participation of community members in each of the microenterprises and study groups. It has also increased the negotiating power of an otherwise excluded people within formal governance structures and processes; their strategy includes organised pressure and tactical identification of opportunities and 'spaces' within unfolding processes. The Association addresses issues of food security, poverty alleviation, livelihood diversification and collective land-use systems ensuring that customary norms of reciprocity, solidarity, equilibrium and flexibility prevail. It addresses adaptation by facilitating access to opportunities for knowledge creation, innovation, communications and microenterprise development through joint programmes and projects with ANDES and other institutions. Its operations are guided by an inter-community benefit-sharing agreement, which was developed collectively and signed by each community. The association enables the communities to enter into legal agreements with others and to negotiate more effectively as a group.

3. **Biocultural protocols: the Intercommunity Agreement for Benefit Sharing** (collaborative innovation). The Potato Park Intercommunity Agreement for Equitable Benefit Sharing was developed jointly by the Association of Communities of the Potato Park and ANDES in response to policy developments within the Convention of Biological Diversity, FAO, and national policy fora in the area of traditional knowledge access and benefit sharing. The agreement has the format of a biocultural community protocol[7] using customary laws to ensure equitable benefit sharing amongst the five communities that make up the Park, based on a local perspective of equity. The protocol establishes claims to a range of rights in domestic and international law. In essence, the broad rights claim allows the community to determine for itself what equity consists of, and how to share benefits, which in turn ensures the continuation of their stewardship practices. The value of the agreement lies in its ability to act as the glue that holds together the mosaic of communities that make up the Park, which are fragmented under different customary laws and policies. Ten per cent of the revenues of all the products and services that carry the Park's collective trademark are channelled into a communal fund and the funds are redistributed to the communities at the end of each year in accordance with the benefit-sharing agreement. The agreement was developed through a community-led research process involving several meetings within and among communities, facilitated by community researchers.

7 Biocultural community protocols are community-led instruments that regulate community self-governance associated with the customary sustainable use of biodiversity, according to standards and procedures set out in customary, national, and international laws and policies.

4. **Network of community-based researchers** (collaborative innovation). A network of community-based researchers has been drawn from the Potato Park communities. They advance endogenous capacity development and indigenous leadership in participatory research, and the management of the Potato Park and its large native potato collection. The network was formed as a result of research collaboration between ANDES and the communities of the Park. The network's exchange of knowledge is crucial for the effective governance of the Park. Community-based researchers are organised in two groups: 1) *tecnicos locales*, experts who operate under community supervision and act as a catalyst to ensure that the communities' interests are articulated, encouraged and incorporated into the Park's research activities and policy decisions; and 2) the *Papa Arariwa* (Potato Guardians) who are elected by their communities to the group because of their highly specialised knowledge, dedication and interest in native potatoes. Members of both groups are recognised leaders in their communities, and, through an iterative learning process, support capacity development to build resilience into the agricultural system at the production, conservation and innovation levels.
5. **Horizontal partnerships with scientists** (collaborative innovation). The Potato Park has well-established and exemplary collaborative partnerships with research centres, including the International Potato Center (CIP) and national and international universities. These partnerships are based on written agreements that are based on mutual respect. The objectives are research oriented, aimed at contributing to the sustainable management of biodiversity and landscapes. Collaboration focuses on complementarities and on producing new ideas and innovation from the cross-fertilisation of indigenous knowledge and science that benefits the well-being of the communities. This allows the community to engage in research that benefits them directly, making sure that research is a source of innovation and enhances their local knowledge, networks and livelihoods. The collaboration framework includes ethical frameworks and review processes for participatory action-research.
6. **New biocultural festivals based on local traditions** (collaborative innovation). Among the 'new' biocultural festivals being implemented in the Potato Park by the communities and ANDES, is the Hachun Huaccachi Festival. Hachun Huaccachi is a native potato cultivar considered a symbol of love amongst the Park communities. The festival, which caters chiefly to the Cusco public, has been linked to Valentine's Day celebrations and highlights the biocultural significance of Hachun Huaccachi and native potatoes for culture, society and global food security. The festival starts with a ritual ceremony of potato peeling, involves couples' contests, and ends with a celebration of food and music. The new practice educates consumers about the varied textures, flavours and hundreds of preparation methods associated with different local potato varieties; it also shows the positive value of this particular variety. The introduction of this festival has enhanced the maintenance of potato intra-specific diversity in the Potato Park. The gathering of all the communities to celebrate the Hachun Huaccachi also strengthens social ties, institutionalising customary rules and social organisations. It particularly enhances the exchange of knowledge, which is crucial for the effective governance and conservation of biocultural heritage and for the development of innovations, thereby helping to reduce risk at community level.

5.5.2 Influencing policy change from the bottom up

1. **Repatriation agreement with the International Potato Center** (collaborative innovation). In 2004, the Potato Park and ANDES signed an agreement with the CIP, located in Lima, Peru, titled "Agreement on the Repatriation, Restoration and Monitoring of Agrobiodiversity of Native Potatoes and Associated Community Knowledge Systems". The agreement is a strategy to avoid the threat of intellectual property rights being obtained by others on traditional knowledge or potato varieties while increasing the level of biodiversity within the Park and addressing a history of wrongful appropriation of indigenous resources. During the 1960s, the CIP carried out a series of activities throughout the country, designed to acquire the widest available range of native potato varieties. While this was done with the intent of safeguarding the potato through its preservation in the Center's *ex situ* gene bank, the acquisitions were carried out without prior informed consent of the many indigenous groups who had cultivated the potato varieties for hundreds of years. Since then, many of these potato varieties have been lost, existing only within CIP's gene bank. The repatriation agreement

returns the native potato varieties collected from the sacred valley, and their full custody and rights, to the five communities of the Potato Park, and expressly prohibits the patenting of these varieties and any related knowledge. Currently, 410 potato varieties have been transferred, bringing the Park's collection to a total of 1,344 different types of potato, of which about 650 are different varieties according to western science. The agreement offers best-practice guidelines to facilitate repatriation of indigenous peoples' biocultural heritage relevant to the conservation and sustainable use of biodiversity, including of indigenous and traditional knowledge in accordance with Articles 8(j) and 17(2) of the CBD. The agreement was renewed for another five years in December 2010.

2. **Membership of the multilateral system of the FAO's International Treaty on Plant Genetic Resources for Food and Agriculture** (ITPGRFA) (collaborative innovation). To advance its objectives as a community-managed gene bank, the Potato Park has applied to enter into the FAO's ITPGRFA multilateral system, which facilitates access to genetic resources through a material transfer agreement. The Potato Park has worked closely with ANDES in making this application. So far, no indigenous community has entered the system alongside governments and gene banks, and doing so will give the Park influence within the system and provide formal recognition of the Park's resources and rights at the international level.
3. **Transferring the Potato Park's potato collection to the Svalbard International Seed Vault** (collaborative innovation). The transfer to the International Seed Vault in Norway, near the North Pole will protect the varieties in the event of a global crisis. While this is seen as a largely symbolic action, the transfer serves also to strengthen the Potato Park's membership of the FAO Treaty multilateral system, raise international awareness of the growing concerns of Peru's potato farmers and promote a balanced relationship between *in situ* and *ex situ* conservation strategies. ANDES and CIP have supported the application and the production of botanical seeds by the farmers (as opposed to seed potatoes).
4. **Declaring a National Day of the Potato** (endogenous innovation). In 2006, grasping the opportunity created by the increased interest from national authorities in the Potato Park, the Park leaders requested that the Peruvian government declare a National Day of the Potato. The idea originated in the communities and lobbying was supported by ANDES. Other actors joined in support of the proposal, including CIP and the Ministry of Agriculture. Ultimately the government passed a law which declared May 30 as the National Day of the Potato, emphasising the potato's leading role as a source of nutrition, and its links to the culture and cuisine of Peru, especially for Andean peoples.

National Day of the Potato, the Potato Park. Credit: ANDES

6. Factors influencing biocultural heritage innovations

The research in the Potato Park included an exploration of the factors influencing biocultural innovation. As agreed with the SIFOR project partners, it explored four types of factors that influence the development of biocultural innovations. These were 1) individual (or 'people') factors; 2) institutional factors; 3) networking factors; and 4) community factors. For this purpose, a brief literature review on factors affecting innovations was carried out, and a questionnaire was applied in the focus groups and in-depth interviews.

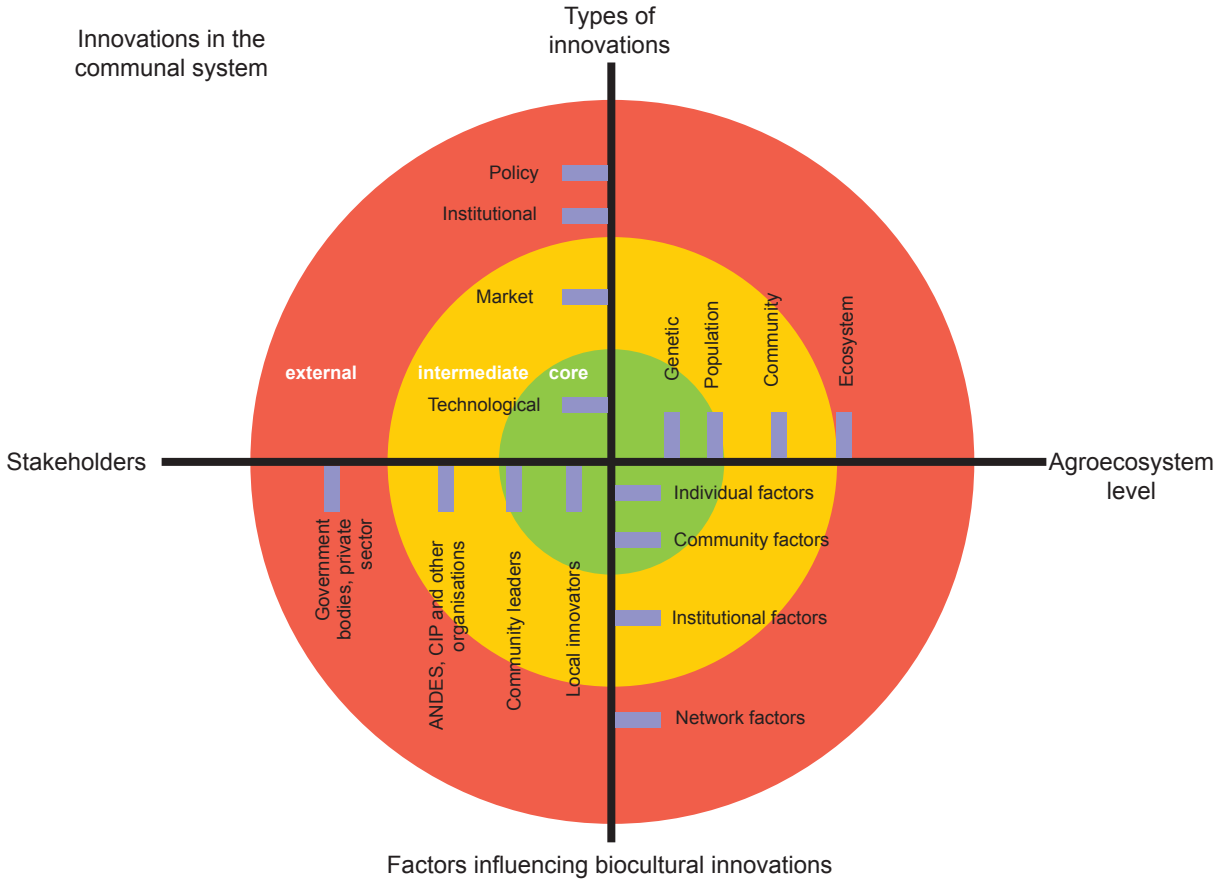
The literature on innovation highlights the role of individual innovators, noting that innovators tend to be creative individuals, who imagine, ask questions, take risks, act based on passion and values, and lead change to seek solutions to large or small problems (Chandler McDonald, 2013). Individual characteristics may also be important for the adoption of innovations. Kumar's review of previous research (2014) concludes that those most likely to adopt innovations are young and have high professional status, income and education levels, although these characteristics were in relation to technological innovations and identified at national levels, and may not apply to biocultural innovation in rural indigenous communities.

Since individuals function within communities and broader social networks, institutional factors and policies also play an important role in innovation. Knowledge sharing and collaboration between people with different knowledge and capabilities, and from diverse cultural backgrounds, may enhance innovation (Niebuhr, 2010 in Kumar, 2014). Empathy and trust may also be important for individual innovators, allowing them to connect with, collaborate and inspire others to participate in the cross-fertilisation of ideas and adopt innovations. This last point is an important one, as people often dislike and resist change (Chandler McDonald, 2013). Regional, national and subnational cultures and trends seem to account for many differences in innovation adoption rates, since innovation and adoption of innovations appear to be closely linked to social beliefs and value systems (Kumar, 2014).

Motivations for innovation vary but they may be influenced by global crises. Co-operation among individuals can lead to social innovation aimed at addressing real social problems or needs. Social innovation can come from public authorities, companies, other organisations (top down), or from individuals and communities (bottom up). Social innovation can play an important role in improving the quality of life, including addressing issues around food, education, culture and health (Maurer and Nunes da Silva, 2014). The concept of social innovation goes beyond technological innovations to changes in attitudes, perceptions and behaviour, and reflects many of the qualities of the concept of biocultural heritage innovations, such as valuing diversity and maintaining and adapting customary laws and institutions.

The focus group discussions (FGDs) used a conceptual diagram developed to analyse the four types of factors affecting biocultural innovations. The graphic (Figure 2) facilitated mutual understanding of the complex relationship between the elements of the innovation systems. The circular chart has three concentric circles and four axes. The circles relate roughly to levels of influence or scale, where the inner ring or 'core' represents the Potato Park communities and the yellow ring represents an intermediary zone where relations between community members and the outside world are negotiated. The upper vertical represents the four types of innovations: technological, market, institutional and policy. The factors supporting or limiting the development, diffusion and adoption of innovations are represented on the lower vertical axis. The horizontal axes of the conceptual framework represent the diverse stakeholders and actors on the left, and the ecosystem level or scale on the right.

Figure 2: SIFOR conceptual diagram for evaluating factors influencing biocultural innovations



The FGDs in the Potato Park identified a range of possible factors that could influence development and dissemination of innovations, by supporting innovators and innovation processes or by limiting them. A brief list of these factors is presented in Box 2.

The great majority of biocultural innovations identified have been adopted in the four study communities, which suggests the wide dissemination of innovations within the Park. The FGD participants understood many of the technological innovations as having been developed by individuals and transmitted from farmer to farmer. Innovations are thought to depend on the presence of elders who are recognised and respected in their communities, and who develop and share innovations. The firmly held beliefs and practices related to customary laws and institutions seem to support the development of biocultural innovations and their diffusion within and across generations, as most agricultural knowledge, including innovative practices, is transmitted orally from farmer to farmer. Other factors that influence innovations are access to technical support and resources for supporting their innovative ideas; the appointment of key individuals as special focal point on innovation within each community (e.g. potato guardians); and the occurrence of co-ordination meetings and participation in community decisions affecting their production systems, including the management of the Potato Park. Other individual factors identified include the existence of women with capacity to act as entrepreneurs and the existence of specialised groups for marketing and selling newly developed products.

On the other hand, most market and institutional innovations were understood as having developed due to the existence of stable and active local community groups and interaction with outside institutions such as Asociacion ANDES and the International Potato Centre. Community assemblies continue to be important sites for sharing knowledge, group decision making and problem solving. The discussions also identified the importance of the presence of creative and innovative external organisations and connections between these organisations and community leaders/innovators. Participation in learning

Box 2: Factors influencing biocultural heritage innovation

Individual factors

- Access to resources for supporting innovative ideas
- The existence of women with capacity to act as entrepreneurs
- Technical support for community innovation
- Existence of specialised groups for marketing and selling biocultural heritage (BCH) products
- Existence of elders who are recognised and respected
- Appointment of individuals as special focal points on innovation within each community, and the organisation of co-ordination meetings
- Participation in community decisions affecting their production systems, including in the management of the Park

Institutional factors

- Adoption or strengthening of appropriate policies and/or legal instruments at the regional and national level
- Recognition of indigenous peoples cultural and spiritual values, traditional knowledge and resource management practices with a view to promoting environmentally sound and sustainable development
- Recognition that indigenous lands should be protected from activities that are environmentally unsound or that the affected indigenous people consider to be socially and culturally inappropriate
- Support for protection of customary seed systems and environmentally sound means of food production to ensure a range of choices on how to improve quality of life and effective participation in sustainable development
- Upscaling successful innovations in other rural areas
- Training to support innovation capacity
- Establishment of microenterprises that are oriented toward BCH innovations
- Cooperation with research centres and universities to develop methods to innovate jointly
- Integration of local norms, rules and protocols in the management of innovations
- Rules for managing innovations based on customary laws

Networking factors

- Existence of capacity-building programmes for indigenous communities, based on the adaptation and exchange of traditional experience, knowledge and resource-management practices, to ensure their endogenous development
- Participation of indigenous people and their communities in the national formulation of policies, laws and programmes relating to conservation, climate change, resource management and other development processes
- Involvement of indigenous people and their communities at the national and local levels in innovations, resource management, conservation strategies, climate change adaptation and other relevant programmes established to support and review sustainable development strategies
- Attention to customers' choices about innovative products
- Establishment of relations with more customers
- Availability of more community members working as researchers
- Training of community researchers about innovation

Community factors

- Definition of the legal status of the Potato Park
- Establishment of a trust fund for BCH innovations
- Establishment of long-term vision for BCH innovation in the Potato Park
- Local authorities with knowledge of innovation
- Recognition and respect of elders by the community
- Transmission of traditional knowledge and practices to younger generations
- Management of innovations based on oral systems
- Community planning in resource management and conservation strategies

networks, including inter-community groups supported innovation, helped by bringing together like-minded individuals and groups to solve problems. Participation in networks and events for sharing and learning can also support the wider dissemination of innovations to farmers, policy makers, scientists and academics.

Institutional factors were identified as critical for the adoption or strengthening of appropriate policies and/or legal instruments at the regional and national level. These policies should recognise indigenous peoples' cultural and spiritual values, traditional knowledge, and resource management practices with a view to promoting environmentally sound and endogenous development. They also identified the protection of indigenous lands and biocultural resources from activities that are environmentally unsound, or that the indigenous people concerned consider to be socially and culturally inappropriate, as an important institutional factor that can support BCH innovations. Another important institutional factor was the protection of customary seed systems and environmentally sound means of food production to ensure a range of choices and innovations. Other key factors identified were training in support of innovation capacity; the establishment of microenterprises that are oriented toward the application of traditional knowledge; and the integration of local norms, rules and protocols for managing innovations.

The FGDs identified critical networking factors, such as the existence of capacity-building programmes for indigenous communities, based on the adaptation and exchange of traditional experience, knowledge and resource-management practices to ensure their endogenous development. The participation of indigenous peoples and their communities in the national formulation of policies, laws and programmes relating to conservation, climate change, resource management and other development processes was another factor identified as important. Similarly, another key factor was the involvement of indigenous people and their communities at the national and local levels in innovations, resource management and conservation strategies, as well as climate change adaptation and other relevant programmes established to support sustainable development strategies. Market factors, such as paying attention to customers' choices about innovative products and establishing relations with more customers, were also seen as important.

The focus groups identified the community factors supporting BCH innovations. These included defining the legal status of the Potato Park, establishing a trust fund for supporting BCH innovations, establishing long-term vision for the Potato Park, electing local authorities supportive of innovation, and the transmission of traditional knowledge and practices to younger generations. Another key factor was the involvement of the community in planning on resource management and conservation strategies.

The role and relative importance of individual, community, institutional and network factors will be further explored, with an eye to strengthening innovation systems and decreasing limitations on these systems. One challenge identified is how to measure the impacts of diverse influences on specific innovations.

6.1 Biocultural heritage policy context

Although Peru has no policy and normative frameworks specifically directed at promoting or protecting biocultural heritage (a relatively new concept in the literature and discourse), this research explored existing policy initiatives and any challenges and gaps in the application of indigenous knowledge-based innovations, with an emphasis on climate change adaptation and food production. It reviewed the policies, laws and regulations that could shape the use of biocultural heritage innovations for adaptation. The study found there are a series of policy and normative frameworks which are geared towards recognising, promoting and protecting different elements of biocultural heritage in Andean communities. Box 3 presents the main policies supporting biocultural heritage in Peru.

Among the key international policy frameworks are the Convention on Biological Diversity (1992), the UNESCO Convention for the Safeguarding of Intangible Cultural Heritage (2003), the UN Declaration on the Rights of Indigenous Peoples (2007), the World Intellectual Property Organization (WIPO) proposal for protecting traditional cultural expressions (2009-10), and the Nagoya Protocol on Access to Genetic Resources (2010). National policies include the Environmental Research Agenda (2013-2021), the National Strategy on Food and Nutrition Security (2013-2021), the National Program on

Box 3: Policies supporting biocultural heritage in Peru

- Convention on Biological Diversity (1992)
- UNESCO Convention for the Safeguarding of Intangible Cultural Heritage (2003)
- UN Declaration on the Rights of Indigenous Peoples (2007)
- Proposal to WIPO to protect traditional cultural expressions (2009-2010)
- Nagoya Protocol on Access to Genetic Resources (2010)
- Decision 391, Common Law for Access to Genetic Resources (CAN) (1996)
- Decision 523 which establishes a Regional Strategy on Biodiversity (CAN) (2001)
- Decision 524 which establishes a Consultative Group on Indigenous Issues (CAN) (2001)
- Law 29196, Law for the Promotion of Organic Production (2008)
- Law 27811, Law for protection of Indigenous Peoples' Collective Knowledge (2001)
- Law 28216, Law which creates a National Commission against Biopiracy (2004)
- Ministerial Resolution 0533-2008-AG, National Registry of Native Potatoes (2008)
- Regional Executive Resolution 1087-2008-GR/CUSCO/PR, Regional Council on Food Security Regional Executive Resolution (2008)
- Draft bill on the Promotion of Peasant Markets (2009)
- Regional Ordinance 010-2007-GRC, Prohibition of the Cultivation of GMOs in Cusco (2007)
- Regional Ordinance 048-2008-CR/GRC, on Access to Biodiversity and protection of TK (2008)
- Law 29785 and DS 001-2012-MC, Law and regulations on Prior consultation for indigenous peoples (2012)
- DS 006-2012-AG, Regulations for the General Seed Law (2012)
- DS 010-2012-AG, Regulations for the Law for the Promotion of Organic Agriculture (2012)
- DS 001-2012-PROMUDEH, Creation of a round table against poverty (2012)
- Draft Bill for Support for the Development of Peasant Cooperatives (2013)
- Environmental Research Agenda (2013-2021)
- National Strategy on Food and Nutrition Security (2013-2021)
- National Program on Biotechnology (2013-2016)
- National Strategy for the Development of Science, Technology and Innovation (2014)

Biotechnology (2013-2016), and National Strategy for the Development of Science, Technology and Innovation (2014).

The study also highlighted policy gaps and possible advocacy tasks for the Potato Park communities, and provides a policy framework for approaching the promotion of biocultural innovations and their diffusion in the country.

This first assessment of the BCH policy landscape in Peru identified policies, norms, strategies, plans, etc., which, either directly or indirectly, relate positively to the innovation process in the Potato Park, and which are also relevant in the context of the SIFOR project and its results, as they are implemented in the Potato Park. The survey certainly does not include every policy, norm or programme which relates to biocultural innovation, but rather just some of the most relevant and those that are more in line with the objectives of the SIFOR project.

The survey was conducted using a policy mix matrix (see Annex 1). This matrix is being used to provide the Potato Park and ANDES with a comprehensive snapshot of how the different dimensions of biocultural innovation in the Potato Park can be directly and indirectly supported by different norms, policies and programmes. It helps to identify where to find the necessary package of support – technical, financial, commercial, legal, and so on – and the relevant agencies that can support communities with incentives and regulations for protection of biocultural heritage and related innovations.

7. Conclusions and next steps

Biocultural heritage innovations (BCHIs) are distinguished from other innovations in that they are based on the concept of biocultural heritage and are rooted in the materials, values and creativity of indigenous peoples and local communities. Most are largely endogenously developed, collectively held and inextricably linked to traditional resources and territories, local economies, and the diversity of genes, varieties, species and ecosystems, cultural and spiritual values and customary laws (Swiderska *et al.*, 2006). However, BCHIs have evolved to reflect the inherent links within social-ecological systems, and between biological, cultural and linguistic diversity, while also integrating new elements from outside knowledge, practices, and institutions (Davidson-Hunt *et al.*, 2012).

This qualitative baseline study presents a useful summary of biocultural innovations, reflecting the understanding of individuals and groups in the Potato Park. The adaptation of the project's conceptual framework and research methodologies to the context of the communities in the Park was very useful for facilitating reflection and conversation on the types of innovation there were, and the factors influencing innovators and the development and diffusion of innovations. The interlinked categories of biocultural innovations identified by community members in the Potato Park reflect an understanding of resilience that includes technological, market and institutional innovations, along with shifts in perception and meaning, patterns of interaction and institutional arrangements. The specific BCHIs have impacts at different scales, including new ways of making a living, alternative understandings of well-being, respectful relations between humans and nature, and alternative market values and relations.

These innovations are being used to challenge the status quo, designing and shaping alternatives to the current flawed global socio-political system (Brown, 2014; Feola, 2014). Inclusive research methodologies bring justice and capacity into the foreground. They create capacity, and include the voices of marginalised indigenous farmers, particularly women, in processes which support the devolution of rights, empowerment, and the leveraging local collective knowledge and collaborative research (Olsson *et al.*, 2014). Many of the BCHIs identified reflect a transition within the current system, particularly in relation to adaptation in the face of climate change. These adaptation processes are essential to maintain the biocultural systems, which are the basis for the future capacity of indigenous communities to innovate. Other BCHIs are clearly aimed at more profound change, including innovations that propose and implement alternative models of development and well-being, such as *sumaq kausay*. These are holistic models of conservation based on territorial approaches, complex systems, and harmonious human-nature relations; and alternative economic models such as the solidarity economy, barter and seed sharing. They represent attempts to open up spaces for the co-production of innovation and new knowledge, while influencing governance regimes and institutions. In this way the current research can contribute to the body of knowledge on resilience and innovation, and particularly the links between agency, networks, and institutions in the processes of innovation.

The next steps of the project are to:

- Further explore the key factors that support or constrain innovation and use the findings to identify priority actions for strengthening biocultural innovation systems.
- Stimulate greater levels of awareness and interest in the Potato Park's achievements, amongst community members and externally.
- Continue strengthening the innovative and positive collaborative relationship with the International Potato Centre.
- In taking forward the conclusions and actions in this report, pursue collaboration and make links to on-going related initiatives in the Cusco region and in Peru.

Bridging knowledge systems and collaborative approaches to learning and social change have great potential for providing solutions to global and local problems. ANDES will continue to build on past experience with learning exchanges to maximise the learning potential and dissemination of BCHI for resilience in the face of climate change. In addition, ANDES will continue to participate in broad and diverse social movements seeking more just social and environmental interactions.

Annex 1: Policy mix matrix for biocultural innovations in the Potato Park

Although there is no universally accepted definition of biocultural innovations, they can be defined as: knowledge, ability, practices or expertise, or any combination of these that help to strengthen and maintain agrobiodiveristy, especially of local seed systems, ways of life, and material and spiritual well-being of communities, adapting to and mitigating global change and impacts, especially climate change. They are based on local biocultural heritage, but can also incorporate external elements. They integrate daily practices with traditional knowledge (TK), spiritual values and customary laws (Dutfield, 2014).

Types of biocultural innovations considered are:

- Technological
  - Native seeds
  - Traditional forms of management of land and crops
  - Forms of seed conservation
  - Forms of food preparation
- Institutional
  - Biocultural protocols
  - Forms of social intra-community control (agreements, association of communities, etc.)
  - Ceremonies and festivals
- Market
  - Seed fairs and farm fairs
- Repatriation of native seeds
- Seed production infrastructure (seed producers)
- Production of goods (teas, creams, etc.)
- Touristic routes
- Craft products

The policy and normative frameworks identified in this matrix are not specifically intended to promote or protect biocultural innovations (a relatively new concept in the literature and discourse), nor do they explicitly exclude future research and exploration of the frameworks in relation to different types of biocultural innovations other than those promoted in the Potato Park.

The matrix developed identifies the policies, norms, strategies, plans, etc., which, either directly or indirectly, relate positively to the innovation process in the Potato Park, and which are also relevant in the context of the SIFOR project and its results, as they are implemented in the Park. For more information about SIFOR's expected results/outcomes, see: http://pubs.iied.org/G03557.html

Law/Policy	Summary**	Theme	Location	(Potential) impacts of drivers of change in the Potato Park	Scale of implementation (national/ regional)	Relation to the SIFOR project's Expected Results
Convention on Biological Diversity (1992)	Promotion of the protection and dissemination of indigenous knowledge, innovations and practices (with FPIC of participating communities)	Protection of TK (including knowledge, innovations, practices of indigenous peoples)	International	Political/legal foundation for much of the work in the Park related to TK, genetic resources, repatriation and other activities related to conservation and sustainable use of the biocultural heritage of the Potato Park	Advances in the application of the law on the protection of TK, mainly through registers (public confidential)	Result 1: recognition and revaluing local innovations and TK which contribute to improved conditions of sustainable use of agrobiodiversity Result 2: tools to promote local innovation and its diffusion Result 3: knowledge, capacity, preparation and strengthening of local agrobiodiversity.
UN Declaration on the Rights of Indigenous Peoples (2007)	Recognition and protection of cultural heritage (TK and innovations) for indigenous peoples	Cultural heritage and TK	International	Political/legal foundation for much of the work in the Park related to biocultural heritage and recognition of rights	Creation of a Ministry of Culture and Vice-Ministry of Inter-culturality (2010); process of incorporating TK in the internal ministerial agenda	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity
UNESCO convention for the safeguarding of the Intangible cultural heritage (2003)	Intangible cultural heritage	Cultural heritage	International	There is a possibility of identifying elements of biocultural heritage to be registered before INC	The Direction of the Registry of Cultural Heritage of the National Institute of Culture is in the process of identifying/ registerign samples of national cultural heritage	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity
Proposal to WIPO to protect traditional cultural expressions (2009-2010)	Protection of cultural expressions	Biocultural heritage	International	Process underway; not linked, but with possible inspirational elements for inclusion in the regional and national processes.	Relatively active participation of the Ministry of External Affairs in international spaces	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity

Law/Policy	Summary**	Theme	Location	(Potential) impacts of drivers of change in the Potato Park	Scale of implementation (national/ regional)	Relation to the SIFOR project's Expected Results
Nagoya Protocol on Access to Genetic Resources (2010)	Protection of TK	TK and biocultural protocols	International	Express mention of protection of TK and biocultural protocols as a tool to provide protection of collective biocultural heritage; possible legal foundation for biocultural protocols	Recently ratified; normative review process, especially in relation to access and benefit sharing (ABS)	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity Result 2: tools to promote local innovation and dissemination Result 3: knowledge, capacity, preparation and strengthening of local agrobiodiversity
Decision 523 which establishes a Regional Strategy for Biodiversity (CAN, 2001)	Strategies and recognised lines of action related to agrobiodiversity, TK, ABS, and others	Biodiversity and TK	Andean Sub-region	Foundation for national and regional plans and strategies for agrobiodiversity, climate change and TK	MINAM (Ministry of Environment) has advanced the implementation of specific plans derived from Decision 523 on agrobiodiversity, TK and ABS	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity
Law on the Protection of Collective Knowlege of Indigenous Peoples (Law 27811) (2001)	Procedures for protection of TK associated to biodiveristy	Legal protection for TK	National	Creation of a local registry on TK in the Potato Park; possibility of using this registry in a defensive way (linking to the National Commission of Biopiracy) or as a way of forming a source of data and information for research activities	Public confidential registers have been implemented in charge of INDECOPI (Peru's national authority for intellectual property); training for dissemination and application of the law have been carried out (especially among indigenous groups in Amazonia); law revision underway	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity Result 2: tools to promote local innovation and dissemination
National Registry of Native Potatoes (Resolución Ministerial 0533-2008-AG)	Register (not constituting rights) and recognition of native potato cultivation	Native crops and seeds	National	Possibility of registering the Potato Park's varieties through INIA – the National Institute for Agricultural Innovation	Descriptors have been developed and some native varieties from different parts of the country have been registered	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity

Law/Policy	Summary**	Theme	Location	(Potential) impacts of drivers of change in the Potato Park	Scale of implementation (national/ regional)	Relation to the SIFOR project's Expected Results
Environmental Research Agenda (2013-2021)	Prioritisation of strategy lines and actions for environmental research Also, supports research from the point of view institutional and public policy	Recognition of TK and its contribution to research	National	Integration and strengthening TK and innovations in the Potato Park for territorial management; adaptation to climate change; management and improvement of agrobiodiversity; management of water resources etc.	Recently adopted; co-ordinated by MINAM	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity Result 4: awareness raising among interest groups (scientists, politicians, etc.) of the role of institutional and policy frameworks in relation to incentives for local innovation – as a means to improve local living conditions
National program on Biotechnology (2013-2016)	Promotion of biotechnology in themes of health, agriculture, industry, others	Promotion of biotechnology and recognition of biodiversity	National	Possibility of executing collaborative projects between the Potato Park and research institutions	Coordinated by CONCYTEC – executed with funds from FINCYT	Result 3: knowledge, capacity, preparation and strengthening of local agrobiodiversity
National Strategy for Development of Science, Technology and innovation (2014)	Recognition of potential of TK; territorial focus (regional) del SINACYT; creation of a national program on biotechnology	Promotion of innovation at all levels	National/ Regional	Possibility of alliances between the Potato Park and research institutions to strengthen local innovation (in a participatory way)	Strategy in process of public consultation; led by CONCYTEC	Result 4: awareness raising among politicians, academics and opinion shapers
Prohibition of cultivation of GMOs in Cusco (Ordenanza Regional 010-2007-GRC)	Declares a moratorium on the entry and cultivation of genetically modified organisms (GMOs) in the Cusco Region The conservation of native crops is promoted as an alternative	Biosafety, agrobiodiversity and native crops	Regional	Legal foundation for the Potato Park continuing its organic production and local sustainable technology development activities; possibility to influence policy related to biosafety and GMOs	A moratorium was implemented and an informal monitoring system from civil society has been established; a technical group on Agrobiodiversity, Biotechnology and TK in Cusco has been established (with participation of ANDES)	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity and native crops Result 4: awareness raising among interest groups (scientists, politicians, etc) on the role of institutional and policy frameworks in relation to incentives for local innovation, especially native crops

Law/Policy	Summary**	Theme	Location	(Potential) impacts of drivers of change in the Potato Park	Scale of implementation (national/ regional)	Relation to the SIFOR project's Expected Results
Decision 391, Common Regime for Access to Genetic Resources (CAN) (1996)	Procedures for access to genetic resources (including native seeds and crops) Recognition of the value of TK associated with genetic resources and the need to share benefits	Access and protection of genetic resources and TK	Andean sub-region	Possibility of regulating forms of access to biocultural heritage (in the field of seeds and native genetic diversity) and associated TK for fair and equitable distribution of benefits from research and development activities	Competent authorities recognised in regulations (INIA, Dirección General Forestal y de Fauna Silvestre and Vice-Ministry of Fishing)	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity
Decision 524 which establishes the Consultative Group on Indigenous Issues (CAN) (2001)	Spaces for discussion of indigenous regional agendas and themes	Protection of TK and territories	Andean Sub region	Spaces to develop proposals for regional policies on biodiversity and possibility of influencing policy	At this moment, it is deactivated during a reorganising process at CAN	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity
Law that creates the Comission against Biopiracy (Law 28216, 2004)	Institutional spaces to deal with cases of biopiracy or appropriation of biological resources and TK	Protection of TK, native crops and genetic resources	National	Possibility for the Potato Park to denounce cases of biopiracy related to genetic resources or TK before the Commission	Active and regular work since 2004; 13 cases heard in the international arena related to resources of Peruvian origin (maca, yacón, muña, sacha inchi, others)	Result 4: awareness raising among interest groups (scientists, politicians, etc) on the role of institutional and policy frameworks in relation to incentives for local innovation – as a means to improve local living conditions
Law and regulations on Prior Consultation (Ley 29785 and DS **001-2012-MC)**	Procedures for prior consultation for investment and productive activities in community lands	Prior Informed Consent; preservation of biocultural heritage (at the level of territories and landscapes)	National with regional and local application	It is not clear (it has not been defined by the Ministry of Culture) if the arena for consultation extends beyond Andean indigenous communities	The is still no implementation of the law due to the absence of specific regulations	Result 4: awareness raising among interest groups (scientists, politicians, etc) on the role of institutional and policy frameworks in relation to incentives for local innovation – as a means to improve local living conditions

Law/Policy	Summary**	Theme	Location	(Potential) impacts of drivers of change in the Potato Park	Scale of implementation (national/ regional)	Relation to the SIFOR project's Expected Results
Creation of round table against poverty (DS 001-2012-PROMUDEH)	Promotion of measures to support local development, social inclusion	Poverty alleviation	National (with local and regional application)	Possibility of benefits for the Potato Park with programmes and opportunities to access poverty alleviation mechanisms (social programmes, etc.) but especially taking advantage of the local management of the Potato Park to show successful improvement to living conditions for local communities	Orientation of the round table through policies and supervision of the poverty alleviation programmes	Result 4: awareness raising among interest groups (scientists, politicians, etc) on the role of institutional and policy frameworks in relation to incentives for local innovation – as a means to improve local living conditions.
Draft Bill on Support for Development of Peasant Cooperatives (2013)	Promotion of networks at the community level	Agricultural production, especially crops	National	Possible associative form for the Potato Park to register production of native seeds and their local, regional and national commercialisation	Still at the level of draft bill	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity (especially native seeds)
National Strategy on food and nutrition security (2013-2021)	Policy framework for national and regional food security (Specific Objectives 1.2 – revalues ancestral technologies and agricultural practices, transfer of technologies)	Food Security	National	Specific recognition of local practices and innovations aimed at conserving agrobiodiversity and generating local innovations that support improved productivity and agricultural sustainability	Recently adopted strategy; led by the Multisectoral Commission of Food Security (MINAGRI)	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity
Creation of the Regional Council on Food Security (Resolución Ejecutiva Regional 1087-2008-GR/ CUSCO/PR)	Aims to contribute to food security and reduce vulnerability and destruction	Food security	Regional	Possibility of influencing policy with a specific proposal from the Potato Park (and ANDES) related to Food Security	Initial work agenda established	Result 4: awareness raising among politicians, academics and opinion shapers

Law/Policy	Summary**	Theme	Location	(Potential) impacts of drivers of change in the Potato Park	Scale of implementation (national/ regional)	Relation to the SIFOR project's Expected Results
ABS and TK protection are regulated in Cusco (Ordenanza Regional 048-2008-CR/GRC)	A Regional commission for the Protection of TK, Biodiversity, and Living culgture of communities, regulating bioprospecting, PIC for activiteis related to genetic resources and TK; protection of TK	Protection of cultural and biological heritage of Cusco and its communities	Regional	Participation of the Potato Park (through ANDES) in the Commission; possibility for direct influence in special themes of interest for biocultural innovation: research, bioprospecting, access to TK, etc.	The Regional Administration on Natural Resources is the competent body to implement the Ordinance; the commission from Ordinances 048-2008 and 010-2007 were merged.	Result 1: recognition and revaluing local innovations and TK which contribute to improvements in the sustainable use of agrobiodiversity and native crops Result 3: knowledge, capacity, preparation, and strengthening of local agrobiodiversity Result 4: awareness raising among interest groups (scientists, politicians, etc) on the role of local markets in providing incentives to local agrobiodiversity
Law for the promotion of organic production, (Law 29196, 2008)	Promotion of organic production orgánica	Native and organic seeds and crops	National with regional and local application	Recognition of the SGP asa mechanism for certifying native locally produced seeds from the Potato Park; possibility of implementing participatory guarantee systems (local seed certification)	The criteria have not yet been determined (by INIA) for the production of non-certified seeds in the case of native potatoes and other Andean crops	Result 2: Tools to promote local innovation and dissemination
Draft Bill for the promotion of peasant markets (2009)	Promotion and support to different forms and levels of peasant markets	Promotion and revaluing local products	National	Innovations in the Potato Park at the level of seeds/native crops could be commercialised and disseminated through peasant markets	Recently at the draft bill stage	Result 3: knowledge, capacity, preparation, and strengthening of local agrobiodiversity Result 4: awareness raising among interest groups (scientists, politicians, etc) on the role of local markets as incentive to agrobiodiversity conservation

Law/Policy	Summary**	Theme	Location	(Potential) impacts of drivers of change in the Potato Park	Scale of implementation (national/ regional)	Relation to the SIFOR project's Expected Results
Regulations for General Seed Law (DS 006-2012-AG)	Promotion of seed production Production of seeds, including production of non-certified seeds of native crops	Native crops and seeds	National	Possibility of producing native seeds and commercialising them (in a non-certified way); in general, the informal exchange and commercialisation seed system continues to operate – now it can operate in a more 'legitimate' way from a formal point of view (in case the Potato Park wants to become a producer of native seeds	The criteria have not yet been determined (by INIA) for the production of non-certified seeds for native potatoes and other Andean crops	Result 2: tools to promote local innovation and dissemination
Regulations for the Law for the promotion of organic production (DS 010-2012-AG)	Promotion of organic production (at the regional level on the part of Regional Gov); certification through participatory guarantee systems; creation of Regional Councils for Organic Production	Organic crops and seeds	National/ regional	Possibility of implementing participatory guarantee systems (local seed certification)	Regional Councils for Organic Products (or Consejos Regionales de Productos Organicos – COREPO) are being established (in Cusco it already exists); it has participatory guarantee systems in various provinces of Cusco	Result 2: tools to promote local innovation and dissemination

** Types of innovation

Technological

Institutional

Market

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SIFOR (Smallholder Innovation for Resilience) is an action-research project working with indigenous and local communities in China, India, Kenya and Peru, coordinated by the International Institute for Environment and Development (IIED). It aims to revitalise traditional knowledge, crops and innovation systems for food security in the face of climate change.

This report presents the findings of a qualitative baseline study conducted in 4 Quechua communities in the Potato Park, Pisaq, Peru. The study explored the biocultural heritage innovations developed in response to climatic changes by farmers alone and collaboratively with scientists and NGOs, and the social factors that support biocultural innovation.

Project materials

Food and Agriculture

Keywords:
Smallholder Innovation for Resilience (SIFOR), traditional knowledge, biocultural heritage, climate change adaptation

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