

Mountain Ecosystem-Based Adaptation Project

Part of the Global Ecosystem-based Adaptation (EbA) Programme

**Challenges and Opportunities for Adaptation to Climate Change
at the Nor Yauyos Cochas Landscape Reserve, Peru**





INTRODUCTION

Climate change is one of today's most important challenges. It affects ecosystems, their functions and the goods and services that they supply to society, including food, water, fuels, medicines, raw materials, pest control and the mitigation of soil erosion, as well as air and water purification.

In turn, ecosystems are a key element of the global response to climate change, since they sequester and store carbon, thereby helping to mitigate this phenomenon. Likewise, healthy and well-managed ecosystems increase the resilience of communities and help them adapt to climate change by providing means that favour their wellbeing.

Acknowledging this key role, the Ecosystem-based Adaptation (EbA) approach emerges as a means of adaptation to climate change which, within the context of an overall strategy, helps people face the adverse effects of climate change through the use of biodiversity and ecosystem services.

The United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP) and the International Union for the Conservation of Nature (IUCN) have jointly developed the Ecosystem-Based Adaptation (EbA) Programme, a collaborative effort to implement the EbA approach at a national scale in mountain ecosystems in Peru, Nepal and Uganda to generate experiences and tools that can become part of the national climate change planning instruments. In Peru, the programme is commissioned by the Ministry of Environment of Peru (MINAM for its Spanish acronym) and is implemented in the Nor Yauyos Cochis Landscape Reserve with the support of the National Service of Natural Protected Areas (SERNANP for its Spanish acronym). The activities under IUCN's responsibility are implemented in partnership with The Mountain Institute (TMI).

THE NEED FOR CLIMATE CHANGE ADAPTATION

There is currently broad scientific consensus that carbon dioxide (CO₂) emissions and other greenhouse gases (GHG) derived from human activities are the main cause of recent climate changes (UNEP, 2012).

Indeed, the Intergovernmental Panel on Climate Change (IPCC) states that warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in rise of global mean sea level, and in changes in some climate extremes (IPCC, 2013).

In this context, humans are directly affected, for example through alterations in freshwater supply, agricultural productivity and health, and indirectly

by the economic and social impacts of loss of biodiversity and ecosystem services. (UNEP, 2012).

Over more than two decades, countries, aware of the magnitude of this issue, have been developing strategies, policies and measures at global, regional, national and local scales. However, these efforts are still insufficient. Such strategies aim to limit GHG emissions in order to reduce their concentration in the atmosphere (mitigation) and to adapt natural and human systems to current and future impacts of climate change (adaptation).

Most effects of climate change will last for many centuries, even if CO₂ emissions were to cease altogether (IPCC, 2013). Given this context, adaptation to climate change is a priority. is a priority need.



BOX 1:

What is CLIMATE CHANGE?

The greenhouse effect is a natural process through which atmospheric greenhouse gases (GHGs) trap heat emitted from the Earth's surface, warmed by the sun, hence keeping a constant temperature in the Earth and enabling life in the planet. Human activities, such as burning fossil fuels to produce energy, and industrialization and deforestation, among others, have impaired this natural process, leading to high GHGs concentrations in the atmosphere. The anthropogenic buildup of GHGs is the primary cause of the phenomenon called Climate Change.

BOX 2:

What is climate change ADAPTATION ?

Adaptation to climate change is the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2007). Adaptation involves a sustainable and permanent process of adjustment in response to new and changing environmental circumstances; it consequently implies the modification of behaviours, livelihoods, infrastructure, laws, policies and institutions in response to experienced or expected climate events (UNDP, 2008). Climate change adaptation measures may be aimed at reducing **vulnerability** to changing conditions, or at increasing **resilience**

Resilience The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change (IPCC, 2007). **Vulnerability** The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.

Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity. (IPCC, 2007).

ECOSYSTEM BASED ADAPTATION (EbA)

Ecosystem-based adaptation is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change (CDB, 2009).

EbA can be applied at regional, national and local levels, at both project and programmatic levels, and benefits can be realized over short and long time scales (CDB, 2009). Likewise, EbA incorporates the traditional knowledge generated by local communities and indigenous peoples throughout generations in response to changing weather conditions.

EbA includes various activities for ecosystems sustainable management, including the integrated management of water resources for regulating water flows, the restoration of ecosystems (e.g. wetlands, forests) to reduce the risk of disasters (e.g. protection against high waters and

floods) and the diversification of agricultural production to face changing climate conditions (e.g. adaptation of crops and livestock to climate variability). Furthermore, EbA measures can supplement mitigation strategies, as the conservation and sustainable management of forests allow carbon sequestration and storage (IUCN, 2012).

BOX 3:

EbA Approach

- Reduces the population's vulnerability to climate change.
- Increases the resilience of biodiversity and ecosystems either directly or indirectly.
- Uses biodiversity and ecosystem services in a sustainable way, without affecting them and, to the extent possible, improving them.



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ECOSYSTEM-BASED ADAPTATION PROGRAMME

The Ecosystem-based Adaptation Programme (EbA) is a global initiative implemented by UNEP, UNDP and IUCN, funded by BMUB. The World Conservation Monitoring Centre (UNEP-WCMC) also participates in this effort.

These organizations work with national governments to help communities living in different types of ecosystems (e.g. mountains, water basins, arid zones, coastal ecosystems, among others) to adapt to climate change using the EbA approach, through national-level projects.

For mountain ecosystems, experiences are being developed in the Peruvian Andes, the Himalayas in Nepal, and in Mount Elgon in Uganda. Mountain ecosystems and populations are particularly sensitive to the impacts of climate change, and hence are of interest to the EbA Programme.

MAP 1: INTERESTING ASPECTS OF THE NYCLR FOR EBA

The NYCLR protects ecosystems that are immersed in a mosaic of landscapes of particular beauty which support many productive activities carried out by local communities. These communities have for hundreds of years developed organizational structures that allow them to efficiently manage agricultural production and natural resources. (INRENA, 2006)

GOVERNANCE

- Local institutions are committed to the conservation of natural resources
- Reserve Management Committee includes all major local stakeholders
- Existence of natural resource planning documents such as the Reserve Management Plan and Tourist Management Plan

PRODUCTIVE ACTIVITIES

- Cultivation of corn, potato, lava beans, oca, mashua, wheat, barley, medicinal and aromatic plants and those for livestock grazing like alfalfa, cultivated grass, barley and others (INRENA, 2006)
- Domestic animals such as Andean camelids (llama, vicuña and alpaca) and cattle, goats, sheep and pigs (FDA 2013)
- Trout farming (FDA, 2013)
- High potential for ecotourism and cultural tourism (37 pre-colombian sites) (INRENA)
- High potential for hydroelectric production: hydropower plant in Llapay (INRENA, 2006)

NATURAL RESOURCES

- Rivers and streams fed by glacial melt and precipitation
- 485 lagoons
- Great genetic diversity of wild flora and fauna (INRENA 2006)
- 75 species of birds, 15 species of mammals, 4 species of reptiles, among others (MINAM, 2011)
- 10 different types of vegetation (queñoa, boqueal and barkac forests, wetlands, grasslands, scrubs)
- Diversity of morphological features such as canyons, waterfalls, caves and glaciers

SOCIAL ASPECTS

- 10,300 inhabitants in 12 communities
- Two thirds depend on the ecosystem services of the reserve
- Local communities maintain their ancestral way of life in harmony with nature
- Social organization for communal production, protecting cultural-historical values
- The population is vulnerable to climate change because of the high dependency on ecosystem services

The Nor Yauyos Cochash Landscape Reserve was created in 2001 and is the first of its kind in Peru. It is 330,707 hectares in size, including its buffer zone

Source: Prepared by the autor on the base of the Master Plan 2006-2011 of the NYCLR. INRENA, 2006; Inventario y evaluación del Patrimonio Natural en la RPNYC. MINAM, 2011 and FDA, 2013.

MOUNTAIN EBA PROJECT IN PERU

In Peru, EbA is being implemented in the Nor Yauyos Cochash Landscape Reserve (NYCLR), located in the Lima and Junín departments, as it meets a number of environmental, social and political features of interest (see Map 1). The main objective of the project is to strengthen the country's capacity to identify and implement Ecosystem-based Adaptation measures aimed at reducing the vulnerability to climate change of local communities living in high-mountain ecosystems. The EbA project is a joint effort of UNDP, UNEP and IUCN. The activities under IUCN's responsibility are implemented in partnership with The Mountain Institute (TMI) in the communities of Canchayllo and Miraflores.

COMPONENTS

The Mountain EbA project includes four inter-related components (Figure 1).

Component 1. Development of methodologies and tools for EbA decision-making in mountain ecosystems sets out the information base needed for developing EbA criteria in mountain ecosystems.

Component 2. Application of Methodologies and Tools at the Ecosystem Level uses Component 1 outputs to formulate EbA options for the NYCLR and promotes a participatory process aimed at identifying the most suitable areas for applying EbA options.

Component 3. Implementation of EbA Measures at the Ecosystem Level and Capacity Strengthening includes the implementation of EbA measures specifically selected for the NYCLR through a consultation process with local stakeholders and supported by scientific studies. The consultation process takes place while strengthening the local community's capacities for identifying and applying such measures, in order to promote internalization and ownership of the project.

Component 4. Making the case for EbA at the national level, includes promoting the integration of EbA within national and regional strategies, programmes and policies for climate change adaptation, as an option that is both economically and socially attractive, alongside other approaches to adaptation.

The first two components are designed to create the conceptual, methodological and information bases required to develop the project's third component, i.e. the implementation of EbA measures at the ecosystem level in pilot sites. The fourth component gathers these experiences and promotes their inclusion in policy planning.



FIGURE 1:

Figure 1. Components of the Mountain EbA Project in Peru Components



Source: Prepared by the autor on the base of the Peru Mountain EbA project document.

STAKEHOLDERS AND PARTNERS

The **Ministry of the Environment (MINAM)** is the main political partner at the national level. This agency leads the project and promotes synergies with other initiatives. The **National Service for Natural Protected Areas (SERNANP)**, under MINAM, is another national stakeholder. It provides coordination and technical support to ensure a smooth project implementation at the NYCLR. Additionally, the **Ministry of Economy and Finance** also participates in the project.

The **regional governments (Lima and Junín)** that have territorial jurisdiction where the reserve is located are also strategic partners for the project's implementation.

At the local level, the NYCLR Administration, comprised by the Reserve Manager, specialists and park rangers are all essential stakeholders, as they contribute a deep insight into the local reality, and represent, together with the local communities, a mechanism for the project's sustainability.

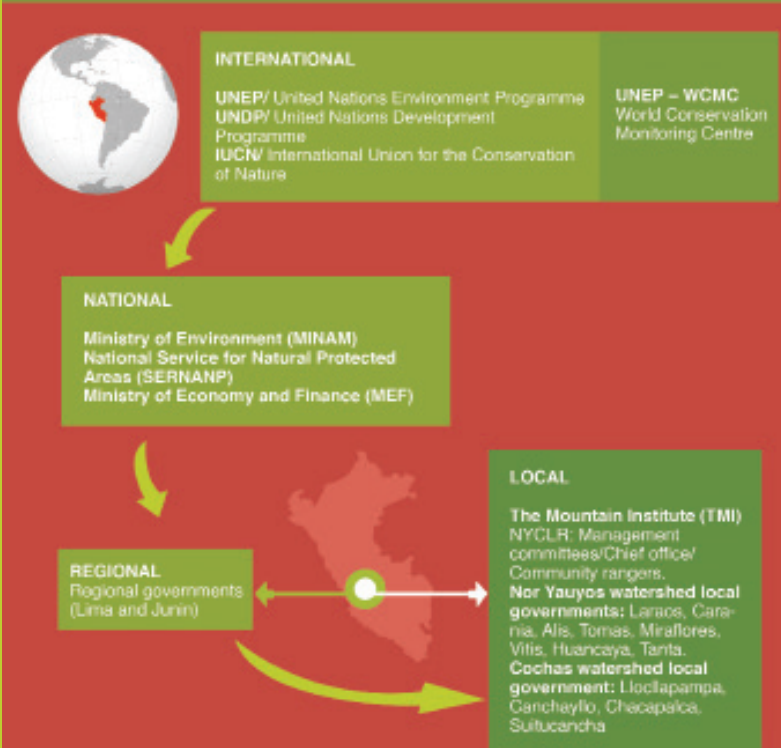
The local population, distributed in twelve communities located in the **Nor Yauyos (Laraos, Carania, Alis, Tomas, Miraflores, Vitis, Huancaya, Tanta) and Cochabas (Llocllapampa, Canchayllo, Chacapalca, Suitucancha) basins, participates through the the NYCLR Management Committee**, which also includes representatives from the civil society and the private sector (Figure 2).



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FIGURE 2:

Figure 2. Participation of different institutional levels



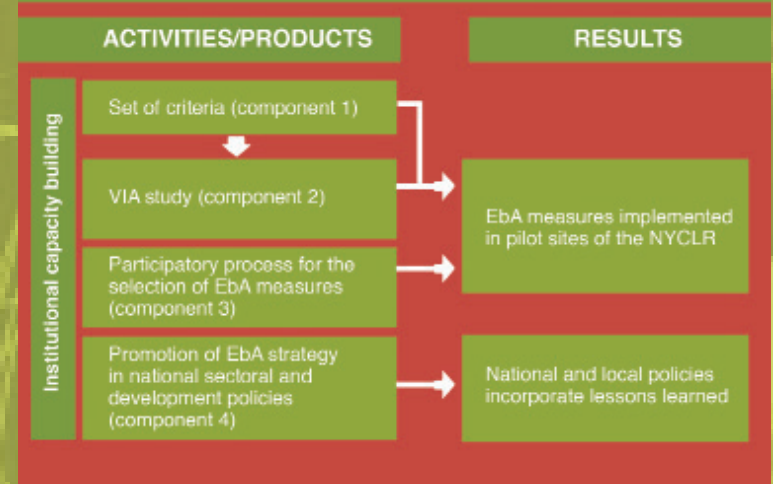
Source: Prepared by the author on the base of the Peru Mountain EbA project document.

BUILDING EbA MEASURES IN THE NYCLR

Within the framework of the four components of the EbA-Mountain project, a number of activities are developed to identify EbA measures for the RPNYC (Figure 3).

FIGURE 3:

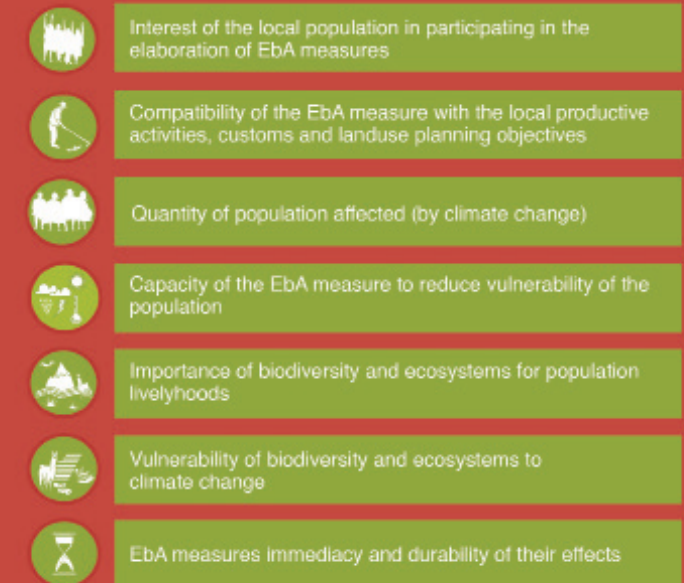
FIGURE 4: EbA measures building process



These include the definition of a set of criteria for identifying and prioritizing a number of potential adaptation options for the reserve (Figure 4), and the formulation of the “Climate Change Vulnerability and Impact Assessment (VIA) in the Nor Yauyos Cochabas Landscape Reserve and its Buffer Zone (NYCLR-BZ)”. The VIA results show how this phenomenon affects ecosystem services and which communities are the most vulnerable (Box 4).

FIGURE 4:

Figure 4: Set of Criteria for the selection and prioritation of EbA measures in the NYCLR



Within the framework of Component 3, a participatory process for the analysis, design and planning of potential no-regret measures was carried out. The process included EbA project members, SERNANP, external specialists and local researchers from the NYCLR communities, technicians and park rangers, as well as representatives from the Chanchayllo and Miraflores communities. The methodologies used for this process were the Participatory Action Research (PAR) and the Integrated Participatory Rural Appraisal (IPRA) (TMI, 2013a and 2013b).

What are no-regret adaptation measures?

No-regret adaptation measures are defined as adaptive measures that are worthwhile (i.e. they bring net socio-economic benefits) and will yield positive outcomes regardless of future climate change scenarios or how climate plays out. Such measures should be strongly rooted in the local population and constructed through a bottom-up approach.

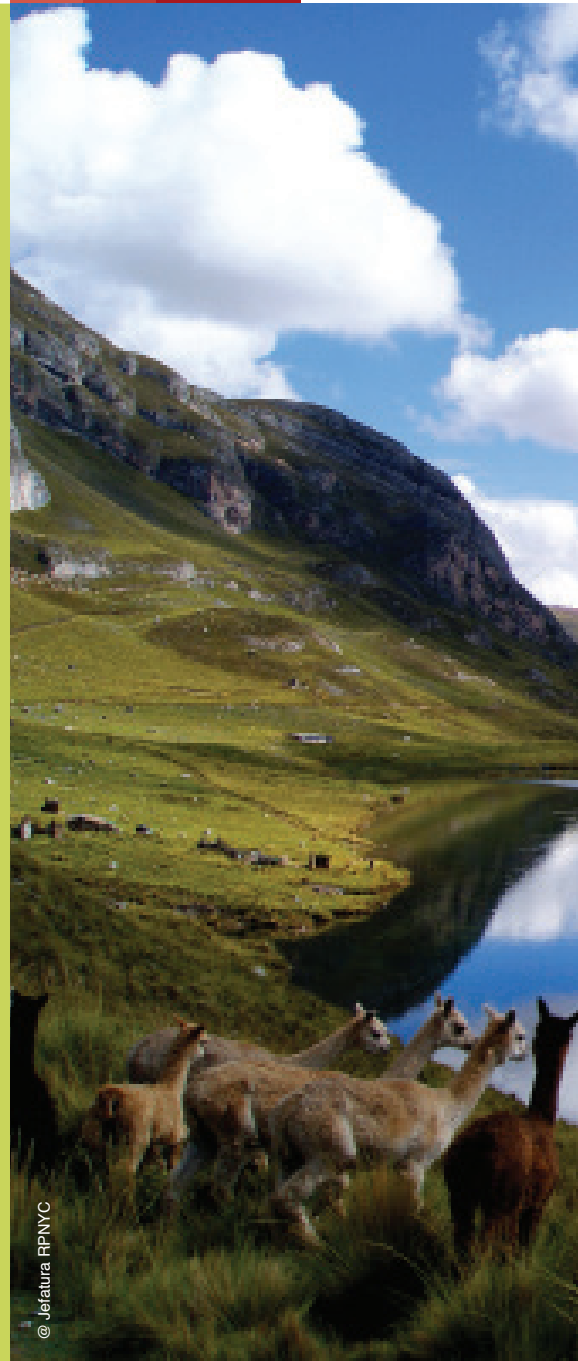
BOX 4:

Climate Change Vulnerability and Impact Assessment (VIA) of the Nor Yauyos Cochab Landscape Reserve and its Buffer Zone (NYCLR-BZ)

This study is an initial approach for discussing strengths and weaknesses to address climate change challenges in the NYCLR-BZ, and specifically for 11 of its districts. It presents results on sensitivity, impact and vulnerability, and provides recommendations for discussing adaptation measures in the area of interest. To this end, vulnerability indices were derived on the stress imposed by human populations on ecosystem services, as well as a water-vulnerability index within the context of variations in rainfall and temperature. Information is presented in the form of vulnerability maps and radial charts for each district, considering the year 2030 as the outlook horizon. Vulnerability maps depict: 1) vulnerability and risk of water stress at the district level, 2) vulnerability of six ecosystem services to climate change, and 3) maps on socioeconomic sensitivity and vulnerability. The conclusions enable the prioritizing of measures that combine the long-term provision or improvement of ecosystem services —which are the livelihoods basis for households in the NYCLR— along with appealing frameworks that enhance the short-term income of the population. The assessment was developed by a research group comprised of the Conservation Data Centre (CDC) and the College of Economy and Planning (FEP, in Spanish) at the Universidad Nacional Agraria La Molina (UNALM); the International Research Institute for Climate and Society (IRI) and the Earth Institute Center for Environmental Sustainability (EICES) at Columbia University.

Source: Fundación para el Desarrollo Agrario, 2013.

Institutional and technical capacity strengthening are conducted permanently through workshops, meetings and other activities targeting local authorities and technicians. Another permanent activity is the multisectoral, inter-institutional and interdisciplinary outreach and coordination at local, regional and national levels. This allows promoting the inclusion of EbA measures in sectoral and development policies, considering that the NYCLR pilot project will provide lessons learned that can then be incorporated into sectoral and development policies at the national level. Furthermore, this process has included the technical and scientific support of various professionals from the selection process to the design of the EbA measures. Therefore, there has been a knowledge dialogue between diverse stakeholders.



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OUTCOMES

Three EbA measures that are being implemented in the reserve include: a) **Vicuña management to produce animal fiber**, b) **Community-based sustainable native grasslands management, including live stockmanagement**, and c) **Community-based sustainable water management, including (ancestral) hydric infrastructure, and wetland and grasslands restoration**. (Figure 5).

These measures, prioritised using different methods, approaches and processes, aim at developing a sustainable livestock management. This would benefit mainly natural grasslands known as bofedales (wetlands) and pajonal/puna grassland, which are the NYCLR's most extensive ecosystem units and supply the largest amount of ecosystem services for the population, as these support livestock production — the major economic activity in the area.

Likewise, both ecosystems are the ones most pressured by livestock grazing, and are potentially the most seriously threatened by the adverse effects of climate change, according to the VIA. In this respect, sustainable livestock management can improve the economy of the NYCLR population, increasing its adaptation capacity under the future scenario of a changing climate.

The first measure is being implemented

in the community of Tanta, in response to the key stakeholders' interests, the alignment of this measure with the EbA principles, and as an effective response to the vulnerability of both ecosystems and the human population, according to the VIA results. The other two measures have been prioritised through participatory processes aimed at identifying no-regret measures in response to the needs and perceptions of the Canchayllo and Miraflores communities. These measures under implementation are composed of three pillars: 1) institutional strengthening and community organization; 2) capacity building to enhance local and traditional knowledge; 3) green-grey infrastructure (TMI, 2013b).

FIGURA 5:

Figure 5: EbA measures for the NYCLR

| Measure | Pilot Site | Benefits | | |
|--|------------|---|--|---|
| | | Ecosystems | Ecosystem services | Population |
| <ul style="list-style-type: none"> Vicuña management (in association with animal husbandry). | TANTA | <ul style="list-style-type: none"> Reduces pressure on natural pastures, wetlands and alpine ecosystems favoring their recuperation. | <ul style="list-style-type: none"> Enhances the production of animal fiber, scenic beauty and recreation. | <ul style="list-style-type: none"> Creates employment opportunities derived from the commercialization of the fiber. Boosts tourism activities. |
| <ul style="list-style-type: none"> Community-based native grassland. Improvement of ancestral hydrological infrastructure. | CANCHAYLLO | <ul style="list-style-type: none"> Reduces the pressure on (over-grazed) grasslands and wetlands, favoring their recuperation. | <ul style="list-style-type: none"> Enhances agricultural production, production of fiber and animal protein. Prevents soil erosion. Contributes to hydrological regulation. Hydrological regulation, fire prevention, minimum impact of extreme events and other ecosystem services, such as biodiversity conservation and enhancement of carbon storage in the preserved/restored grasslands. | <ul style="list-style-type: none"> Improves animal yields and agricultural production. Improves ancestral infrastructure. Strengthened institutional arrangements and capacities for community management of water, grasslands and livestock. Increased livestock productivity and quality through improved livestock distribution and grassland quality and the creation of natural troughs. Higher resilience and adaptive capacity in both communities. |
| <ul style="list-style-type: none"> Community-based native grasslands management. Conservation and management of upper micro-watersheds, wetlands and water-courses. Improvement of ancestral hydrological infrastructure. | MIRAFLORES | <ul style="list-style-type: none"> Allows wetland and grassland restoration. | <ul style="list-style-type: none"> Enhances agricultural production, production of fiber and animal protein. Prevents soil erosion. Contributes to hydrological regulation. Hydrological regulation, fire prevention, minimum impact of extreme events and other ecosystem services, such as biodiversity conservation and enhancement of carbon storage in the preserved/restored grasslands. | <ul style="list-style-type: none"> Improves animal yields and agricultural production. Improves ancestral infrastructure. Strengthened institutional arrangements and capacities for community management of water, grasslands and livestock. Increased livestock productivity and quality through improved livestock distribution and grassland quality and the creation of natural troughs. Higher resilience and adaptive capacity in both communities. |

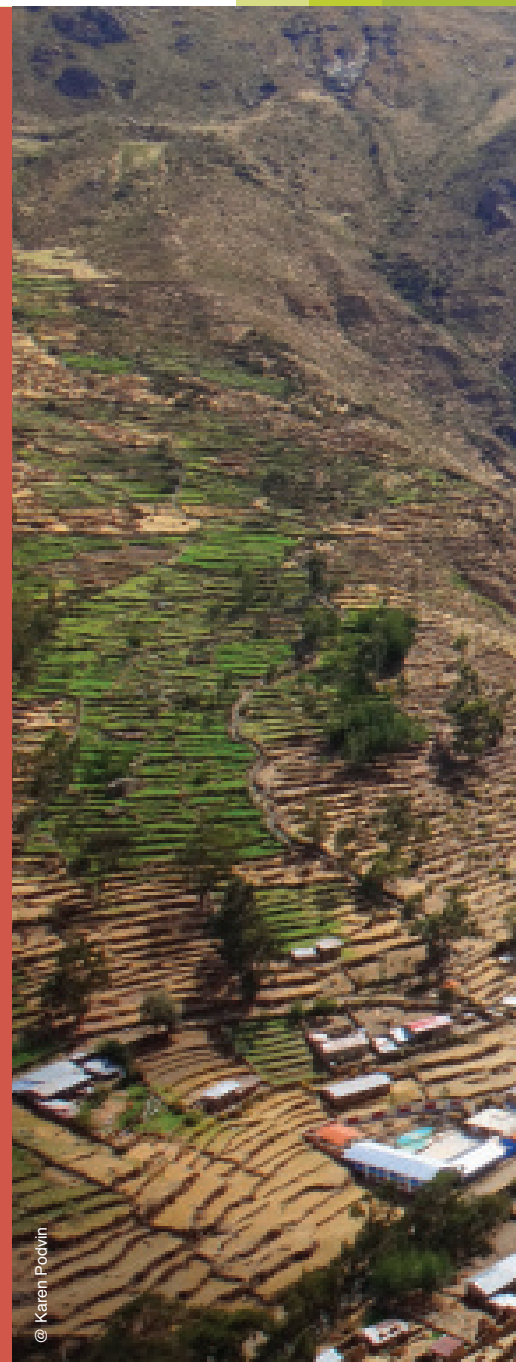
Source: EbA Mountain Project, Peru

LESSONS LEARNED

The Mountain EbA project in Peru is the first approximation to the EbA approach in Latin America and it provides important untries. The early lessons learned will provide the foundations for developing new EbA strategies in both the country and the region.

The key lessons learned are the following:

- Participatory planning and inter-institutional coordination ensure outcomes that match the needs of communities as well as environmental priorities.
- The use of participatory approaches/methods facilitates the process of planning, designing and validation of EbA measures.
- Multi-disciplinary teams are essential for identifying EbA measures.
- The large number of stakeholders involved requires clearly articulated networks, as well as coordination and communication between all participants to supplement and potentiate all efforts.
- Traditional knowledge and ancient practices of local populations are key to identifying measures, as these are the result of a long history of adaptation to changing weather conditions that has led to the development of strategies based on the interaction between humans and nature.
- As a tool, the experts' dialogue allows the creation of a trust-based relationship between communities and technicians throughout the measure-selection process by incorporating historic-cultural values, this relationship will ensure a sense of ownership of these measures.
- Vulnerability and impact studies produce valuable background information on the population state, socioeconomic activities, ecosystems, ecosystem services, biodiversity and climatic trends.
- At the NYCLR scale, the temporal and spatial coverage of atmospheric and biodiversity data is still insufficient for developing low-uncertainty projections and models.



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