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# Restoring for water: The Kiuñalla community case, in the Andes of southern Peru

*Cesar Sabogal, Benjamín Gutiérrez, Roberto Kometter*

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## **PART I – The Apurimac Region as macro landscape**

Land degradation in Peru is considered a problem but also a challenge of national interest and primary concern. This responds to factors such as deforestation, desertification, expansion of the agricultural frontier, land use change, poor agricultural, grazing and logging practices; illegal mining among others. It is estimated that at least 10 million hectares of existing degraded landscapes need to be recovered in their three major eco-regions (the coast, the mountains or Andes and the jungle or Amazon). In the context of the Bonn Challenge, the Peruvian Government has committed to recover 3.2 million hectares of degraded areas through plantations for commercial purposes as well as for the recovery of ecosystem functions.

The Apurimac Region, located in the southern Andes of the country (**Figure 1**), has been one of the first in initiating actions within the framework of this commitment and it is in this region where the Government, with cooperation support, has established one of the restoration pilots to serve as reference and learning in the process nationwide.

## 1. Introduction to the biophysical and socioeconomic context of the landscape

Apurímac is a region of rugged and abrupt topography, with features ranging from high peaks, rolling hills, ravines to deep valleys thus creating a diversity of microclimates and ecological zones with impressive natural landscapes. But this same geography makes the region vulnerable to the impact of natural disasters, caused by human action and climate change<sup>1</sup>.

The economy of the Apurímac Region, with a land area of 20,895 Km<sup>2</sup> and a population close to 406 thousand inhabitants in 2017, is mainly based on agricultural production, complemented by livestock activity; however, mining is also important with a growth potential among the highest in the country.

On the other hand, Apurímac is among the regions in the country with the highest poverty rates and deficiencies in education, health and living conditions in general. The high levels of poverty, the existence of mining investments in the peasant communities and headwaters, along with the strong social inequality, have led to the increase of social conflicts that have deteriorated the emerging institutional framework and governance in the region (Regional Government of Apurímac 2018).

Agricultural production is very low and poorly diversified in many rural areas of Apurímac, even as to ensure self-consumption. This is largely explained by migration, mainly of young people, to the cities, while those remaining in the rural areas are abandoning the agricultural activity and dedicating to service activities, which means that agricultural tasks are performed by women and the elderly (Regional Government of Apurímac 2016).

The land organization in Apurímac, as in most of the Andean regions of the country, is historically established in rural communities, made up of peasant-indigenous families who speak Quechua and share a long trajectory based on principles and values such as reciprocity<sup>2</sup>. The communities are self-governed and, within them, families use the land under communal ownership in an organized manner (Flores et al. 2011, cit. per cit. by Regional Government of Apurímac 2014). As can be seen in this form of organization, the cultural characteristics of the region with the customs and traditions of its people, have contributed to the conservation of the agrobiodiversity<sup>3</sup> through technological practices to preserve Andean crops, medicinal

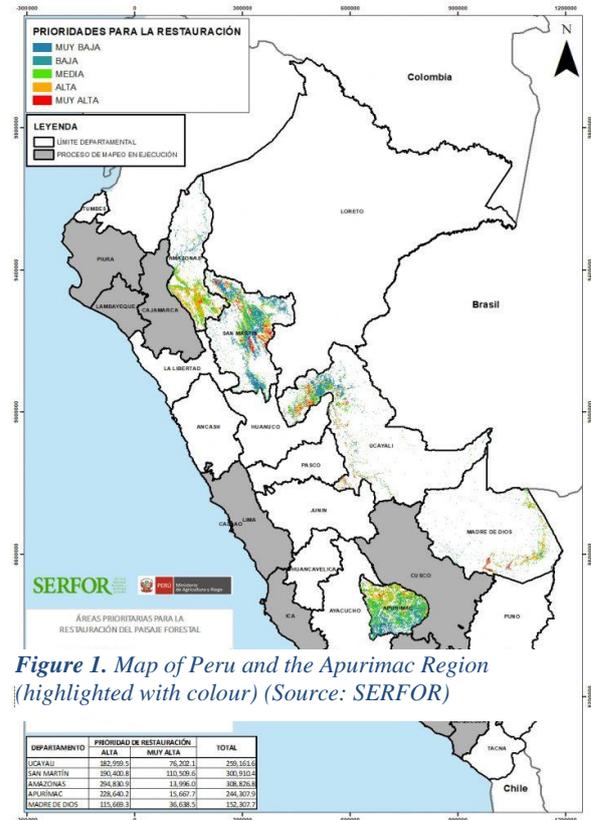


Figure 1. Map of Peru and the Apurímac Region (highlighted with colour) (Source: SERFOR)

<sup>1</sup> The effect of climate change is related to the retreat of glaciers, average temperature increase and changes in precipitation patterns, which is manifested with hydrological cycle variations, decreasing the water availability during the dry season (Kometter 2018).

<sup>2</sup> In Apurímac there are 459 peasant communities that manage a total area of just over 1.8 million hectares (ha) or almost 90% of the regional territory. (Alegría and Estrada 2010, cited by Regional Government of Apurímac 2014).

<sup>3</sup> Agrobiodiversity includes all the components of biological diversity relevant to agricultural production, including food production, livelihoods and habitat conservation of agricultural ecosystems. (Regional Government of Apurímac 2014).

plants, forest stands or their relicts, and water sources especially in watersheds and micro-basin headwaters (Regional Government of Apurímac 2014).

## 2. Problems affecting the landscape and its resources

Various internal and external threats have been affecting the natural landscapes and their associated resources in Apurimac with increasing impact, being desertification, deforestation, agriculture in hillside areas, burning, and mining among the most serious (Regional Government of Apurimac 2014).

The direct drivers of regional biodiversity change are: a) climate variability and climate change; b) erosion and desertification processes; c) low profitability and recognition of regional agrobiodiversity; d) expansion of the agricultural frontier and loss of connectivity; e) increasing mining; and f) cultural activities harmful to biological diversity. In addition, there are structural factors that condition and increase biodiversity degradation processes such as: organizational weakening, lack of an institutional framework for managing biological diversity at different levels, and the lack of public policies (Regional Government of Apurímac 2014).

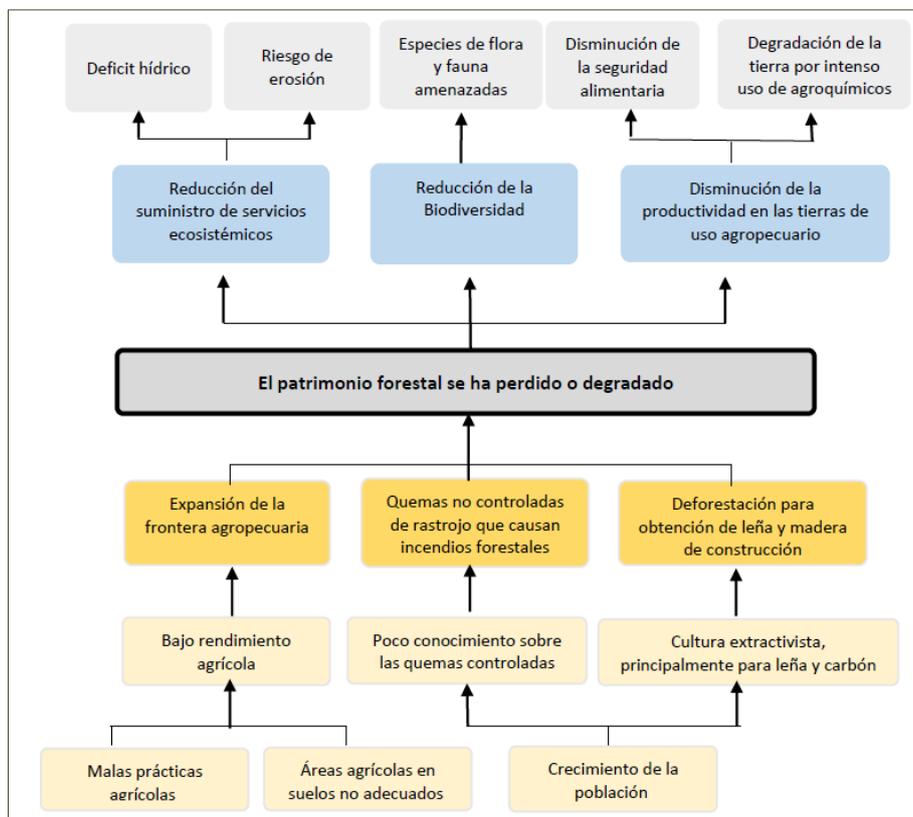
According to the participatory diagnosis made by the Andean Forest Programme (*Programa de Bosques Andinos – PBA*), the problem of the Andean forest landscapes in the Apurimac region can be summarized as follows (Kometter 2018):

- a. Segmented and degraded forests
- b. Reduction of ecosystem services
- c. Insufficient basic knowledge for decision making
- d. Reduction of water flow in water sources
- e. Increase of forest fires
- f. Use of resources in a non-sustainable way
- g. Economic activities placing pressure on forests
- h. Delay in the development of the water service compensation system
- i. Little commitment and consolidation of stakeholders
- j. Absence of forestry development planning

From a perspective related to the restoration of degraded lands, in 2017 the Restoration Opportunities Assessment Methodology - ROAM (IUCN / WRI 2014) was used at the scale of the Apurimac Region. The causes and effects of land degradation (**Figure 2**) and the land uses in need to be restored were identified in a participatory way. Since there is no mapping of the degraded areas regionally, experts from Apurimac identified the following units in need of restoration (Calderón 2017):

- *Andean forests*, of vital importance for the provision of ecosystem services mainly related to the water cycle, regional climate regulation and carbon capture and storage.
- *High Andean pastures and grasslands*, under continuous disturbances, mainly due to burning and overgrazing, mining activity, and afforestation with exotic species.
- *Agricultural areas and pastures*, affected in their productivity by drought, destruction of soil structure due to overuse, intensive grazing and excessive mechanization in agricultural areas.
- *High Andean wetlands* of great importance for water regulation and storage; due to their high water absorption capacity they retain water during the rainy season, buffering floods and maintaining reserves for the dry season.

*Riparian strips*, whose vegetation has been removed for the change of use to agriculture; they have a fundamental role not only for the regulation of the hydrological cycle but also for wildlife conservation.



*Figure 2. Chart of the causes and effects of land degradation in the Apurimac Region prepared under the ROAM methodology (Source: Calderón 2017)*

### 3. Desired future landscape

The Apurimac Region has undertaken several strategies and programs to deal with the problems presented in the previous section. The Concerted Regional Development Plan, projected to 2021 (Regional Government of Apurimac 2016), includes as a general strategy to reduce vulnerability to natural and anthropic phenomena, specifically through two strategic objectives (SO):

SO 9: *Improve environmental quality* with actions such as: promoting sustainable investments in productive and extractive activities, improving water management and implementing a climate change adaptation and mitigation program.

SO10: *Reduce the population vulnerability to natural and anthropic phenomena*, which includes actions such as: increasing the resilience levels to disaster risks in the population and promoting the protection and conservation of vulnerable soils and ecosystems.

The Regional Strategy of Biological Diversity for the Apurimac Region also projected to the year 2021, declares as a general objective “promoting and managing the conservation and sustainable use of regional biodiversity and ecosystem services in order to generate development opportunities, ensure food supply, adapt to climate change and improve the living conditions of the population of Apurímac” (Regional Government of Apurímac 2014).

The use of the ROAM methodology analysis (presented in the previous section) allowed the identification and mapping of areas and landscapes with more urgent restoration needs, with more immediate benefits and most likely to succeed; additionally, it was complemented with the diagnostic tool (WRI 2015) to efficiently and swiftly identify the existence or current state of factors for the successful implementation of landscape restoration (Calderón 2017). According to the effects of the main problem identified (Figure 2), the priority objectives for landscape-scale restoration in the Apurimac Region were as follows:

- 1) Stopping and reversing degradation in forest lands
- 2) Strengthening the supply of ecosystem services
- 3) Conserving and recovering biodiversity
- 4) Improving the productivity of agricultural land

Also, through this analysis, the restoration transitions for each degraded land use were identified and a Map of Priority Areas for Landscape Restoration in the Apurimac region was developed (Figure 3). This map shows the areas with the potential to meet the four landscape restoration objectives based on priority levels. The areas identified as very high and high restoration priority in Apurimac cover 244,307 ha<sup>4</sup>.

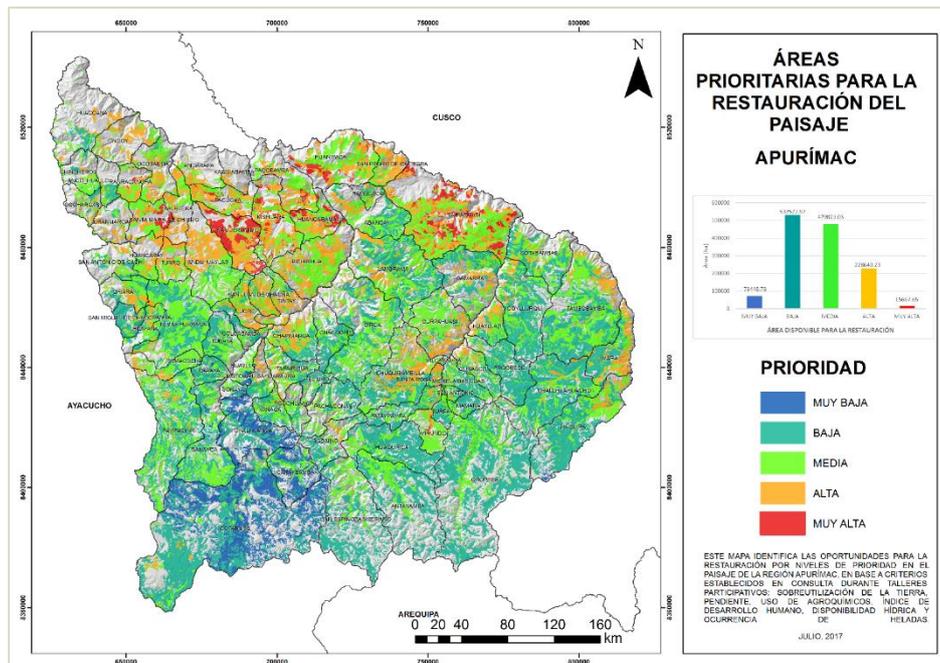


Figure 3. Map of priority areas for landscape restoration in the Apurimac Region (Source: Calderón 2017)

<sup>4</sup> Information on this surface was obtained from: <https://andina.pe/agencia/noticia-serfor-presenta-mapa-sitios-prioritarios-para-restauracion-5-regiones-694947.aspx>

### **The Sacha Tarpuy Program**

It is an ambitious program initiated in 2014 by the Regional Government of Apurímac aiming at “recovering the forest cover as a means to preserve important environmental services - including water resources -, stopping soil degradation and loss, mitigating the climate change effects and biodiversity loss, and reducing poverty in communities.” The Program is one of the most significant because of its goals and level of public financing in the history of forest plantations in the Andean region of Peru. Its implementation area is throughout the Apurimac Region, with a planting goal of 29,731 ha using 16 forest species, mostly pine and eucalyptus.

After three years, Sacha Tarpuy presents some deficiencies in its efficient implementation (e.g., loss of 40% of the installed forests), but also positive results due to the innovative nature of the Program regarding past activities. An important feature is to contemplate an integrity of actions that include, besides the forestry variable, best pasture management practices, infiltration ditches, protection of water sources, territorial zoning, and strengthening of community participation. It is also important having incorporated the communal agenda in forest plantation work and boosted community interest and participation.

Source: Arce (2018)

## **PART II – Forest Landscape Restoration Initiative of the Kiuñalla Community**

### **1. Introduction**

The initiative undertaken by the community of Kiuñalla represents an important effort from the community itself to address the problems of land-use change and degradation of the forest and agricultural soils that affect their livelihoods and development potential. The regional problem is thus largely reflected and, as will be seen, the actions undertaken by the community with local institutional support and from the cooperation contain many replicable elements that should serve as a reference and inspiration for upscaling restoration in the Peruvian Andes.

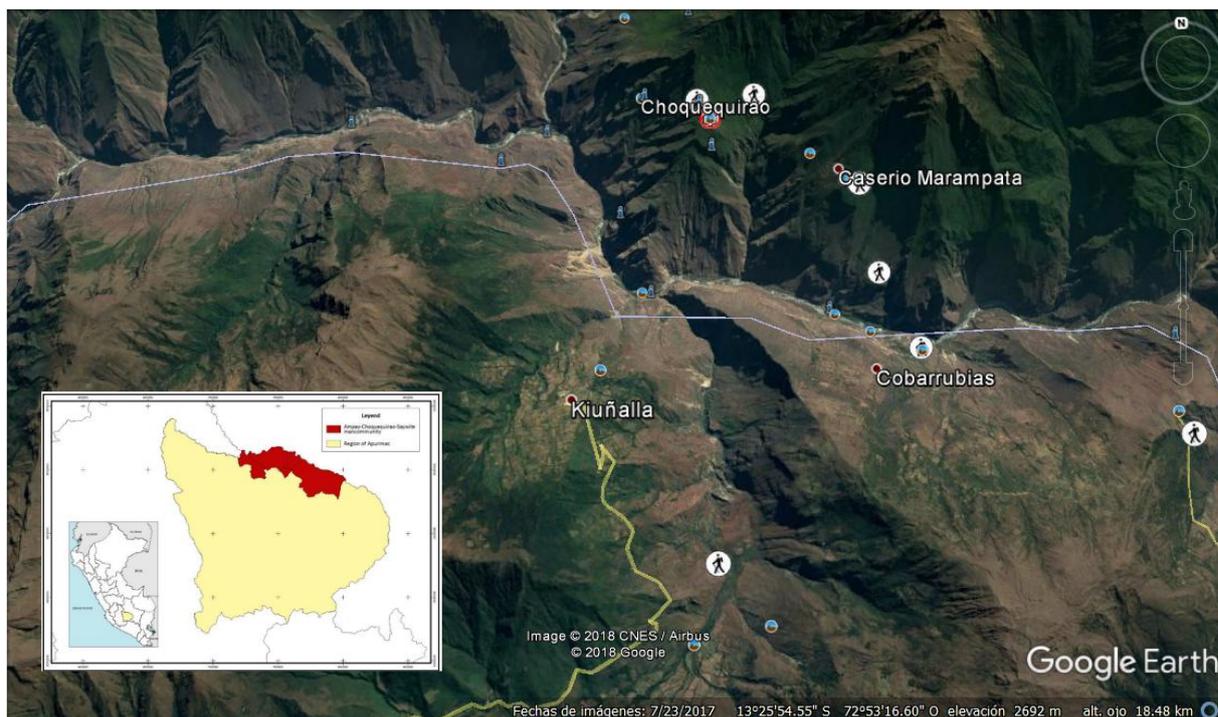
#### **1.1 Biophysical and socioeconomic characteristics of the Kiuñalla landscape**

The peasant community San Ignacio de Kiuñalla is located in the district of Huanipaca, province of Abancay, in the Apurímac region (**Figure 4**). The town is 86 km from the city of Abancay, at 2970 meters above sea level, between the deep canyons and valleys formed by the Apurimac River. The Inca Choquequirao archaeological complex, in the Cusco region, is in front of the town.

The community has a population of 1250 inhabitants (276 families) on an area of 3,179 ha (Calderón 2016 and Cabrera 2017). The average annual temperature in Kiuñalla is 14.1 °C with an annual rainfall of 949 mm in two well-marked periods: rainy (from December to May) and dry (from June to November). Problems of drought and water deficit for vegetation occur during the dry season (Landolt 2016, Guerrero 2019).

The territory is characterized by an abrupt topography where steep slopes and rugged hills predominate, with an altitudinal gradient that goes from 1,386 meters above sea level to 4,414 meters above sea level. This altitudinal strip, besides its location on the eastern slope of the Andes Mountains, suggests that in the past the entire territory was covered by lush masses of transitional forests between the Andean and the tropical vegetation (PBA 2016, cited by Cabrera 2017).

The territory of the community comprises 1,017 hectares of Andean forests (commonly called cloud forests), of which 628.5 hectares are for agricultural use and 1,536.5 hectares are native grassland meadows located mainly in the headwaters and streams (Plan de Vida de la Comunidad San Ignacio de Kiuñalla 2019-2030, 2019).



**Figure 4.** Location map of the Kiuñalla community in the Apurimac region and satellite view of the territory  
(Source: Google Earth. November 2018)

The forests of the Huanipaca district are unique, since they represent the transition between the Andean forests and the tropical forests, housing a distinctive biodiversity and becoming one of the largest reservoirs of genetic resources. These forests are acknowledged for their significance in water collection regulations; its downstream form the Apurimac River until it converges the Amazon River (Calderón 2016, cited by Guerrero 2019).

Andean forests have been subject to historical degradation and alteration processes due mainly to the expansion of agricultural land and selective logging. These patterns of occupation, use and land tenure have brought out the different successional trajectories currently found in Kiuñalla (SERFOR 2018, PDV 2019). Among the most important tree species in the upper zone are the *Myrcianthes oreophila* (unka) and *Ocotea multinervis* (palta), while in the lower zone with more human intervention, *Viburnum aff. reticulatum* (panti) and *Critoniopsis pycnantha* (yanale) (Vega 2016).

The community of Kiuñalla has agriculture as its productive base, which is for family sustenance and commercial purposes. The most widespread crop and main source of family income is potato (*Solanum tuberosum*), mostly in commercial varieties. The low sale prices of potatoes in recent years and losses in production due to weather and management matters are jeopardizing food security and forcing the population to seek economic alternatives.

Other crops are also produced depending on market opportunities, such as: tarwi (*Lupinus mutabilis*) a native legume, pumpkin (*Cucurbita maxim*) and beans (*Phaseolus vulgaris*). Corn (*Zea mais*) production is done by tradition and it has no economic objectives but as food security; this crop has several uses which makes it a fundamental product for the daily life in Kiuñalla, mainly for 'chicha' production, food preparation, poultry feed, etc. Additionally, livestock is part of the economic activity, but given the low



- 6) Limited income generation alternatives that may allow them to send cash to their family members (children) living outside the community, and
- 7) Absence of economic activities or economic instruments to encourage forest conservation (such as ecotourism or payment schemes for ecosystem services, etc.)

Besides these drivers, some of the main underlying socioeconomic conditions are (Guerrero 2019):

- limited access to the labour and resource market;
- price variation of the main crop, the potato;
- lack of definition of criteria promoting forest conservation for the allocation of agricultural plots;
- absence of collective action for resource management in periods of extreme climate events (e.g., droughts), among others.

Additionally, the development of infrastructure projects for the promotion of tourism of the archaeological complex of Choquequirao (construction of a cable car that will connect Kiuñalla with this complex, and the construction of road rings in Apurimac and Cusco), will have significant impacts on the socioeconomic dynamics of Kiuñalla and the surrounding communities. Therefore, it is necessary to anticipate the potential negative impacts towards the efforts of restoring and preserving the native forests of Kiuñalla (Guerrero 2019).

In contrast to these socioeconomic dynamics, the inhabitants identify “the need for cleaner water, the possibility of maintaining forest resources for future generations and the opportunity to have an attractive landscape for a potential community-based tourism initiative” (Cabrera 2017). That is, part of the population of the community recognizes the connection between the forest and the quality and quantity of water (ecosystem services for water provision and water regulation), as well as the potential for ecotourism in the area (Guerrero 2019).

## 2. Implementation

### 2.1 Community initiative to restore their forests

*The water ecosystem service is the most important benefit that the Andean forests of the community of Kiuñalla provide; water is vital for family consumption, for agriculture and other economic activities.*

Since 2010, discussions were held in the community about the need of taking action to face problems such as the contamination of water sources, the advance of cultivation areas within the forest and the need to preserve the landscape with a view to undertaking ecotourism activities, productivity improvement of local crops and activities outside agriculture, among others. However, the decision to protect and undertake restoration actions in the forest areas was only made in 2012 at a community assembly (Cabrera 2017).

#### Main problems faced by the community of Kiuñalla

- Segmented and degraded forests: habitat loss
- Reduction of ecosystem services
- Insufficient basic knowledge about Andean forests for decision making
- Reduction of water flow in water sources
- Increase of forest fires
- Use of resources in a non-sustainable way
- Economic activities placing pressure on forests
- Absence of community development planning

(Source: Kometter et al. 2018)

The restoration objective focused on improving the supply of ecosystem services, especially water regulation.

## 2.2 Stakeholders of the forest restoration initiative

The restoration initiative arises and is implemented directly by the Kiuñalla community through the *Forest Management Committee*. The stakeholders are as follows (Cabrera 2017):

- The *Andean Forest Programme (Programa de Bosques Andinos PBA)* which promotes the community restoration initiative together with its local partners (CEDES and the Apurímac Regional Government) and the *National Forest and Wildlife Service (Servicio Forestal y de Fauna Silvestre - SERFOR)*. The PBA has facilitated the participation of specialists to carry out socioeconomic, flora and fauna diagnoses, the Kiuñalla forest restoration plan, the community Life Plan, and studies on economic alternatives for the sustainability of the initiative, among others.
- The non-governmental organization *CEDES*<sup>7</sup>, responsible for conducting hydrological monitoring and training on management of forest nurseries and forest enrichment planting as well as organizing the tasks for forest fencing and building “q’ochas” or artificial ponds with the community.
- *The Municipality of Huanipaca*, which supports the community both politically and with technical assistance. Technical talks on the management of forest nurseries and forest enrichment planting have been held; additionally, they offered media support to the Forest Management Committee for calling for meetings or giving announcements related to the initiative.
- *The National Forest and Wildlife Service (SERFOR)*, of the Ministry of Agriculture and Irrigation (MINAGRI), which supported the community in the development of its forest restoration plan and through talks on the importance of restoration. It is expected that the Kiuñalla's experience contributes to improving the implementation of the Program for Restoration of Degraded Land Ecosystems (PRO-REST) that SERFOR is about to launch.
- *AGRORURAL*, a national program of MINAGRI, with adequate participation on training community members in the production of forest and fruit seedlings.

## 2.3 Technical design of restoration interventions

**Background.** The problem of the inhabitants of Kiuñalla, with poverty levels exceeding 40% (almost double the national average) and a significant reduction of goods and services due to the ongoing forest degradation, has encouraged the community to face their causes and start their territory restoration. The first actions began by approaching municipal and regional authorities to express their interest in restoring the community forests. Joint awareness activities were undertaken with discussions and meetings to contemplate and analyse the best way to restore forests. Moreover, native forest species were planted in some areas of the community, but it was unsuccessful as it was done after the rainy season, they were not taken care of and were eaten by cattle; besides, a fire was recorded in an area adjacent to the forest that killed all the trees previously planted (Cabrera 2017).

Since 2016, and as part of the activities of the Andean Forests Program, community's interest was regained and a Restoration Plan was proposed jointly with the community and the support of SERFOR, where concrete actions were identified and planned with a view to restoring the forests of the Kiuñalla community.

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<sup>7</sup> The Centre for Studies and Social Development (CEDES) has more than 25 years of work in Apurímac in activities such as rural development, sustainable management of natural resources and especially in water resources management. A team of three technicians specifically accompany the community in forest restoration activities.

**The Andean Forest Restoration Plan of the community of Kiuñalla.** The Plan was developed in a participatory manner, with field work and various restoration actions and strategies that have been progressively implemented by the community with the support of CEDES-PBA and SERFOR.

At the Community Assembly, the community decided where to start the restoration of their forests. With the support of satellite images, considering the degree of degradation, a pilot restoration area of 105 ha was defined and demarcated in the field by setting up posts and installing cattle fencing. The pilot area covered the Andean forest in advanced successional stage (63.1 ha), the Andean forest in early successional stage (4.4 ha), an area in the process of land covering with scrub (8.1 ha), grasslands (29.2 ha) and an intervened area (0.2 ha).

Several studies were developed to define the baseline considering the flora (establishing permanent monitoring plots), fauna, and socioeconomic aspects. The most important species in the study of the flora are: *Badilloa sphagnophila* (upa ccalato), *Myrcianthes oreophila* (unka), *Ocotea multinervis* (palta, palta), *Viburnum aff. reticulatum* (panti) and *Critoniopsis pycnantha* (yanale). As stated by the inhabitants, the most important species for water collection are: *Alnus acuminata* (lambras or aliso), *Sambucus nigra* (layán), *Erythrina falcata* (pisonay), *Weinmania sp.* (chamchi), *Phenax sp.* (quisa quisa), *Smilax parviceps* (yareta) and *Morella pubescens* (yoroma) (Vega 2017). As for the fauna, the most abundant species are *Lycalopex culpaeus* (Andean fox), *Nasuella olivacea* (Andean coati), *Gastrotheca marsupiatata* (marsupial frog), *Proctoporus succullucu* (succullucu lizard), *Zonotrichia capensis* (rufous-collar sparrow), among others (Valenzuela 2016). The soils are “leptosoles eutricos”, little-evolved, superficial and with lithic outcrop and limestone bedrock (MINAM 2010 and GORE Apurimac 2017).

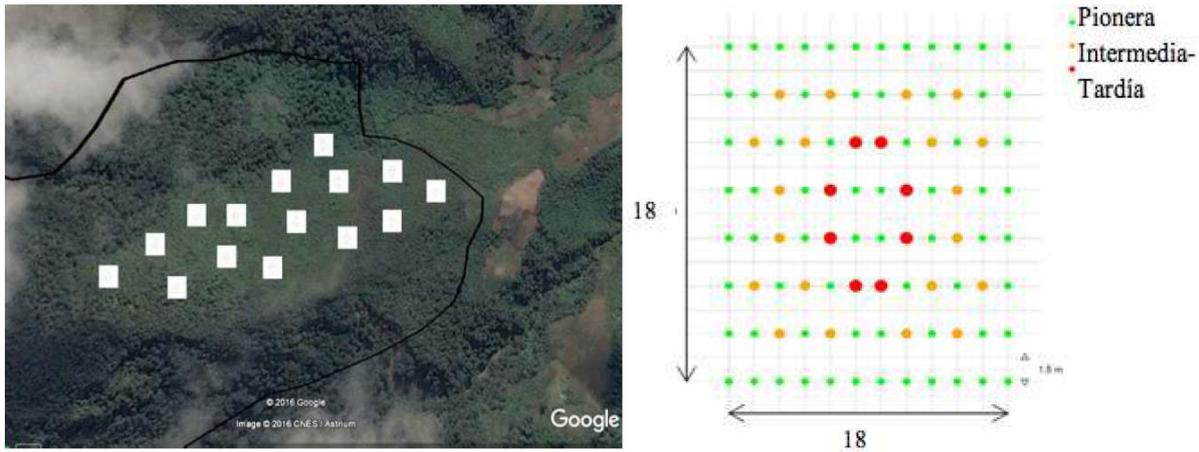
From the baseline information, the communal knowledge about their forests and the orientation and approach that the community itself decided to give to the restoration, the Community Forest Restoration Plan was developed in a participatory manner. This plan includes the selection of key species for restoration, among which are: *Myrcianthes oreophila*, *Escallonia resinosa* (chachacomo), *Verbesina ochroleucotricha* (ccalato), *Alnus acuminata* and *Prunus huantensis* (puka piskay).

The selected restoration strategies were:

- 1) *Exclusion*, for areas with forest in advanced successional stage
- 2) *Enhancement of clearings and assisted natural regeneration*, for areas with forest in early successional stage (**Figure 6**)
- 3) *Soil treatment, removal of dominant species, high density areas and installation of artificial perches*, for areas with vegetation in initial successional stage or scrubland

The Restoration Plan also includes the propagation of vegetative material for restoration treatments through nurseries, fire control, maintenance until year 3, and monitoring until year 20.

The main actions considered in the framework of the Restoration Plan included the reconstruction of the communal nursery, the collection of native germplasm (natural regeneration) and its transfer to the nursery, the construction in the upper part of a “q’ocha” (or artificial pond) to recharge natural aquifers, the nomination of the management committee for the community forests restoration, the strengthening of the community organization, the development of the community Life Plan, the updating and approval of the community statute, valuation studies of ecosystem services and productive alternatives, eco-hydrological and forest restoration monitoring, the formation and training of community fire brigades, and maintenance activities.



*Figure 6. Design and location of enhancement areas in the zone of greatest degradation within the pilot restoration area. (Source: Kometter 2018)*

## 2.4 Monitoring

Two types of monitoring have been designed: monitoring of forest restoration and eco-hydrology monitoring.

Forest restoration monitoring focuses on reforestation and afforestation with native species, assessing variables such as survival, diameter at breast height (DBH), natural regeneration (abundance of seedlings and saplings) and floristic diversity (floristic composition, typifying species according to their functional trait and characterizing by means of diversity indexes). This monitoring is participatory, carried out by the community Forest Management Committee with support from CEDES and SERFOR.

The Eco-hydrological monitoring seeks to evaluate the changes in vegetation and the water flow and regulation, for which fog catchers have been installed. With this tool the hydrological behaviour of the headwaters and the storage capacity of mist water (or horizontal precipitation) can be known. Also, precipitation and flow rates are measured to determine if restoration interventions in the headwaters and in the forest produce the desired outcomes in terms of water flow.

## 3. Results

Having started in 2016, after three years of effective implementation, there are some intermediate results (Kometter et al. 2018):

- Community awareness regarding the care of natural resources, which is expressed in the strengthening of the forest management committee, the approval of the community statute and the development of the Life Plan
- Protection of 105 ha of forest with a communal agreement for its conservation
- Field setting of 3,000 seedlings of native species in areas of forest degradation
- Afforestation of 5 ha with the native species queuña (*Polylepis sp.*) in water recharge areas
- Creation of a rustic dike to form a “q’ocha” (artificial pond) to recharge natural aquifers
- Setting up of 1,600 m of protection fences to prevent animals from entering the restoration plots
- Setting up and functioning of a communal nursery with 4,000 native species of seedlings for afforestation and reforestation in degradation areas
- Formation of community fire brigades

- Training activities for the community, e.g. on the importance of relict forests for biodiversity in fragmented landscapes, prevention and control of forest fires, recovery of Andean ecosystems with afforestation of native species, apiculture (organic honey production from the native forest)
- Community commitment for the protection and recovery of “manantes” or springs in the intervention areas
- Forest development monitoring and eco-hydrological monitoring

Likewise, various studies have been carried out with an adaptive management approach to learning, in order to generate information for decision making:

- Systematization of community restoration activities
- Valuation of environmental services and restoration costs
- Economic alternatives contributing to the sustainability of the restoration initiative
- Alternatives for communal communication

**Systematization of the restoration experience.** Through this implementation, which involved the various stakeholders of the initiative, the following achievements are identified (Cabrera 2017):

*The active engagement of national stakeholders at different levels*, such as the national forestry authority, SERFOR, who participated in the preparation of the restoration plan and in technical meetings for community members. The Municipality of Huanipaca, who has included among its activities the forest restoration inspired by the case of Kiuñalla. At the community level, the different tasks for the implementation of the restoration plan highlights the interest and importance given by the community members to restore their forests. Several high participation tasks have allowed, for example, the creation of a “q’ocha” to achieve a better endowment of water throughout the year by means of runoff down the basin. The community has also participated in the production of plants and tree and fruit seedlings (bagging, hole making, maintenance, irrigation), despite the many unsatisfied basic needs, such as the lack of drinking water, the lack of sewage, the lack of local employment opportunities, difficulties with the prices of agricultural products in the area, etc.

*Perceptions of benefits.* It has been difficult to clearly identify the benefits perceived by the community around forest restoration so far, mainly due to the short period of implementation of the initiative. The expected benefits of the restoration plan are directly related to the aspirations of the community when considering such a plan in 2012, that is: the need to have cleaner water, the possibility of maintaining forest resources for future generations and the opportunity to have an attractive landscape for a potential community tourism initiative. It can be perceived that the community needs to strengthen the reasons for the decisions taken in 2012 on which they decided to implement a restoration plan that is underway.

The restoration plan is not supported by all members of the community, as expected. The main reasons are: (i) lack of understanding about the benefits of restoring forests; (ii) the concern of some families who seek to extend their crop areas within the forests or in the areas to be restored, that are adjacent to the forest; (iii) some families have cattle and the fencing of forested areas prevent them from taking their livestock to drink water and grazing in forest clearings.

### **About the landscape governance in Kiuñalla**

The most recent efforts to raise community awareness about the need to conserve forests led to community agreements discouraging the appropriation of forest areas and therefore a certain level of control over the extension of the agricultural frontier encroaching over the forests. When a grazing

event is identified in the forest near the restored areas, the Forest Management Committee and the representative of CEDES - PBA are informed. The problem of forest degradation is explained to these people and, as an incentive, they are allowed to work as day labourers in restoration maintenance. This response mechanism helps to temporarily discourage cattle grazing in the forests near restoration areas. (Guerrero 2019).

The development of the community Life Plan is another important step towards enhancing community governance. This is a management and operational instrument with a 2030 horizon for internal organizational and shared management strengthening, led by the community leaders in partnership with the district municipality of Huanipaca (Mallma 2019). The Life Plan approved in the Communal Assembly has incorporated the recommendations of the Andean Forest Restoration Plan of Kiuñalla, which ensures continuity of actions beyond external accompaniment.

### ***Analysis of the costs and benefits of restoration activities***

An analysis of the restoration activities was carried out based on the values of the environmental services provided by the protected forests and the artificial ponds installed in the community, and the costs incurred by the stakeholders for these activities. In the study (Landolt 2016), carried out jointly with the community members, priority was given to the analysis of a variety of goods and services (water for consumption, water for irrigation, firewood, wood, fruits, fodder, medicinal plants, bee-honey and tourism). The results show that forest restoration is contributing to the community with income equivalent to US\$ 123,000 per year. Considering only water for irrigation and consumption, the annual contribution is estimated at US\$ 79,893 (64% of the total) and, in the case of non-timber forest products, at US\$ 16,781 (21% of the total). The net present value of the Andean forest of Kiuñalla is just over US\$ 2 million in 30 years, provided by irrigation water, firewood, honey and medicinal plants. Although it is a theoretical analysis and the result of a short-term investigation, it gives an idea of how much the community members would pay if they did not have the goods and services of the forest and, therefore, to think about the possibility of valuing similar ecosystems.

The valuation of what has been invested in restoration activities in the Kiuñalla community between 2016 and 2017, including all costs (materials, infrastructure, equipment, studies, consultancies, technical assistance, administration, etc.), resulted in a total cost of US\$ 86,332. This valuation corresponds to the contribution of PBA, its local partner CEDES and the community, which mainly includes the value for the construction work of the artificial ponds, plant production and the implementation and maintenance in general. However, the costs of SERFOR for training events and contributions to the restoration plan nor the contribution costs of the Municipality of Huanipaca are included. If the amount invested for the pilot restoration area (105 ha) is divided, it can be assumed that about US \$ 411 has been invested per hectare per year (Guerrero 2019).

### ***Economic alternatives for the restoration initiative sustainability***

The restoration sustainability in Kiuñalla should be based on the adequate approach of economic alternatives, within the Andean forest landscape management perspective, demonstrating the restoration benefits for the inhabitants, addressing the deforestation and degradation patterns of the native forest and the landscape as a whole, and at the same time, considering the socioeconomic needs of the inhabitants of Kiuñalla (e.g. income, food security, labour time-use, etc.) (Guerrero 2019).

In the study (Guerrero 2019), guidelines of different economic alternatives were analysed and proposed to discourage deforestation and degradation of the Andean forest landscape in Kiuñalla and thus contribute to the sustainability of the restoration initiative. Three economic alternatives were selected: 1) Ecotourism; 2) Improvement mechanisms for agricultural productivity and soil conservation

associated with potato crops (or other local crops); and 3) Compensation scheme for ecosystem service: fallow lands, or adoption of conservation practices for soil restoration, or agrobiodiversity recovery. Some key messages that can be taken from the analysis of these alternatives are (Guerrero 2018):

- The economic activity of ecotourism (a form of sustainable tourism) would allow the inhabitants to obtain direct benefits from the restoration, the forest and its ecosystem services. In order to take advantage of the positive impacts of tourism and minimize or avoid negative impacts, it will be necessary to strengthen the social capital for its development and common resources management (forests, grasslands, wetlands and agrobiodiversity), to generate spaces for coordination and planning at the municipal and regional level, mainly so that the community has a certain level of decision on access to investment opportunities for private stakeholders, and to design tourism development strategies considering the capital heterogeneity of the community members.
- The improvement mechanisms for agricultural practices proposed by the inhabitants of Kiuñalla seek to increase production with organic fertilizers, to develop the associativity for the commercialization of cash crops, to diversify agriculture, to adopt better technologies for potato crops, and to increase the production of fruit trees and beans in the low zone considering agroforestry systems. This requires training and the implementation of productive projects considering these mechanisms; therefore, they will contribute to reduce the costs associated with inappropriate practices and improve the productivity of the assigned plots, thus reducing the need of keeping new forest plots.
- The compensation schemes for ecosystem services of the boundary part of the forest and the agricultural area should involve the community members who have fallow land in the highlands so that they remain uncultivated, and those with production plots can consider leaving them fallow. Likewise, the schemes considering the forest ecosystem services should contemplate the participation of community members with livestock grazing in the areas surrounding the forest to avoid incidents of forest degradation. The schemes seeking to recover Andean agrobiodiversity could cover the production costs of Andean crops in part of the plots in the middle and high non-irrigated areas, and grassland; as long as the low prices of potato crops are maintained, the most profitable option for most farmers is to leave the plots fallow and therefore they need incentives to grow Andean varieties.

## 2.5 Financing

Financing for the restoration initiative has come from several sources:

- from the community itself through labour, a counterpart that is valued with the wages provided by the community members;
- from the collaboration of *Helvetas Swiss Cooperation* through PBA (Andean Forests Programme) and its partner CEDES Apurímac, supporting with food supplies during works and various inputs (logs for fencing, livestock mesh, production of seedlings, capacity building etc.)
- from public funds channelled through the Municipality of Huanipaca
- from SERFOR by supporting with technical assistance and training

In recent months, an agreement has been signed with the REGENERA network (<https://www.serfor.gob.pe/wp-content/uploads/2018/12/Frank-Hajek-Nature-Service-Peru.pdf>), acknowledging and valuing the population of Kiuñalla as custodians of their native forests for their contribution to the carbon emissions reduction, receiving a compensation of S/. 1000 monthly (about US\$ 295), that will contribute to restoration actions and any other activity prioritized by the community.

## 2.6 Communications

The experience in Kiuñalla has been shared through various means:

- web pages (PBA, CEDES, SERFOR)
- newsletters (del PBA)
- regional and local radio
- videos (in Quechua language, e.g. about fire prevention and control, water care)
- regional and national events (conference, seminars, workshops)

Internships is another contributing method to communicate the efforts that have been made in Kiuñalla, since communities in other jurisdictions (even outside Apurímac) visit Kiuñalla and exchange knowledge, practices and experiences of the process.

The participation of CEDES - PBA as a member of the Regional Environmental Commission, the Round Table for the Fight against Poverty and the Compensation Mechanisms for Ecosystem Services (MRES) platform for the Mariño Basin, also help to spread the experience of Kiuñalla and could be taken into account in the agendas for implementing restoration actions in the region, mainly by involving the Regional Government of Apurímac through its Natural Resources Department.

## 2.7 Lessons learned

The Kiuñalla community restoration initiative, despite its short history, has served to generate some lessons in the framework of a participatory process by nature and an adaptive process by necessity.

On the one hand, governance has been and continues being a challenge for initiatives such as these. Thus, some **difficulties** encountered by the community are (Kometter et al. 2018):

- weak community organization (there is a high percentage of non-resident community members)
- Intermittent spaces for consultation and joint work
- weak presence of local and regional governments and sectors supporting innovations
- poor participation of residents in community actions (such as assemblies and tasks) vis-à-vis other options or opportunities that generate income and/or temporary employment.

On the other hand, the benefits expected by the community for its restoration efforts are focused on increasing the water resource, both for agricultural and domestic use, the recovery of the landscape and the income that could be obtained by local internships (lodging, food and transport). These benefits have not yet occurred during the short period of the initiative, but most of the community members maintain the spirit and commitment to continue promoting it. They know that the changes that the expected benefits will also bring shall contribute to food security, the development of intensive agriculture with an ecological approach (with crop association and rotation), income generation due to the increase in tourism (lodging, food, guides), the production and sale of honey and pollen, the sale of handicrafts and medicinal plants and, finally, the revaluation of local knowledge and practices.

In a way, Kiuñalla has become a laboratory in the area of restoration for the Apurímac Region and the country. It is important to consolidate the restoration proposal based on the results and lessons learned from the current experience in Kiuñalla in order to recommend its out- and upscaling in other contexts. Additionally, it is essential to have the support of the State and the private sector organizations for their

restoration activities. Unfortunately, society in general is unaware and does not perceive these activities because environmental services are not very tangible in urban and business action areas (Cabrera 2017).

The following can be identified as opportunities to improve the impacts and scalability potential of restoration activities in Kiuñalla (Cabrera 2017):

- 1) The need to **address restoration from a comprehensive approach** in relation to the other challenges of the community. The work approach must be broad and inclusive to face community problems. The Life Plan of Kiuñalla makes it possible to visualize what are the main needs, aspirations and opportunities in order to achieve these objectives, as well as to be clear of the institutional and territorial development panorama.
- 2) It is important **to place the restoration initiative in perspective with the territory, the roles of the people, the community and the supporting institutions**. In this way, it will be clearer how to develop a sustainable process for forest restoration, define and identify the reasons why the forest should be conserved and restored despite current needs, given its strategic importance for the community, so that it can be transmitted to community members and new generations.
- 3) The need **to identify alternative economic activities to improve local income and reinforce the restoration practice**. Currently, agriculture is an activity that cannot, on its own, support the majority of families living in Kiuñalla. Hence the importance of developing alternative strategies to create local sources of employment that do not depend primarily on agriculture and, if so, identify promising crops to increase local income. In that sense, apiculture is serving as a productive activity that generates income from the added value of organic honey, pollen and propolis.
- 4) The possibility of **establishing an incentive system for community members who are committed to restoration**. These would not be economic incentives, but ones that would allow the community and its members to have new opportunities related to the experience of being the pioneers in implementing a restoration process of forest ecosystems. Based on this, it would be of great significance for the board members and the Forest Management Committee of Kiuñalla to have recognition allowing them to replicate the experience through technical assistance service sales and knowledge sharing with others public or private communities and institutions that promote landscape restoration.
- 5) The possibility of **engaging the Municipality of Huanipaca and the Regional Government of Apurimac in supporting the community** of Kiuñalla and its development plans. It is an incentive that should be greatly emphasized, since they are the closest government stakeholders to the community.
- 6) The need to **adapt and strengthen the community, municipal and national policy normative instruments against the impact on ecosystems and sensitive areas**. The idea is to include characteristics of the restoration and sustainable management of forests within the bylaws of the community, thus ensuring to have formal punishment processes for infractions against the community forest resources.
- 7) The **opportunity offered by the ecotourism potential in Kiuñalla as an income generating mechanism that allows conserving and restoring forests in the long term**. Ecotourism is presented as the alternative with the greatest potential to ensure a compatible economy with the management and protection of forest resources in the Kiuñalla community. Its strategic location, scenic beauty, local traditions and the commitment of its inhabitants make it feasible to think of such an alternative.

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