Methodology for beneficiaries' estimation

for

Resilient Puna

Ecosystem based Adaptation for sustainable high Andean communities and ecosystems in Peru

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Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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1 Introduction

As described in the funding proposal, the programme “Resilient Puna: Ecosystem-based approaches for sustainable High Andean communities and ecosystems in Peru” aims to enhance ownership and resources of Indigenous People and Local Communities to build their own resilience to climate change by defining, implementing and monitoring their Ecosystem based Adaptation (EbA) priorities to improve the Puna ecosystems management to and ensure the continuous provision of their services such as water provision that will be captured during raining season for their livelihoods during dry season.

The design and execution of the Puna Facility will support small-scale grants for the implementation of the local EbA measures and climate resilient value chain interventions selected from a menu of eligible adaptation investments, aligned with national objectives. The establishment of the facility and targeted capacity developments will improve how climate funds are channelled to the local level and effectively programmed for the Puna ecosystems. Adaptation investments will, for instance, allow vulnerable communities to introduce climate resilient value chains and sustainable land management practices, and ecosystem-based adaptation measures. Awareness raising, monitoring and evaluation will ensure achievement of the project's adaptation objectives.

The project will be implemented and executed by GIZ. In addition, here will be four Peruvian Executing Entities: i) the Ministry of Agricultural Development and Irrigation (MIDAGRI), ii) the National Service of Natural Protected Areas (SERNANP) as part of the Ministry of Environment (MINAM), iii) the Peruvian Trust Fund for National Parks and Protected Areas (Profonanpe), and iv) Instituto de Montaña (IdM).

Adaptation impact: The programme will have a significant impact in the Puna ecosystems where interventions will be implemented, increasing the resilience of the most vulnerable people and communities, strengthening the food and water security, and increasing the resilience of ecosystems and ecosystem services. The benefits will be rolled out through the implementation of the project and the climate adaptation investments that will take place on the local level.

2 Climate Vulnerability

In terms of climate projections, Annex 2 – Feasibility study states the following:

The key climate change impacts identified for the project include increase in droughts and reduced water availability, decreased crop yields and shorter growing seasons and glacial retreat and melting. The climate risks, impacts and adaptation options are summarised below.

Table 1: Summary of climate change risks and impacts with corresponding adaptation options.

Climate change impacts	Description of impact	Ecosystem-based Adaptation options (from EbA catalogue)[1]	Other adaptation options (non EbA)
Increase in droughts and reduced water availability	Under RCP 8.5, there is an increase of droughts in the Altiplano region by 2050, and wetter climates at lower altitudes. The total number of drought months by some estimates is projected to almost double by 2100 under the RCP 8.5 scenario (Potter, et al., 2022). This will have impacts on the water balance, with knock-on impacts on agricultural activity.	● **Conservation and restoration of wetland ecosystems** (*bofedales)* retain rainwater, regulate runoff flows, increasing soil moisture and improve water regulation. ● **Infiltration ditches**- retain and infiltrate rainwater, Increase the humidity of the soil plant water system as a result of localized infiltration. The deposited water infiltrates the soil and helps with aquifer recharge improving water regulation. ● **Qochas** – Qochas are natural reservoirs in the High Andes that store rainwater and improve infiltration.	● Geotanks ● Greenhouses
Decreased crop yields and shorter growing seasons	Potato crops in Apurimac and Cusco (SE subregion) would decrease. In Arequipa (SW subregion), onion yield will present larger physiological imbalances. The wheat crop yield projections will significantly decrease in this region. Pests and diseases will affect potato and onion crops due to shifts in species distribution (SENAMHI, 2015).	● **Andenes/terraces** to reduce water runoff and soil erosion, usually on steep slopes. Terraces maintain soil moisture and generate a suitable microclimate for crops (HELVETAS Swiss Intercooperation, 2017). ● **Agroforestry -** tree-crop interaction helps control erosive processes and increases water infiltration (HELVETAS Swiss Intercooperation, 2017). Agroforestry measures increase soil productivity and contribute to food security, while providing agrobiodiversity benefits. ● **Forest restoration with native species-** native species such as Buddleja coriaceae*, Alnus acuminata* or *Polylepis racemosa* have high soil retention capacity, stabilize sudden temperature changes and hold soil and environmental moisture. ● **Integrated soil fertility management** (ISFM) via green manure and majadeo[2]. ISFM enhances soil fertility, improves water retention and even reduces germination	● Technified irrigation. ● Integrated pest management techniques. ● Crop rotation ● Solar pumping ● Productive diversification (vegetables, guinea pigs) ● Management of crop and livestock health.

[1] More detailed information on the EbA measures can be found in Section 9.

[2] Majadeo is the practice of soil fertilization using herds. The process starts with herd grazing, in which the animals are guided to feed on specific plots of land, and then the leftover manure is used to plant crops (Tapia, Fries, Mazar, & Rosell, 2007).

Climate change impacts	Description of impact	Ecosystem-based Adaptation options (from EbA catalogue)[1]	Other adaptation options (non EbA)
		time through seed priming (Liniger, Mekdaschi, Hauert, & Gurtner, 2011). ● **Contour farming:** Consists in orienting the crop rows following the contour lines of the topography. This practice helps to reduce water runoff and soil erosion. ● **Conservation agriculture –** farming system that prevents soil disturbance and emphasizes maintenance of permanent soil cover. Hydrological optimization for water retention, improve water retention and reduce erosion rate.The aim is to enhance biodiversity and improved and sustained crop production.	
Glacial retreat and melting	According to the National Research Institute on Glaciers and Mountain Ecosystems (Inaigem), Peru glaciers have been reduced by 43% over the last 40 years because of global warming. In the Andean glaciers, at least seven watersheds have already crossed peak flow; once the glaciers feeding these rivers are gone, dry season average discharge may decrease by up to 30 per cent causing actually water stress. (Baraer et al., 2012 cited by Bergmann et al 2021[3]). Evidence from the field shows that in recent years the scarcity of water	EbA's would be located downstream from glaciers to better retain and collect water: ● **Conservation and restoration of wetland ecosystems**- *bofedales* retain rainwater and regulate runoff flows, increasing soil moisture. ● **Qochas** – Qochas are natural reservoirs in the High Andes that store rainwater. ● **Infiltration trenches- retain and infiltrate rainwater.** The deposited water infiltrates the soil and helps with aquifer recharge.	N/A

[3] Bergmann, J., K. Vinke, C.A. Fernández Palomino, C. Gornott, S. Gleixner, R. Laudien, A. Lobanova, J. Ludescher and H.J. Schellnhuber, 2021. Assessing the Evidence: Climate Change and Migration in Peru. Potsdam Institute for Climate Impact Research (PIK) and International Organization for Migration (IOM). Potsdam and Geneva

Climate change impacts	Description of impact	Ecosystem-based Adaptation options (from EbA catalogue)[1]	Other adaptation options (non EbA)
	resources has impact local livelihoods in areas closer to glaciers melted because of the Andean community's vulnerability.		
Shifting landscapes-affecting grasslands	● Ludeña et al. (2014) show there will be an increase in shrub surface under a high emissions scenario in the Puna region. The same phenomenon is projected for the *páramos.*[4] ● Glaciers, the suprandino area (the area between glaciers and the *puna*[5]), the *puna* and *yungas* forests show large reductions in extension. ● Projected expansion of desert and dry areas will reduce water availability (Ludeña, Sánchez-Aragón, de Miguel, Martínez, & Pereira, 2014). ● Wetlands, grasslands and shrub-lands will change in surface due to glacial retreats and temperature increases. The area that is constituted by grasslands, wetlands, and shrub-lands, which in 2010 represented 77.6% of the total extension of the *puna,* would be reduced to approximately 50% by the end of the century Flores (2016).	● **Forest restoration with native species-** intended to avoid the spread and dominance of invasive species in the Andes, such as *Eucalyptus globulus.* Native species Polylepis incana, *Alnus acuminata* or Buddleja coriaceae intercept, condense and infiltrate water, making them resilient to dry conditions. ● **Sustainable grassland management-** by controlling overgrazing, increasing water infiltration, and controlling erosion.	● Rotation of livestock grazing

[4] Grassland and shrub-land ecosystems found in Peru and other areas of South America.

[5] The ecoregion above 3,500 masl

Climate change impacts	Description of impact	Ecosystem-based Adaptation options (from EbA catalogue)[1]	Other adaptation options (non EbA)
Diminished carrying capacity of ecosystems for livestock (including camelids)	● Meat production (sheep, cattle, camelids, equines and goats) will decrease due to the reduction of available grazing land and water availability. This impact will be larger under a high emissions scenario Ludeña et al. (2014). ● An economic study found that under a high emissions scenario, the economic impact on livestock in the whole of the Andean region (i.e. not just the project intervention area) is projected to be up to 9 billion Peruvian *soles* in accumulated losses at a discount rate of 0.5% by 2100 (MIDAGRI, 2012).	● **Forest restoration with native species-** Native species *Schinus Mole, Alnus acuminata* or *Podocarpus glomeratus* intercept, condense and infiltrate water, hold soil and environmental moisture and have high soil reterention capacity. This means that they can help regenerate ecosystems. ● **Sustainable grassland and pasture management-** by controlling overgrazing, increasing water infiltration, and controlling erosion, grasslands can be recovered and provide enough fodder for livestock (HELVETAS Swiss Intercooperation, 2017).	
Impacted livelihoods	● The chosen districts in the SHAP are rural areas, where the system of small agricultural producers dominate. Some highland communities use migration to anticipate or react to hazards. Migration of workers is influenced by climate impacts such as drought, especially of young people, in highland communities in the Puno region (Sperling et al., 2008). ● 4.5 million people live in the SHAP of whom 50 % are women. Around 40 to 60 % of this population live in rural areas and rely on subsistence	● **Aforementioned EbA interventions related to soil management, agroforestry and water management-** these will have knock on impacts on ecosystem services and provide timber and non-timber products for income generating activities, for example.	● **Promotion of eco-agrotourism as a revenue source to diversify livelihoods-** By managing visitor flow in a way that limits ecosystem degradation and wildlife disturbance but generating local alternative incomes. ● **Investment in climate-resilient value chains-** helping rural communities increase and diversify their income, as well as enhance the resilience of their

Climate change impacts	Description of impact	Ecosystem-based Adaptation options (from EbA catalogue)[1]	Other adaptation options (non EbA)
	agriculture and livestock breeding as main source of income. They have been identified by Peru's 3rd National Communication to UNFCCC as highly vulnerable to climate change's impacts on High Andean ecosystems (Ministerio del Ambiente, 2016). ● Women depend to a larger extent on ecosystem services at a household level, due to existing inequalities in education, access to credit and public services. (MIMP, 2012)		livelihood source (small-scale agriculture and livestock production)

3 Programme Theory of Change and Description

The programme level Theory of Change state that:

IF public and private financing for investing on EbA measures to enhance climate resilient livelihoods are accessible to vulnerable communities in the Puna Ecosystem;

THEN the resilience of these communities will be improved as a result of the conservation and restoration of ecosystems and ecosystem services through EbA measures;

BECAUSE local communities will scale up conservation and management of ecosystems based on best practices and ancestral knowledge, develop climate resilient diversified livelihoods through better market access and economic opportunities with support from multilevel landscape governance instruments.

The project is comprised of three components:

Component 1 – Resilient ecosystems and communities

Component 1 will promote resilient Puna ecosystems and value chains by financing and co-financing climate-focused investments at local landscape level. By implementing investments on the ground, the aim is (i) to maintain or improve the provision of puna ecosystem services for climate resilience of the high Andean population and (ii) to strengthening climate resilient value chains that are dependent on and impacting on those ecosystems. A series of structural interventions, technological packages, trainings, information materials and communities' exchanges to nurture dialogue will be implemented to co-produce knowledge and foster community monitoring to measure EbA impacts that then will result in investment on the ground.

Component 2 – Public and private investments for the scale up of EbA measures

Component 2 will establish a Facility (The Puna facility) to align and leverage public and private financing for EbA measures and climate resilient agribusiness at different and coordinated levels. The focus of this component is on mobilizing finance at different scales and with different sources, with impact beyond the specific landscape. The key feature of this component is its leverage potential financing and facilitate the mobilization of MIDAGRI investments, PES, private and financial institutions resources.

Component 3 - Multilevel governance of the territory for the incorporation of EbA measures

Component 3 will promote integrated landscape planning, governance platforms and policy improvement and coordination, fostering dialogue and improving coordination among stakeholders that intervene in the landscape (local, regional and national governments, rural communities, producer organizations, watershed committees, and MIDAGRI extension services, among others).The most adequate processes through effective participatory approaches or platforms for knowledge exchange, dialogue, coordination and consensus-building will be fostered according to local needs.

The following subsections provide a detailed overview of the three components, activities and sub-activities of the project. Each Activity and Sub-Activity is described in detail, including the

contribution to the project Component, the budget allocation, the baseline, the deliverables, the technical justification, and the institutions involved.

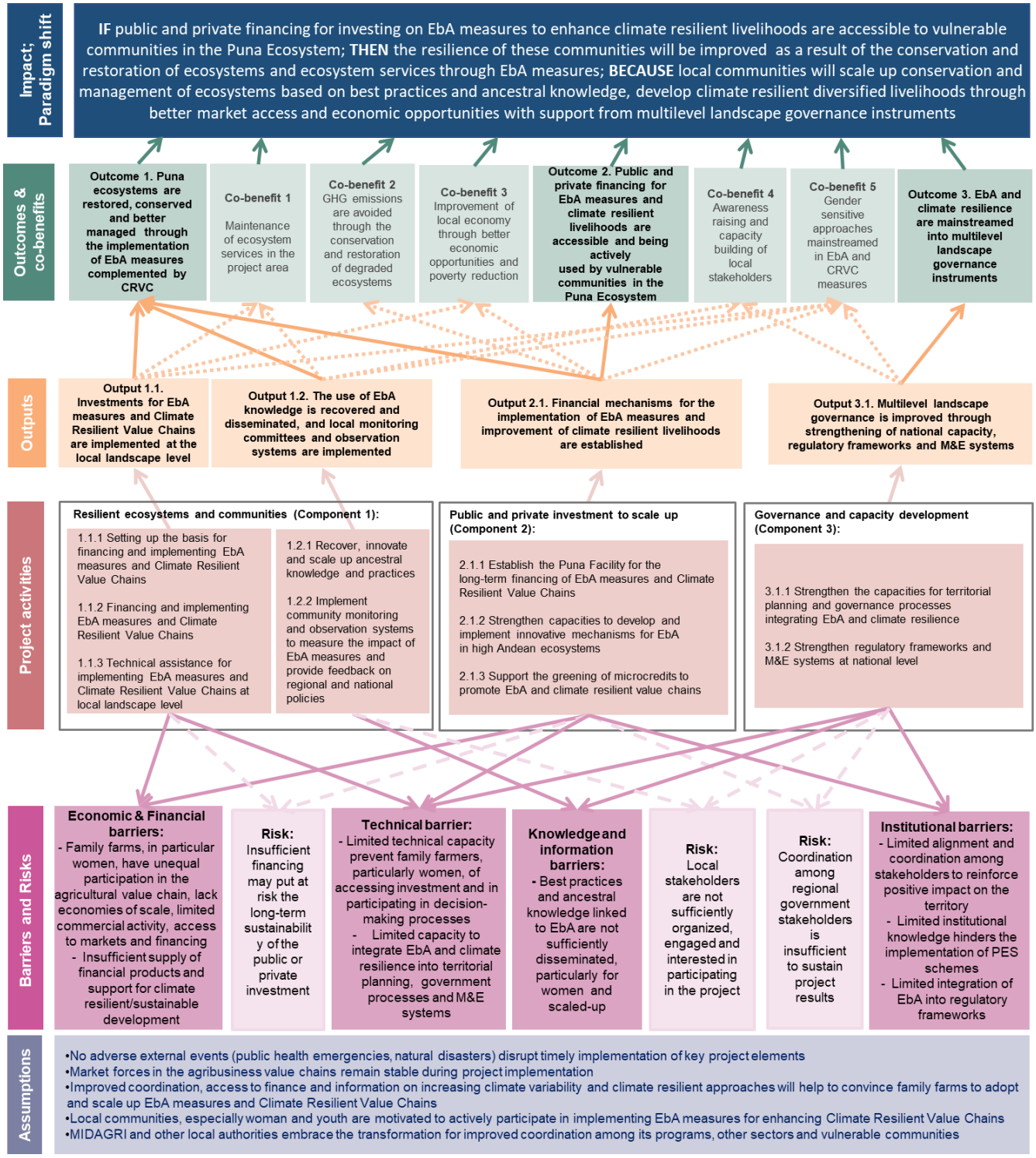

Figure 1: Project Theory of Change

4 Adaptation benefits

The target scenario with project implementation foresees a paradigm shift to promote the development and maintenance of financial, technical and regulatory support to the implementation of EbA measures and climate resilient value chains within the puna ecosystem, promoting the enhancement and recognition of ecosystems and their inhabitants.

During project implementation will be reached60,715 direct beneficiaries within 91 districts and 2,011,856 indirect beneficiaries in the lower part of the five (05) watersheds that will benefit from conserved water ecosystem services. Project activities will also work on building the conditions to support mainstreaming of EbA and climate resilience, as well as strengthening institutional capacities in Peru. This will enable the development and scale up of financial options and technical support for local communities to improve its climate resilience and promote climate change adaptation in the region.

The successful experiences, the development of capacities and the favourable regulatory frameworks promoted by the project will allow the scale up of similar activities in a broader scope, as well as in the territory itself.

Through the establishment of the Puna Facility (Outcome 2) the project will permit the scaling up of financial incentive for local communities to implement EbA measures and climate resilient value chains. The Puna Facility will work with different sub-windows to provide financial support for the implementation of EbA measures and climate resilient value chains (CRVC) to support local most vulnerable communities and improve ecosystem services in the region.

Besides providing financial support, the project will work on strengthening technical, social, political and institutional capacities of local actors, as well as instruments and norms for the management of ecosystems and their services to reach EbA and climate resilience mainstreamed into multilevel landscape governance instruments (Outcome 3).

Likewise, the project will promote better governance in the prioritized areas, seeking that communities and local governments plan and manage their territories in close coordination.

Through the dissemination of successful experiences, the installed capacities and favourable institutional frameworks, the project will make scaling up possible.

5 Beneficiaries' estimation

This section aims to present an overview of the GCF result areas, core indicators and supplementary indicators, its methodology, assumptions and results expected from the implementation of the proposed project.

5.1 Methodology and assumptions

- **Core indicator 1: Greenhouse gas (GHG) emissions reduced, avoided or removed/sequestered (Unit: tonnes of carbon dioxide equivalent) (Disaggregation: results area)**
    - **MRA 4: Forests and land use**

The project recognizes as a valuable co-benefit the reduction of GHG emissions. The proposed intervention measures aim to prevent emissions from existing carbon sources, like

livestock, crops, and pasture management, and contribute to carbon sequestration in soil and vegetation, through pasture and forest management, and wetland restauration.

GHG reductions are calculated using the methodology presented in the IPCC Good Practice Guidance for LULUCF, applied though the tool EX-ACT (version 9.4) developed by FAO. This methodology was chosen due to its widespread recognition, general applicability in both the baseline and with-project scenarios, and the availability of relevant data.

In order to assume a potential budget distribution for the different EbA measures in the selected districts, the data collected by the cartographic analysis was used to determine the probability of implementation. Even though the sub-projects that will get funded by the Puna Resilience facility are not yet determined, a methodology is proposed to reach assumptions on a distribution that is likely to happen, based on the data available.

The aim of this exercise was to generate the data required to perform the impact assessment and GHG calculations resulting from the application of the EbA measures. The analysis determined the potential units per EbA measure and the associated costs of implementation.

Table 1 shows an overview of the total area catalogued with "high-suitability" of implementation of each EbA measures in the selected departments, and the probability of implementation, understood as the total area with "high-suitability" per EbA measure divided by the total area with "high-likelihood" of all EbA measures.

The calculations performed can be resumed as:

Ha per EbA measure = Budget per Eba measure / Unitary cost per ha for each EbA

Budget per Eba measure = Available budget * probability of implementation

Probability of implementation = Area characterized as highly suitable per EbA measure/Total are characterized as High suitable for at least one EbA

Table 4 – Overview of EbA's probability of implementation and areas with "high-likelihood" of implementation, in hectares.

EbA measures	Apurimac (ha)	Arequipa (ha)	Cusco (ha)	Lima (ha)	Puno (ha)	Total (ha)	Probability of implementation (%)
EbA 1: Bodefal restauration and conservation	5,021	18,041	17,316	1,191	20,781	**62,350**	3.3%
EbA 2: Family Qochas	371	2,168	5,262	389	2,912	**11,101**	0.6%
EbA 3: Integrated Soil fertility management	31,168	11,793	81,663	1,161	25,056	**150,840**	7.9%
EbA 4: Contour farming	400	882	17,163	14	4,942	**23,400**	1.2%

EbA 5: Infiltration ditches	22,016	5,672	4,706	1,296	1,687	**35,378**	1.8%
EbA 6: Sustainable grassland management[6]	285,106	399,719	274,604	66,197	454,140	**1,479,766**	77.2%
EbA 7: Conservation Agriculture	14,699	3,567	20,119	895	12	**39,293**	2.0%
EbA 8: Agroforestry	15,979	6,076	50,694	846	24,937	**98,532**	5.1%
EbA 9: Reforestation with native species	0	4,403	534	1,606	0	**6,542**	0.3%
EbA 10: Andenes/ Terraces restauration	2,867	1,260	5,595	702	100	**10,524**	0.5%

Once determined the probability of implementation, the total investment assigned to EbA measures (14,400,000 EUR), was distributed using the probability number, to obtain the expected budget to be utilized in each EbA measure implementation. In order to obtain the impact of each EbA measure, the investment available per measure was divided by the unitary cost, determining how many units of each measure could be achieved with the budget assigned. The results are displayed on Table 2.

Table 5 – Overview of EbA's probability of implementation and areas with "high-likelihood" of implementation, in hectares.

EbA measures	Probability of implementation	Total investment per EbA (EUR)	Cost per unit		Value
			Soles	EUR	
EbA 1: Bodefal restauration and conservation	3.3%	468,180	1,880	470.00	996 ha
EbA 2: Family Qochas	0.6%	83,360	20,000	5,000.00	17 qochas
EbA 3: Integrated Soil fertility management	7.9%	1,132,643	6,844	1,710.94	662 ha
EbA 4: Contour farming	1.2%	175,708	1,041	260.25	675 ha

[6] Includes areas with medium and high-suitability of implementation.

EbA 5: Infiltration ditches	1.8%	265,648	5,000	1,250.00	213 ha
EbA 6: Sustainable grassland management	77.2%	11,111,397	2,286	571.50	19,443 ha
EbA 7: Conservation Agriculture	2.0%	295,049	6,113	1,528.13	193 ha
EbA 8: Agroforestry	5.1%	739,867	1,898	474.50	1,559 ha
EbA 9: Reforestation with native species	0.3%	49,126	4,500	1,125.00	44 ha
EbA 10: Andenes/Terraces restauration	0.5%	79,023	2,441	610.21	130 ha
TOTAL					**23,914 ha**

- **Core indicator 2: Direct and indirect beneficiaries (female/male) reached (number of individuals)**

Direct beneficiaries of an adaptation intervention will include all individuals who will receive i) targeted support from the GCF-funded intervention and ii) a measurable adaptation benefit from a GCF-funded intervention, including:

a) Individuals that implement local initiatives that will be financed and supported by the Puna Facility, multiplied by the average number of members of the groups/legal entities supported and the average members per household in the region.

b) Individuals that will be supported by MIDAGRIs co-finance programs, multiplied by the average members number per household in the region.

c) Individuals that will receive technical assistance from the GCF- funded intervention (e.g trainings, support to develop site-specific climate diagnostics and preparation of participatory project intervention plans)

a) Direct beneficiaries of the Puna Facility receive i) targeted support from the Puna Facility and ii) have a measurable adaptation benefit with the adoption of EbA and Climate Resilient Value Chain measures. The beneficiaries were calculated based on the following:

- 127 Local initiatives[7]
- Average number of community members per supported organization
- 5 members per households in High Andes

b) Direct beneficiaries from the MIDAGRI co-finance programmes receive i) targeted support from the MIDAGRI programmes and ii) have a measurable adaptation benefit with the adoption of EbA and Climate Resilient Value Chain measures. The beneficiaries were calculated based on the following:

[7] Correspond to the number of beneficiaries under Puna Facility. It is estimated that the 127 projects will support an average of 50 households (based on the local consultations) and each household is estimated to include 5 members (https://www.globallivingwage.org/wp-content/uploads/2020/11/Rural-Peru-LI-Reference-Value_EN-FINAL.pdf)

- 5263 individual beneficiaries[8]
- 5 members per households in High Andes

c) Direct beneficiaries from activities 1.1.1.2 and 1.2.1.1 receive i) targeted support through trainings, support to develop site-specific climate diagnostics and preparation of participatory project intervention plans etc. and ii) have a measurable adaptation benefit due to increased capacity in identifying climate threats and adopting climate resilient agricultural practices. The beneficiaries were calculated based on the estimated people participating in the said activities, with the assumption that there is going to be a 50% overlap of 1.1.1.2 beneficiaries with 1.1.2.1 direct beneficiaries.

The overall number of direct beneficiaries is 60,715 (30,088 women)

Table 4- Direct beneficiaries calculation and assumptions

Puna & MIDAGRI					
Subactivity	**Direct beneficiaries**	**No of Projects**	**No of community members supports per project**	**Household size**	**Number of beneficiaries**
1.1.2.1	Puna Facility Beneficiaries	127	50	5	31,750
1.1.2.2 1.1.3.2	MIDAGRI Beneficiaries[1]	Not applicable	5,263	5	26,315
1.1.1.2	People trained in territorial planning and EbA adoption in this subactivity[1]				1,740
1.2.1.1	Local experts trained				910 (637 men and 273 women)
Total other Activities					60,715

[1] To avoid double counting a 50% overlap of beneficiaries with sub-activity 1.1.2.1 is assumed.

Table 5 – Overview of direct beneficiaries avoiding double counting

Indirect beneficiaries of the project will be those that do not receive targeted support from the GCF-funded intervention but will benefit from water generated by the improvement of ecosystems that contribute to water regulation in the basin in the main cities of Cusco, Arequipa, Abancay and Cañete. This improvement in the ecosystems will be generated,

[8] Estimation based on the MIDAGRI pipeline. The estimation avoids double counting by estimating a 50% overlap in beneficiaries with the Puna Facility for the interventions that will take place in the areas also supported by the Puna Facility.

through the Puna facility, that will give support to EbA interventions in the catchment areas of five (05) EPS. Therefore, the population served by these EPSs are considered the indirect beneficiaries of the project. In addition to indirect contributions from the ecosystem services generated by the support to local initiatives, the project will also contribute by strengthening the MERESE managed by this 5 EPS in the project area, so that they can guarantee the maintenance of ecosystem services in the long term.

Indirect beneficiaries under Core 2 Indirect beneficiaries reached are estimated as follows:

As the project will contribute to secure the water quantity and quality, the indirect beneficiaries are estimated as those benefiting from the water delivered by the EPS (public water and sanitation companies) as presented in the table below. The population that will benefit from the supply of drinking water and sewerage was determined through the tariff studies made by each EPS and approved by SUNASS[9]. This estimation is based on the results of the latest Population and Housing Census, in this case for 2017, conducted by the National Institute of Statistics and Informatics (INEI) and the growth rate is calculated based on the annual population growth observed between the different censuses conducted (1981, 1993, 2007 and 2017) by the INEI. Based on the determination of the population served, the number of connections is estimated and the demand for drinking water and sewerage services that the EPS will face in the regulatory five-year period is determined.

The total number of indirect beneficiaries is 2,011,856 (1,005,928 women).

Monitoring the ex post indirect beneficiaries

The number of beneficiaries that have been served by each EPS in the previous period is evaluated each 5 years in the tariff studies. This report is public and could be used as a means of verification of the people indirectly benefited by the MERESE strengthened by the project. This document also provides an analysis of compliance with the EPS's management goals for the previous five-year period, including the annual increase in water and sewerage connections, which makes it possible to verify whether the EPS was able to meet the established goals and therefore provide the service to the identified population, which would be the indirect beneficiaries of the project.

Table 6 – Indirect beneficiaries estimation according to EPS

EPS	**Región**	**Micro-basin**	**Project beneficiary districts inside the Micro-basin**	**User Population (downstream)**
SEDAPAR	Arequipa	Quilca-Vitor-Chili	San Juan de Tacurani	1,387,820 [10]
SEDACUSCO	Cusco	Piuray, Paucartambo, Vilcanota	Sicuani	440,259[11]
EMSAPA CALCA	Cusco	Cochocc	Calca	14,999[12]

[9] The National Superintendence of Sanitation Services

[10] https://www.sedapar.com.pe/wp-content/uploads/2021/11/Estudio-Tarifario-2021-2026.pdf

[11] etf_sedacusco_2020-2025.pdf (sunass.gob.pe)

[12] emsapacalca_etfinal_191118.pdf (sunass.gob.pe)

EPS	Región	Micro-basin	Project beneficiary districts inside the Micro-basin	User Population (downstream)
EMAPA CAÑETE	Lima	Cañete	Miraflores, Laraos, Carania y Tomas	168,778[13]
EMUSAP ABANCAY S.A.C.[14]	Apurímac	Rontoccocha, Simpe, Cachimayo	Abancay y Tamburco	63,955[15]
Population dowsntream				2,011,856

- **ARA 1: Most vulnerable people and communities**
  - **Supplementary indicator 2.1 Beneficiaries (female/male) adopting improved and/or new climate resilient livelihood options (number of individuals)**

The total number of direct beneficiaries under Core 2 Direct beneficiaries reached and Supplementary 2.1 Beneficiaries (female/male) adopting improved and/or new climate-resilient livelihood options is 60,715 (30,088 women).

Table 7 – Description of benefit received by direct beneficiaries.

Activity	Description	Number of beneficiaries
Direct beneficiaries		
Sub-activity 1.1.1.2	Beneficiaries will receive targeted support through trainings, and they will receive a measurable adaptation benefit in terms of increased capacity on participatory territorial planning, climate risk, EbA, etc.	3,480 beneficiaries (men: 1,740, women: 1,740)
Sub-activity 1.1.2.2	Beneficiaries will receive targeted support through the investments of MIDAGRI and will have a measurable adaptation benefit in terms of adopting climate smart agriculture practices.	34,575 beneficiaries (men: 17,288, women: 17,288)
Sub-activity 1.1.2.1.	Beneficiaries will receive targeted support through the investments and will have a measurable adaptation benefit in terms of adopting climate smart agriculture practices.	26,315 beneficiaries (men: 13,157, women: 13,158)
Sub-activity 1.1.3.2	Beneficiaries will receive targeted support through the technical assistance provided through MIDAGRI and will have a measurable adaptation benefit in terms of adopting climate smart agriculture practices.	

[13] emapa-canete_fina_271218.pdf (sunass.gob.pe)

[14] The user population of this EPS has not been added to avoid double counting, since part of this population will also be direct beneficiaries.

[15] emusap_abancay_proy_82019.pdf (sunass.gob.pe)

Activity	Description	Number of beneficiaries
Sub-activity 1.2.1.1	Beneficiaries will receive targeted support through training and they will have a measurable adaptation benefit in terms of improved capacity on ancestral and innovative knowledge linked to EbA and climate resilient value chains (CRVC) measures.	910 beneficiaries (men: 455, women: 455)
	TOTAL	60,715 beneficiaries (men: 30,088, women: 30,088)

- **ARA 2: Health, well-being, food and water security**
  - **Supplementary indicator 2.2 Beneficiaries (female/male) with improved food security (Unit: number of individuals)**

From the 60,715 direct beneficiaries that will be supported under sub activities 1.1.2.1, 1.1.2.2 and 1.1.3.2 74.88% are estimated to be subsistence farmers. Therefore, the targeted support will also with improved food security for 45,463 (22,732 women) beneficiaries [16].

- **Core indicator 4: Hectares of natural resource areas brought under improved low-emission and/or climate-resilient management practices (Unit: hectares) (Disaggregation: type of natural resource areas; and results area)**

  - **ARA 4: Ecosystems and ecosystem services and indicators**
    - **Supplementary indicator 4.1: Hectares of terrestrial forest, terrestrial non-forest, freshwater and coastal marine areas brought under restoration and/or improved ecosystems (Unit: hectares)**

For ARA4, it was estimated that 23,914 hectares will be brought under restoration and/or improved ecosystems, with the support of the Puna Facility. Table 1 presents the breakdown of the different ecosystems and types that will be restored or be brought under improved management.

    - **Supplementary indicator 4.2: Number of livestock brought under sustainable management practices (Unit: number of livestock)**

A total number of 19,443 alpacas are estimated to be supported in the scenario without project, following the current trend of the baseline of around 1 alpaca/ha. This number greatly exceeds the grassland carrying capacity, assumed in 0.16 alpacas/ha, resulting in overgrazing of the grassland area.

*19,443 * 0.25 LSU/alpaca = 4,861 LSU*

The scenario with project projects to limit the number of alpaca to match the carrying capacity of the restored grassland, which is assumed to be 0.33 alpacas/ha[17]. The resulting number of

[16] Cabrera Cevallos, C.E. y De la O Campos A.P. 2023. La agricultura familiar en el Perú - Brechas, retos y oportunidades. Economía del desarrollo agrícola de la FAO – Estudio técnico N.o 28. Roma, FAO. https://doi.org/10.4060/cc4897es

[17] Carrying capacity based on Annex 3 - Economic and Financial analysis.

heads is 6,416 alpacas. Additional to the livestock that will be supported by the restored natural pastures additional 29,000 of alpacas will be supported through cultivated pastures and greenhouses for the production of fodder.

*19,449 hectares * 0.33 alpaca/ha = 6,416 alpacas*

Additional to the livestock that will be supported by the restored natural pastures additional 29,000 of alpacas will be supported through cultivated pastures and greenhouses for the production of fodder.

(*6,416 alpacas + 29,000 alpacas) * 0.25 LSU/alpaca = 8,854 LSU*

Therefore, the overall number of livestock in the with-project scenario under sustainable management practices is 8,854 LSU, resulting in a reduction of 3,993 LSU from the without-project scenario.

5.2 Project Impact by GCF Result areas

The programme will utilise the following direct and indirect beneficiary indicators that assess the specific contributions of the project interventions to each of the GCF's eight results areas:

MRA 4: Forests and land use

- **Core indicator 1:** Greenhouse gas (GHG) emissions reduced, avoided or removed/sequestered (Unit: tonnes of carbon dioxide equivalent) (Disaggregation: results area)

The overall mitigation impact from the project quantified by EX-ACT is a reduction of 407,657 tCO2e in the 15 years analysed, which include five years of implementation phase and ten years of capitalisation phase. It is measured against a scenario without project that would have increased by 93,905 tCO2e the GHG emissions in the areas of intervention.

The gross fluxes corresponding to the different activities with a direct mitigation impact are presented in Table 4. The numbers reflected correspond to the impact during the 15 years considered for analysis in a total area of intervention of 23,914 ha.

Table 8. Summary of project emission reductions

Value chain	Activity	Scenario without project	Scenario with project	Balance
Ecosystem based Adaptation	EbA 1: Bodefal restauration and conservation	0	-142,447	-142,447
	EbA 2: Family Qochas	No direct mitigation impacts, considered together with EbA 1.		
	EbA 3: Integrated soil fertility management	11,373	-77,734	-89,107
	EbA 4: Contour agriculture (TA)	No direct mitigation impacts.		

	EbA 5: Infiltration ditches	No direct mitigation impacts, considered together with EbA 1.		
	EbA 6: Sustainable grassland management	No direct mitigation impacts.		
	EbA 7: Conservation Agriculture	No direct mitigation impacts.		
	EbA 8: Agroforestry	15,401	-120,619	-136,020
	EbA 9: Reforestation with native Species	1,804	-1,804	-3,608
	EbA 10: Andenes/Terraces restauration	No direct mitigation impacts.		
Value Chain 1: Camelids (vicuñas and alpacas)		65,327	28,853	-36,474
Value Chain 2: high Andean Crops		Considered in EBA 3- Integrated Soil Fertility Management		
Value Chain 2: high Andean Crops		No direct mitigation impacts.		
Total emissions, tCO2-e		**93,905**	**-313,751**	**-407,657**
Total emissions, tCO2-e/ha		**4.1**	**-13.8**	**-18.0**
Total emissions, tCO2-e/ha/yr		**0.3**	**-0.9**	**-1.2**

ARA 1: Most vulnerable people and communities

- **Core indicator 2: Direct and indirect beneficiaries (female/male) reached (number of individuals)**

Resilient Puna will contribute to increased resilience of 60,715 (men: 30,088 , women: 30,088) direct and 1,855,669 (men: 927,835, women: 927,834) indirect beneficiaries.

  - **Supplementary indicator 2.1 Beneficiaries (female/male) adopting improved and/or new climate resilient livelihood options (number of individuals)**

The total number of direct beneficiaries under Core 2 Direct beneficiaries reached and Supplementary 2.1 Beneficiaries (female/male) adopting improved and/or new climate-resilient livelihood options is 60,715 (30,088 women).

ARA 2: Health, well-being, food and water security

  - **Supplementary indicator 2.2 Beneficiaries (female/male) with improved food security (Unit: number of individuals)**

The targeted support will also improve food security for 45,463 (22,732 women) beneficiaries.

ARA 4: Ecosystem and ecosystem services

- **Core indicator 4**: Hectares of natural resource areas brought under improved low-emission and/or climate-resilient management practices (Unit: hectares) (Disaggregation: type of natural resource areas; and results area)

- **Supplementary indicator 4.1:** Hectares of terrestrial forest, terrestrial non-forest, freshwater and coastal marine areas brought under restoration and/or improved ecosystems (Unit: hectares)

Type of natural resource areas	Land use type	Associated EbA measure	Number of hectares
Terrestrial forest	Forest	EbA 9	44
Terrestrial non-forest	Inland wetlands (bofedales)	EbA 1	996
	Annual cropland	EbA 3, EbA 4, EbA 5, EbA 7, EbA 8	3,302
	Grassland	EbA 6	19,443
	Other	EbA 10	129
		TOTAL	**23,914**

- **Supplementary indicator 4.2:** Number of livestock brought under sustainable management practices (Unit: number of livestock)

The overall number of livestock (LSU) in the with-project scenario under sustainable management practices is 8,854 LSU.