Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Geospatial Analysis

Determining suitability of area for the implementation of Ecosystem based Adaptation measures in selected value chains

for

Resilient Puna

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

11.09.2023, v.01

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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1. Acronyms

EbA- Ecosystem-based Adaptation

EEZ- Exclusive Economic Zone

INGEMMET- National Geological and Mining Institute

MIDAGRI- Ministry of Agriculture

MINAM- Ministry of the Environment

SENAMHI- National Meteorological Service

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4. Introduction

This analysis details the methodology and results of a geospatial analysis used to determine the areas that are more suited to implement the prioritised Ecosystem-based Adaptation (EbA) measures to increase resilience of the value chains that will be supported by the Puna Facility including camelids (vicuñas and alpacas) and high Andean crops (quiona and potatoes). It also includes information about the complementary value chain community-based tourism. The results of this analysis were used to determine adaptation and mitigation impact estimations and provide relevant data for for project implementation. For a detailed explanation on the technical and implementation aspects of EbA measures and how these were prioritized for this project, please refer to the Feasibility Study.

The scope of this cartographic analysis is, therefore, to recognize, at a macro landscape scale, the areas of the territory that are best suited for the implementation of each of the EbA measures, achieving a first approximation of the suitability or otherwise of the physical environment. It is important to emphasize, however, that given the territorial scale of the analysis, the final definition of the set of possible EbA measures to be considered in each specific project will require an analysis of the conditions of the territory at a smaller scale in later stages of the project, which will be carried out during Activity 1.1.1 of the project (please see Activity Sheet for more details). The variables prioritized in this cartographic analysis do not limit, therefore, the possible integration in later phases under a local analysis of the specific conditions of the territory to be carried out under sub-activity 1.1.1.2.

5. Methodology for geospatial analysis for EbA and value chain suitability

5.1. Sources of information of geospatial analysis

The sources of information listed below were used for to obtain geospatial data from the Ministry of Agriculture (MIDAGRI), the Ministry of the Environment (MINAM), the national meteorological service (SENAMHI) and the national Geological and Mining Institute (INGEMMET).

Table 1- Data sources for analysis

#	Geospatial layers used in this study	Source and Link
1	Climate change classification of Peru	SENAMHI (2020)
2	Vegetation cover of Peru	MINAM (2015)
3	*Bofedales* of Peru	INAIGEN (2021)
4	Marshes of Peru	MINAM (2012)
5	Economic Exclusive Zone (EEZ) of Arequipa	MINAM (2010)
6	EEZ Cusco	MINAM (2009)
7	EEZ Puno	MINAM (2015)
8	Hydrological information	INGEMMET (2014)
9	Geological information	INGEMMET (2016)
10	Soil Erosion	SENAMHI (2020)
11	Alpacas per district	CENAGRO (2012)
12	*Andenes* (terraces)	MIDAGRI (2015)
13	Topography	MIDAGRI (2017)
14	Number of potato species (cultivated)	MINAM (2017)
15	Number of potato species (wild)	MINAM (2017)

5.2. Methodology for geospatial analysis for EbA and value chain suitability

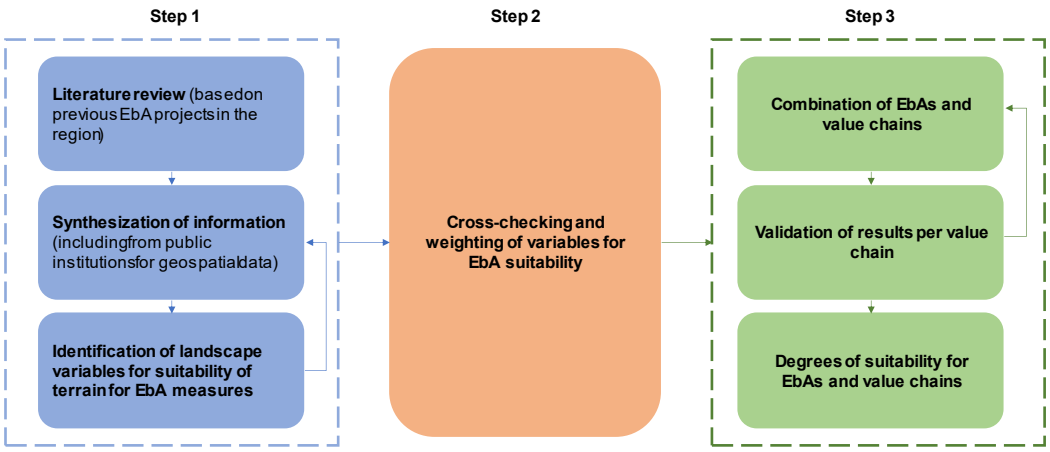
The objective of this analysis is to determine the areas that are most suitable for the implementation of the EBA measures, in light of the existing value chains, at the district level. To achieve this, a geospatial analysis based on different landscape-level variables was used to determine where it is most suitable to implement EbA measures. Then, EbA measures where matched with the value chains (i.e., which EbAs would allow strengthening the value chain climate change resilience) to obtain the number of hectares and districts where the EbA measures and value chains could be better suited to be implemented per district. This analysis provides an estimation of EbA adaptation and mitigation impacts. It is important to note, however, that the exact adaptation and mitigation impacts will depend on the final Local initiative which the Puna Facility will fund.

The methodology is detailed in the following sections and has three steps:

1. Literature Review and identification of variables
2. Weighing of the variables
3. Multicriteria analysis to determine suitability areas.

Figure 1 below shows a summary of the steps taken and using EbA 1: *Bofedal* conservation and restoration, and Value Chain: "Vicuñas/alpacas" an illustrative example is also provided.

Figure 1- Steps taken to determine the location and degree of suitability of different districts for different EbAs and value chains.



5.3. Step 1: Literature review and identification of variables to measure suitable terrain for EbA measure implementation

This step consisted in the revision of available literature on the various EbAs to determine the biophysical geospatial data that could facilitate identifying the suitable territory for each EbA measure implementation. This step allowed determining the variables to use for each EBA.

For wetland (*bofedales)* restoration and conservation, literature indicated that the size of the *Bofedal* and its altitude are relevant. A third variable was included which was that the Bofedales had to be included in the registries (datasets) of Both MINAM 2015 and INAGEIN 2021.

5.4. Step 2: Cross checking and weighing of variables

A matrix was used for every identifies variable (Step1) for each EbA measure. Each variable was scored between 1-3, 1 designating the areas that are the least suitable as 1 (Low) and 3 (High) for the most suitable.

Example: For *Bofedal* restoration and conservation, this was done as follows:

Table 2- Illustrative example of variables and their weighting to measure EbA suitability for wetland restoration

Weight	Variable 1: Bofedal size		
20%	Area lower than 0.2ha	Low	1
	Area between 0.2- 0.7ha	Medium	2
	Area greater than a0.7ha	High	3

Weight	Variable 2: Concurrence in the *bofedal* registry (INAGEIN-MINAM) 2015-2021		
40%	Low INAGEIN-MINAM concurrence/agreeement	Low	1
	Medium INAGEIN-MINAM concurrence/agreement	Medium	2
	High INAGEIN-MINAM concurrence/agreement	High	3

Weight	Variable 3: Altitude		
40%	Lower than 3500 m above sea level	Medium	2
	greater than 3500m above sea level)	High	3

Each geospatial layer is weighed (totalling 100%) according to their influence on the suitability of the terrain. The process was done using ArcGIS 10.8 software.

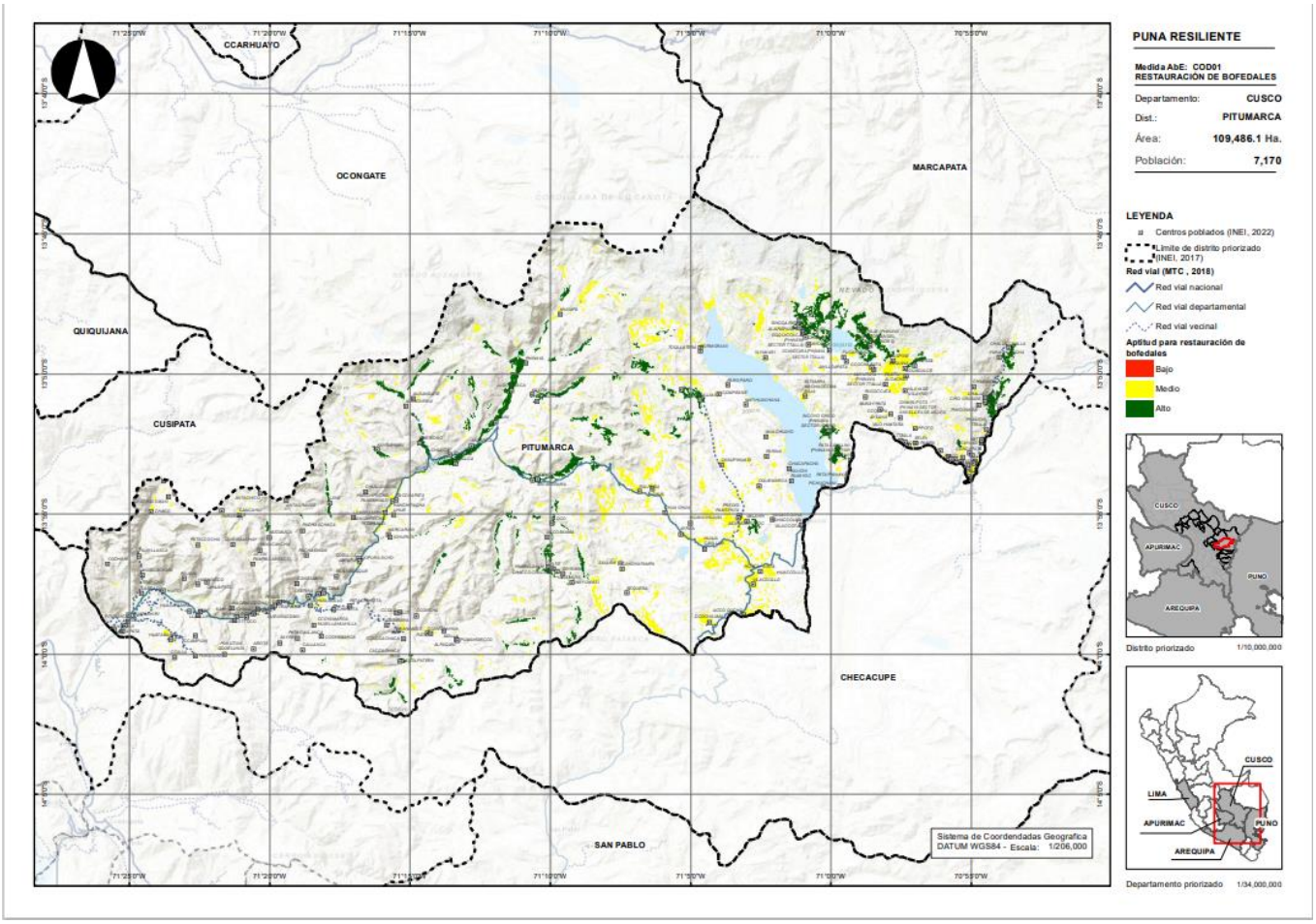
As a result of this analysis, EbA suitability was determined per hectares per district and region. The results for restoration and conservation of Bofedales per region are shown below as an example. . For a more detailed table including district data, please refer to section 6 of this analysis. Additionally, using the information produced, maps were generated, in Spanish, showing the location of suitable territory. An example for the district of Pitumarca, Cusco, and its suitability for the implementation of all 10 EbAs can be found under Appendix 1 of this analysis . . An example of a map showing territory suitability for EbA 1: *bofedal* conservation and restoration can be seen in

Figure 2

Table 3- Suitability of terrain (Low, Medium, High) per region for EbA measure: restoration and conservation of bofedales.

Region	Low (ha)	Medium (ha)	High(ha)
PUNO	57.96	28.767.48	20,780.72
AREQUIPA	178.37	56.994.32	18,040.81
CUSCO	102.68	32.263.06	17,316.41
APURIMAC	21.45	8.924.94	5021.01
LIMA	1.10	1.141.80	1191.16
Total	**361.56**	**128,091.60**	**62,350.11**

Figure 2- Example of map produced for the district of Pitumarca, Cusco, for the implementation of EbA 1: bofedal restoration and conservation. Yellow indicates medium suitability, and green shows high suitability.



5.5. Step 3: Multi-criteria analysis to determine EbA measures per value chain and surface area suitability

The multicriteria analysis for value chains used inputs from stakeholder consultations including local/regional community consultations (described in Annex 7: SEP) as well as a technical workshop that took place in June 27th and included 42 experts from various organisations, as well as an extensive literature review on agricultural resilience in the SHAP region (see Appendix 2 of this analysis for the full list of participants). The EbAs

that were mentioned from the stakeholder consultations that would increase resilience of value chains were given a higher weighting (2) than those purely identified in literature (1). The table below details the EbA measures considered for the three value chains and their weighting.

Table 4- EbAs per value chain and their weighting

#	EbA measure	Abbreviation	Value Chain 1 Vicuñas/Alpacas	Value Chain 2 High Andean Crops	Value Chain 3 Community-basedtourism
1	Restoration and conservation of *bofedales*	Rbf	2	2	2
2	Family *Qochas*	Qo	2	2	2
3	Infiltration trenches	Zin	2	1	0
	Integrated soil fertility management	Mfs	0	2	0
	Contour farming	Agc	0	1	0
6	Sustainable pasture management	Mp	2	0	0
7	Conservation agriculture	Acs	0	1	0
8	Agroforestry	Agf	1	1	0
9	Restoration of forests with native species	Rbq	1	0	1
10	*Andenes* and terrace restorations	Rat	0	2	2

Then, three categories were used to describe the territory and surface area suitable for EBA measures and each value chain, using data from Stage 2, as shown below.

Table 5- Classifications to determine suitability of hectares for EbA and value chain investments

Category	Description
Not favourable	No aplicable EbA measures
Moderately unfavourable	Predominately “Low” suitability of EbAs, and/or a “Medium “ EbA measure.
Favourable	2 EbA measures with “high” suitability and/or a “High” one.
Very favourable	3 EbA measures with “high” suitability and/or a “medium” ones.

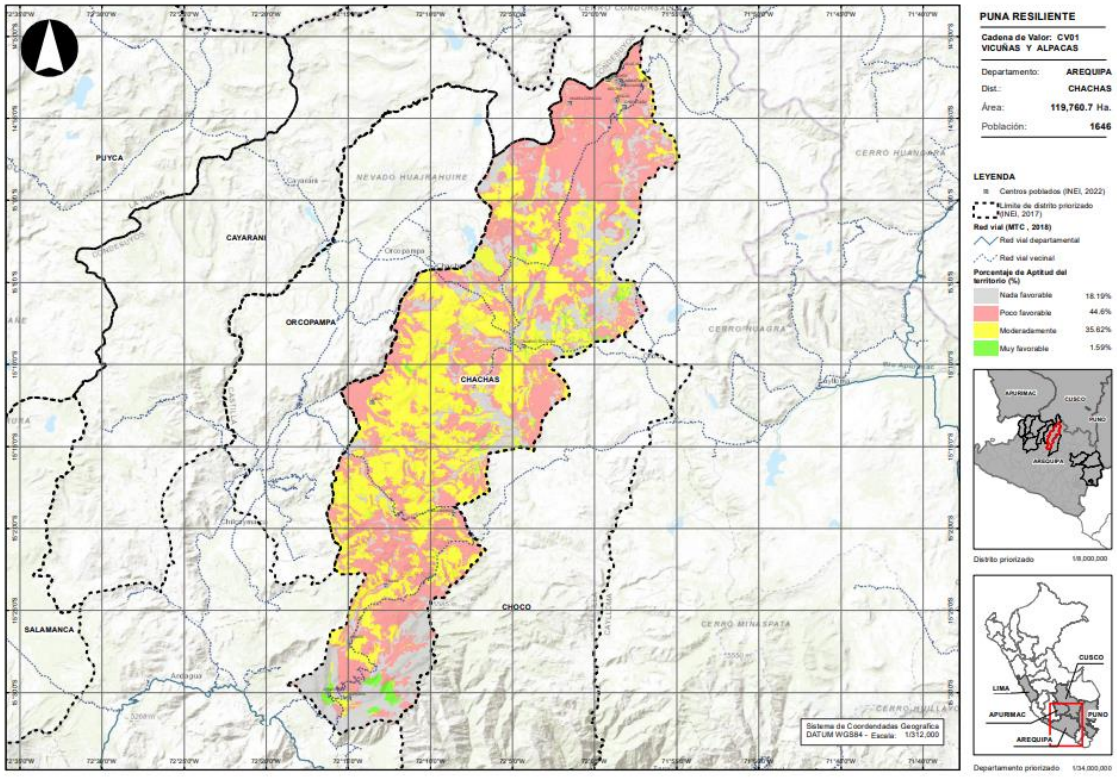
The result of this analysis shown the level of suitability of hectares per district, per EbAs and value chain. For example, conservation and restoration of *Bofedales* was identified as a suitable measure to make Value Chain 1 “Vicuñas/Alpacas” production more resilient, rated as “2”, as seen on Table 4. Other EbA measures determined as suitable for Value Chain 1 are: *Qochas* (EbA 2), infiltration trenches, sustainable pasture management, restoration of forests with native species, restoration of *andenes* and terraces (refer to Table 4).

Table 6- Suitable hectares for strengthening Value Chain 1 resilience, per region (only moderately favourable and very favourable shown). See section 13 for more detail.

Region	Favourable (ha)	Very favourable (ha)	Total	% of territory with best suitability
PUNO	398,523.82	59,821.65	458,345,47	31.0%
CUSCO	327,817.65	57,665.63	385,483,28	26.1%
APURIMAC	297,550.88	26,697.45	324,248,33	22.0%
AREQUIPA	216,532.43	21,408.28	237,940,71	16.1%
LIMA	66,830.78	3310.64	70,141,42	4.8%
			1,476,159.21	100.0%

Maps have been produced (in Spanish) and have been annexed as supplementary material 1, showing the location and surface area per value chain in relation to EbAs. An example for Value Chain 1 suitability in the Chachas district in Arequipa is shown in Figure 3.

Figure 3- Map of Chachas, Arequipa, showing the suitability for measures to increase the resilience of the camelid value chain (Value Chain 1). Areas in green designate very favourable areas, areas in yellow designate favourable areas.



The following sections presents the results of the analysis described above, for technical and implementation information on the EBA measures, please refer to the Feasibility Study (Section 9.2)

6. EbA 1: *Bofedal* restoration and conservation

6.1. Variables used for cartographic analysis and their weighting

As part of the analysis, the largest wetlands have been prioritized, as it is understood that this is a condition that allows us to recognize areas with a greater territorial predisposition for the implementation of the EbA measure. However, this does not rule out that the EbA measure "Bofedal restoration and conservation" could be considered in smaller wetlands than those prioritized in this first phase of macro analysis, in an integrated manner with other complementary EbA measures identified in a smaller scale analysis phase.

Weight	Variable 1: Bofedal size		
20%	Area lower than 0.2ha	Low	1
	Area between 0.2- 0.7ha	Medium	2
	Area greater than a0.7ha	High	3

Weight	Variable 2: Coincidencia en registro de bofedales 2015-2021		
40%	Low INAGEIN-MINAM similarity	Low	1
	Medium INAGEIN-MINAM similarity	Medium	2
	High INAGEIN-MINAM similarity	High	3

Weight	Variable 3: Altitude		
40%	Lower than 3500 m above sea level	Medium	2
	Greater than 3500m above sea level	High	3

6.2. Surface area suitable for EbA 1 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
AREQUIPA	**178.37**	**56,994.32**	**18,040.81**	**75,213.50**
SAN ANTONIO DE CHUCA	0.61	12,279.95	993.98	13,274.53
PUYCA	66.17	7,591.35	3,112.35	10,769.86
CAYARANI	24.26	7,298.51	2,698.33	10,021.10
SAN JUAN DE TARUCANI	0.78	6,583.95	1,334.41	7,919.14
CHACHAS	16.99	5,360.12	736.41	6,113.52
YANQUE	3.02	4,453.32	1,574.78	6,031.11
PAMPAMARCA	12.02	2,712.61	2,212.12	4,936.74
HUAYNACOTAS	34.92	2,722.57	1,638.03	4,395.52
ORCOPAMPA	1.91	3,090.60	1,087.04	4,179.55
CHOCO	11.58	3,287.99	480.51	3,780.08
SALAMANCA	6.12	1,409.15	2,172.86	3,588.13
COTAHUASI		204.21		204.21
CUSCO	**102.68**	**32,263.06**	**17,316.41**	**49,682.15**
SANTO TOMAS	16.97	6,178.52	2,223.94	8,419.43
CHECACUPE	21.99	3,647.20	2,867.27	6,536.47
PITUMARCA	38.68	3,702.37	2,788.46	6,529.51
OCONGATE	3.01	4,140.84	1,803.21	5,947.06

District	Low (ha)	Medium (ha)	High (ha)	Total general
SICUANI	2.81	1,791.92	2,659.99	4,454.72
LAYO		2,800.60	1,119.33	3,919.93
MARANGANI	4.32	1,493.66	1,090.07	2,588.05
SAN PABLO	5.33	1,161.87	1,375.43	2,542.63
MARCAPATA	7.47	1,959.10	474.61	2,441.18
LARES		1,173.90		1,173.90
QUIQUIJANA		672.07	219.37	891.44
OLLANTAYTAMBO	0.14	535.60	180.48	716.22
CUSIPATA	0.91	228.94	295.77	525.62
PAUCARTAMBO		490.70		490.70
CCARHUAYO	0.76	488.87		489.63
CHALLABAMBA		459.75		459.75
LIMATAMBO	0.29	266.11	139.26	405.65
CALCA		269.56		269.56
HUAROCONDO		178.74	57.83	236.56
PISAC		201.02		201.02
ACOMAYO		177.86	12.53	190.38
LAMAY		165.37		165.37
SAN SALVADOR		78.51	8.87	87.38
PUNO	**57.96**	**28,767.48**	**20,780.72**	**49,606.16**
NUÑOA	24.23	9,074.65	11,059.05	20,157.93
SANTA ROSA	3.44	6,185.90	2,000.20	8,189.54
MACUSANI	11.03	3,762.02	1,677.72	5,450.77
CORANI	14.26	1,491.19	2,670.73	4,176.18
ANTAUTA	1.50	2,094.36	1,344.65	3,440.51
POTONI		2,345.08	1,006.57	3,351.65
CRUCERO	0.49	1,746.33	378.83	2,125.65
AJOYANI	2.13	1,174.66	375.05	1,551.84
CUYOCUYO	0.87	893.30	267.92	1,162.09
APURIMAC	**21.45**	**8,924.94**	**5,021.01**	**13,967.40**
OROPESA	13.35	3,976.04	2,893.63	6,883.02
ANTABAMBA	7.98	1,787.58	586.54	2,382.10
HUAQUIRCA	0.12	519.10	380.44	899.66
LAMBRAMA		512.59	351.72	864.31
HAQUIRA		654.33	190.25	844.59
CHUQUIBAMBILLA		469.21	220.26	689.47
PATAYPAMPA		319.48	199.31	518.80
PROGRESO		333.19	143.41	476.60
ABANCAY		294.70	55.44	350.15
TAMBURCO		58.71		58.71
LIMA	**1.10**	**1,141.80**	**1,191.16**	**2,334.06**
LARAOS	0.45	429.70	960.30	1,390.45
TOMAS		478.43	112.62	591.05
MIRAFLORES	0.65	198.20	118.24	317.09

District	Low (ha)	Medium (ha)	High (ha)	Total general
CARANIA		35.47		35.47
Total general	**361.56**	**128,091.60**	**62,350.11**	**190,803.27**

7. EbA 2: *Qochas*

7.1. Variables used for geospatial analysis and their weighting

When considering geospatial data for lakes provided by MINAM, we established three key variables. Of utmost importance are lakes that possess the ability to recharge aquifers, experience rainy climates during certain seasons of the year, and are in proximity to a *bofedal*. Among these variables, the first two carry the highest weight, each accounting for 40% of the evaluation.

Although qochas can be implemented prioritizing their storage function ("water harvesting") or their infiltration function ("water seeding"), in this case the permeability of the substrate has been weighted through Variable 1 "Hydrigeology of the qocha", considering the benefits that infiltration presents, not only in the water availability of the middle and lower basin, but also directly in the environment itself of the intervention in the upper basin, improving the soil structure and consequently, the substrate for crops, both for the nutrients that the water provides, which favor growth, as well as for the contribution of oxygen, which favors the speed of absorption of nutrients. In the medium term, all this in turn has an impact on improving the soil's water retention capacity, reducing erosion and increasing fertility.

Weighting	Variable 1: Hydrogeology of the *qocha*		
40%	Aquitard (slow filtration semi-permeable)	Low	1
	Aquifer (Good permeability for planting and harvesting water)	High	3

Weighting	Variable 2: Climate of the *qocha*		
40%	Semi-dry with rain deficiency (CD)	Low	1
	Seasonal rainy (B)	Half	2
	Rainy all year (A) (*)	High	3

Weighting	Variable 3: Proximity to wetlands		
20%	More than 2km from a *bofedal*	Half	2
	At the same or less distance of 2km from a *bofedal*	High	3

(*) Although there is a certain level of rainfall throughout the year, in the work areas prioritized by the project, the volume of rainfall is usually insufficient to meet the water demand of crops and other livelihoods. However, since these are small-scale micro-infrastructure storage

facilities, the existence of rainfall would facilitate regular storage throughout the year and, therefore, their constant use.

7.2. Surface area suitable for EbA 2 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
CUSCO		**1,778.96**	**5,262.33**	**7,041.29**
LARES		413.97		413.97
MARCAPATA		318.03	13.20	331.23
CALCA		146.83		146.83
PITUMARCA		132.52	3,420.33	3,552.85
SANTO TOMAS		105.01	185.93	290.94
OCONGATE		101.39	509.08	610.46
MARANGANI		99.12	63.04	162.15
CHECACUPE		86.97	422.83	509.80
PISAC		58.54		58.54
CHALLABAMBA		52.77		52.77
OLLANTAYTAMBO		49.20	1.39	50.59
LAYO		47.91	128.13	176.04
CCARHUAYO		42.60	1.30	43.90
LAMAY		28.60		28.60
PAUCARTAMBO		26.75		26.75
CUSIPATA		24.09	12.01	36.10
SICUANI		14.67	431.51	446.18
SAN SALVADOR		7.91	5.25	13.16
QUIQUIJANA		7.50	46.36	53.85
ACOMAYO		6.06		6.06
SAN PABLO		4.86	15.93	20.79
HUAROCONDO		3.02	5.43	8.44
LIMATAMBO		0.65	0.62	1.27
AREQUIPA	**468.59**	**4,286.70**	**2,167.97**	**6,923.26**
SAN JUAN DE TARUCANI	175.25	1,205.21	12.18	1,392.64
CHACHAS	90.93	901.55	1,210.68	2,203.16
PUYCA	5.04	658.73	492.67	1,156.44
CAYARANI	28.71	549.09	194.71	772.52
HUAYNACOTAS		283.57	0.78	284.36
ORCOPAMPA	3.42	237.96	114.60	355.99
SAN ANTONIO DE CHUCA	8.14	180.96	0.31	189.42
SALAMANCA	50.89	122.06	138.00	310.95
CHOCO	30.21	68.38	2.43	101.01
YANQUE	76.00	52.27		128.27
PAMPAMARCA		23.33	1.60	24.93
COTAHUASI		3.58		3.58

District	Low (ha)	Medium (ha)	High (ha)	Total general
PUNO		**2,844.64**	**2,911.85**	**5,756.49**
CRUCERO		1,150.20	890.06	2,040.26
CUYOCUYO		1,062.95	45.82	1,108.77
CORANI		344.30	52.57	396.87
MACUSANI		116.90	1,146.57	1,263.46
SANTA ROSA		71.84	1.16	73.00
ANTAUTA		55.61	80.92	136.53
NUÑOA		19.65	397.31	416.97
AJOYANI		17.42	265.89	283.31
POTONI		5.76	31.55	37.32
APURIMAC		**1,010.05**	**370.66**	**1,380.72**
HAQUIRA		280.13		280.13
OROPESA		226.61	350.18	576.78
LAMBRAMA		205.59	2.47	208.06
CHUQUIBAMBILLA		89.53	2.28	91.82
ABANCAY		60.49		60.49
ANTABAMBA		58.07	4.05	62.12
HUAQUIRCA		39.09	0.67	39.75
PATAYPAMPA		34.68	0.46	35.14
TAMBURCO		9.81		9.81
PROGRESO		6.06	10.55	16.62
LIMA	**12.22**	**756.08**	**388.66**	**1,156.96**
LARAOS	12.22	274.73	304.86	591.81
TOMAS		268.13	64.63	332.75
MIRAFLORES		150.34	19.17	169.51
CARANIA		62.88		62.88
Total general	**480.81**	**10,676.43**	**11,101.47**	**22,258.71**

8. EbA 3: Integrated Soil Fertility Management

8.1. Variables used for geospatial analysis and their weighting

Within this assessment, three variables were taken into consideration: vegetation cover type, hydrogeology, and altitude. Based on these factors, areas with diverse vegetation, notable aquifer infiltration capacity, and an altitude exceeding 3500 m above sea-level are given higher weight. Among these variables, vegetation cover holds the greatest significance, carrying a weight of 70% in the evaluation.

Weighting	Variable 1: Plant cover		
70%	Pastureland	Low	1
	permanent crop	Half	2
	Crops with concentration of species	High	3

Weighting	Variable 2: Hydrogeology

20%	Aquitard (slow filtration semi-permeable)	Low	1
	Aquifer (Good permeability for water seeding)	High	3

Weighting	Variable 3: Altitude (masl)		
10%	Buffer area (less than 3500 masl)	Low	1
	Direct area of the PUNA project (greater than 3500 masl)	High	3

8.1. Surface area suitable for EbA 3 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
PUNO	**43,995.67**	**400,289.15**	**25,055.59**	**469,340.41**
NUÑOA	6,492.43	123,640.41	6,750.90	136,883.74
CRUCERO	7,847.78	51,652.19	1,029.55	60,529.51
ANTAUTA	556.80	55,791.33	1,943.90	58,292.02
POTONI	270.99	54,421.98	1,159.67	55,852.64
MACUSANI	9,762.08	40,079.88	2,092.82	51,934.77
SANTA ROSA	12,566.22	15,441.97	11,263.18	39,271.37
AJOYANI	619.49	33,604.72		34,224.21
CORANI	807.36	13,535.12	50.99	14,393.48
ANANEA	1,037.85	11,526.54		12,564.39
CUYOCUYO	4,034.67	595.00	764.59	5,394.27
AREQUIPA	**248,770.33**	**153,442.34**	**11,793.43**	**414,006.10**
CAYARANI	55,977.17	50,239.21	1,772.61	107,988.98
CHACHAS	52,028.40	30,321.11	531.12	82,880.63
CHOCO	38,118.17	12,733.88	350.45	51,202.51
ORCOPAMPA	38,744.95	7,707.49	1,776.98	48,229.42
SAN ANTONIO DE CHUCA	16,589.59	29,425.32		46,014.92
YANQUE	32,887.51	6,212.91	1,049.22	40,149.64
SAN JUAN DE TARUCANI	14,100.02	13,812.66	20.44	27,933.12
COTAHUASI		936.57	1,384.60	2,321.18
SALAMANCA	45.42	805.31	1,041.74	1,892.48
PUYCA	279.09	149.39	1,417.86	1,846.34
HUAYNACOTAS		269.49	1,509.32	1,778.82
PAMPAMARCA		828.98	939.08	1,768.06
CUSCO	**85,797.75**	**221,282.84**	**81,662.60**	**388,743.19**
CHECACUPE	8,762.22	42,971.36	1,837.66	53,571.23
SANTO TOMAS	24,277.30	23,133.11	4,200.74	51,611.15
PITUMARCA	5,851.57	29,964.13	892.07	36,707.77
OCONGATE	7,639.34	20,897.30	5,954.98	34,491.63
SICUANI	433.70	25,875.17	6,276.66	32,585.53

District	Low (ha)	Medium (ha)	High (ha)	Total general
SAN PABLO	794.51	24,014.61	2,488.73	27,297.85
LAYO	3,579.47	12,614.55	8,175.60	24,369.63
MARANGANI	1,571.75	10,412.37	3,810.41	15,794.53
MARCAPATA	12,377.70	3,124.40	70.28	15,572.38
PAUCARTAMBO	2,931.47	632.24	8,471.90	12,035.61
OLLANTAYTAMBO	2,927.97	3,673.78	4,424.66	11,026.41
LARES	6,093.69	2,544.29	1,551.10	10,189.08
QUIQUIJANA		3,888.77	4,919.66	8,808.43
LIMATAMBO	886.05	2,030.27	5,122.00	8,038.32
CHALLABAMBA	2,208.77	32.87	5,734.26	7,975.90
HUAROCONDO	39.72	2,477.08	4,254.99	6,771.78
CALCA	950.12	3,353.79	2,015.66	6,319.57
CUSIPATA	230.17	3,610.77	2,015.86	5,856.79
PISAC	1,411.32	785.44	2,499.27	4,696.03
ACOMAYO		1,892.06	2,437.26	4,329.32
CCARHUAYO	2,236.71	1,180.60	662.41	4,079.71
SAN SALVADOR		913.49	2,744.55	3,658.03
LAMAY	594.21	1,260.40	1,101.90	2,956.51
APURIMAC	**191,285.82**	**101,007.93**	**31,168.18**	**323,461.93**
OROPESA	76,409.15	8,598.07	1,141.05	86,148.26
ANTABAMBA	27,616.34	11,933.57	2,030.01	41,579.91
HAQUIRA	19,154.19	13,990.33	8,235.42	41,379.95
CHUQUIBAMBILLA	8,626.28	22,478.36	4,374.38	35,479.02
LAMBRAMA	18,689.89	9,025.67	3,695.04	31,410.60
HUAQUIRCA	17,886.15	10,160.37	1,535.95	29,582.47
PROGRESO	9,042.17	11,177.87	924.74	21,144.78
ABANCAY	7,274.47	5,453.69	6,882.82	19,610.99
PATAYPAMPA	6,587.19	5,814.80	877.33	13,279.32
TAMBURCO		2,375.19	1,471.44	3,846.63
LIMA	**16,100.33**	**50,240.98**	**1,160.50**	**67,501.81**
TOMAS	586.68	25,945.25	50.28	26,582.21
LARAOS	5,401.20	17,517.75	255.40	23,174.35
MIRAFLORES	6,673.38	4,766.70	356.21	11,796.29
CARANIA	3,439.06	2,011.28	498.62	5,948.96
Total general	**585,949.90**	**926,263.24**	**150,840.31**	**1,663,053.44**

9. EbA 4: Contour farming

9.1. Variables used for geospatial analysis and their weighting

The assessment was centered around the layer of agricultural crops, considering three key variables: slope, hydrogeology, and altitude. Among these, areas with slopes ranging from 5% to 18%, significant aquifer water infiltration, and an altitude exceeding 3500 meters above sea level, are of particular interest. The most influential variable in this regard was the slope, which held a weight of 70% in the evaluation.

Weighting	Variable 1: Slope		
60%	< 5% , > 18%	Low	1
	> 5% and <18%	High	3

Weighting	Variable 2: Hydrogeology		
30%	Aquitard (slow filtration semi-permeable)	Low	1
	Aquifer (Good permeability for water seeding)	High	3

Weighting	Variable 3: Altitude (masl)		
10%	Buffer area (less than 3500 masl)	Low	1
	Direct area of the PUNA project (greater than 3500 masl)	High	3

9.2. Surface area suitable for EbA 4 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
CUSCO	**41,372.97**	**40,695.65**	**17,162.69**	**99,231.31**
OCONGATE	1,437.22	1,149.92	6,526.84	9,113.99
PAUCARTAMBO	9,104.08	0.05		9,104.14
LAYO	45.10	2,423.72	6,199.03	8,667.84
SICUANI	1,677.22	5,619.81	278.37	7,575.39
LIMATAMBO	4,923.48	1,837.69	0.00	6,761.17
QUIQUIJANA	4,029.25	1,985.63	609.83	6,624.72
CHALLABAMBA	5,762.89	4.23		5,767.12
HUAROCONDO	2,098.06	3,455.17	0.25	5,553.48
OLLANTAYTAMBO	3,152.39	2,270.30	91.01	5,513.70
SANTO TOMAS	2,955.66	1,654.10	109.77	4,719.53
MARANGANI	57.28	2,332.47	2,074.93	4,464.68
CALCA	16.71	3,059.16	396.67	3,472.53
SAN SALVADOR		3,306.78	33.67	3,340.44
PISAC	982.45	1,998.05	8.22	2,988.71
ACOMAYO	392.36	2,260.08	18.61	2,671.05
SAN PABLO	193.99	2,422.41	40.59	2,656.99
CUSIPATA	891.76	1,216.16	515.91	2,623.84
CHECACUPE	891.51	1,101.44	170.93	2,163.88
LARES	1,035.31	515.79		1,551.10
LAMAY	5.72	1,356.37	10.36	1,372.45
CCARHUAYO	1,084.72	256.94	10.62	1,352.28
PITUMARCA	568.03	466.88	67.08	1,102.00
MARCAPATA	67.77	2.51		70.28
APURIMAC	**11,610.91**	**29,862.33**	**399.97**	**41,873.21**
ABANCAY	3,251.06	6,784.42	4.17	10,039.66
HAQUIRA	559.46	8,682.65	113.51	9,355.62

District	Low (ha)	Medium (ha)	High (ha)	Total general
LAMBRAMA	3,704.07	2,067.10	0.48	5,771.64
CHUQUIBAMBILLA	811.39	4,617.25	24.33	5,452.97
ANTABAMBA	882.93	1,965.17	227.58	3,075.68
HUAQUIRCA	179.98	2,500.90	28.91	2,709.78
TAMBURCO		1,744.83		1,744.83
OROPESA	1,621.77	14.92		1,636.69
PATAYPAMPA	23.73	1,104.02		1,127.75
PROGRESO	576.52	381.08	0.98	958.58
PUNO	**1,962.67**	**18,696.48**	**5,331.16**	**25,990.32**
SANTA ROSA	1,198.08	8,376.43	2,583.48	12,157.99
NUÑOA		6,361.43	389.47	6,750.90
MACUSANI		992.76	1,100.06	2,092.82
ANTAUTA		1,888.61	95.20	1,983.81
POTONI		387.42	772.25	1,159.67
CRUCERO		638.85	390.70	1,029.55
CUYOCUYO	764.59			764.59
CORANI		50.99		50.99
AREQUIPA	**7,449.75**	**7,233.83**	**882.00**	**15,565.58**
COTAHUASI	869.05	1,271.34	180.78	2,321.18
CAYARANI	464.83	1,163.67	345.07	1,973.57
ORCOPAMPA	1,340.97	551.83		1,892.80
SALAMANCA	831.51	1,013.16		1,844.66
HUAYNACOTAS	1,402.69	362.42	13.71	1,778.82
PAMPAMARCA	329.79	1,241.58	196.69	1,768.06
PUYCA	1,306.79	110.10	0.97	1,417.86
YANQUE	446.99	700.33	124.35	1,271.67
CHACHAS	368.74	281.03		649.77
CHOCO	88.40	538.36		626.76
SAN JUAN DE TARUCANI			20.44	20.44
LIMA	**463.76**	**890.76**	**13.70**	**1,368.23**
CARANIA	188.74	462.13		650.87
MIRAFLORES	94.67	303.30	13.70	411.67
LARAOS	180.35	75.06		255.40
TOMAS		50.28		50.28
Total general	**62,860.06**	**97,379.06**	**23,789.52**	**184,028.64**

10. EbA 5: Infiltration ditches

10.1. Variables used for geospatial analysis and their weighting

This assessment considered account the land cover layer involving agricultural, forestry, and pasture areas. Among these, the forestry cover was deemed most important, as it has higher soil formation capabilities, along with its water infiltration capacity (aquifers) and slopes ranging from 10 to 40%.

The primary determining factor was the slope, carrying a weight of 40% in the evaluation, while the other two variables hold equal importance, each with a value of 30%.

Infiltration ditches can also be implemented as complementary actions to other EbA measures such as qochas, or around plantations and cultivation areas. The variables prioritized in this cartographic analysis do not limit their consideration in these more specific contexts, as a result of smaller scale analyses that allow their relevance to be evaluated.

Weighting	Variable 1: Land use		
30%	Pajonal or pasture (soil degradation due to livestock activity)	Low	1
	Agricultural crops	Half	2
	Forest (soils with greater fixation)	High	3

Weighting	Variable 2: Hydrogeology		
30%	Aquitard (slow filtration semi-permeable)	Low	1
	Aquifer (Good permeability for water seeding)	High	3

Weighting	Variable 3: Slope		
40%	<10%	Null	0
	10-20%	Low	1
	20-30%	Half	2
	>30%	High	3

10.2. Surface area suitable for EbA 5 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
CUSCO	**78,410.76**	**696,516.26**	**4,705.71**	**779,632.72**
PAUCARTAMBO	1,161.38	87,065.12		88,226.50
MARCAPATA		86,795.23		86,795.23
SANTO TOMAS	16,248.55	55,712.00		71,960.56
PITUMARCA	23,184.94	44,315.79		67,500.73
CHECACUPE	23,127.67	41,097.08		64,224.75
LARES		51,501.34		51,501.34
OCONGATE	12,196.74	33,031.56		45,228.30
CHALLABAMBA		42,132.21		42,132.21
SAN PABLO		35,415.15		35,415.15
SICUANI		33,551.03		33,551.03
LAYO	1,288.49	28,435.20		29,723.69
OLLANTAYTAMBO		26,742.84	2.49	26,745.33
MARANGANI	14.19	24,422.96		24,437.15
LIMATAMBO		15,109.71	4,575.83	19,685.54
CCARHUAYO		19,083.71		19,083.71

District	Low (ha)	Medium (ha)	High (ha)	Total general
QUIQUIJANA		17,188.32		17,188.32
CALCA		14,797.87	127.38	14,925.26
CUSIPATA	340.24	14,188.47		14,528.71
HUAROCONDO		8,300.96		8,300.96
PISAC	472.82	5,792.92		6,265.74
ACOMAYO	0.07	5,124.55		5,124.62
LAMAY	375.57	3,267.61		3,643.18
SAN SALVADOR	0.10	3,444.62		3,444.72
PUNO	**167,391.77**	**481,005.42**	**1,687.18**	**650,084.37**
NUÑOA	28,409.67	158,156.34	1,597.30	188,163.31
MACUSANI	22,677.51	58,529.85	28.66	81,236.01
CRUCERO	51,001.81	14,469.15		65,470.96
SANTA ROSA	11,153.23	50,205.63		61,358.86
ANTAUTA	16,084.42	43,877.21		59,961.62
POTONI	15,298.59	44,581.90		59,880.49
CORANI	1,198.46	54,416.12	61.23	55,675.82
AJOYANI	4,906.81	35,089.13		39,995.93
CUYOCUYO	16,661.27	21,680.09		38,341.36
AREQUIPA	**313,876.29**	**186,445.11**	**5,672.35**	**505,993.76**
SAN JUAN DE TARUCANI	118,927.83	25,636.31		144,564.14
PUYCA	18,172.10	37,352.50	315.03	55,839.63
SALAMANCA	38,648.59	3,950.18	748.63	43,347.40
CHACHAS	10,406.44	30,671.31	731.24	41,808.99
SAN ANTONIO DE CHUCA	39,121.43	2,164.43		41,285.86
YANQUE	33,055.52	7,166.08	51.09	40,272.69
HUAYNACOTAS	6,134.16	32,006.22	61.94	38,202.32
CAYARANI	19,481.36	14,570.30		34,051.66
PAMPAMARCA	8,860.27	13,824.08	613.98	23,298.32
CHOCO	2,566.74	14,883.25	2,671.10	20,121.10
ORCOPAMPA	15,787.26	2,779.17		18,566.43
COTAHUASI	2,714.59	1,441.28	479.34	4,635.21
APURIMAC	**21,365.14**	**277,575.73**	**22,016.42**	**320,957.29**
OROPESA	2,149.51	83,675.57		85,825.08
ANTABAMBA	1,829.17	37,694.63	1,509.10	41,032.90
HAQUIRA	6,129.23	28,413.31	2,763.68	37,306.23
CHUQUIBAMBILLA		31,299.20	2,922.00	34,221.19
LAMBRAMA	505.68	29,740.09	2,217.45	32,463.22
HUAQUIRCA	8,175.38	18,903.76	2,163.36	29,242.51
ABANCAY		14,509.02	8,210.95	22,719.97
PROGRESO	37.09	20,471.30	68.56	20,576.95
PATAYPAMPA	2,539.08	9,953.35	678.51	13,170.94
TAMBURCO		2,915.50	1,482.81	4,398.31
LIMA	**3,523.12**	**63,584.55**	**1,296.08**	**68,403.74**
TOMAS	13.17	26,534.90		26,548.07

District	Low (ha)	Medium (ha)	High (ha)	Total general
LARAOS	3,509.95	19,962.01	620.42	24,092.37
MIRAFLORES		11,583.88	141.53	11,725.41
CARANIA		5,503.77	534.12	6,037.89
Total general	**584,567.08**	**1,705,127.07**	**35,377.74**	**2,325,071.88**

11. EbA 6: Sustainable grassland management

11.1. Variables used for geospatial analysis and their weighting

This assessment was based on the grassland layer of the EEZ and the vegetation cover. Two variables that were taken into account include: vegetation cover and altitude.

Regarding Variable 1: Natural pastures (ZEE-Plant cover), its categories allude to the natural suitability of the physical environment for the development and cultivation of pastures, and therefore, a favorable aptitude for the implementation of EbA 6.

As a result, areas with potential for natural or cultivated pastures, along with some water resources or agroecological potential, and an altitude higher than 3500m above sea level are given more weight. The determining factor in this evaluation is the vegetation cover, carrying a weight of 60%, while altitude holds a weight of 40%.

Weighting	Variable 1: Natural pastures (ZEE – Plant cover)		
60%	Areas for agroecological quality pastures leave associated with protection	Low	1
	Andean grassland (Lima and Apurimac vegetation cover) Area with aptitude for the protection of natural or cultivated pastures, medium agroecological quality or livestock potential	Half	2
	Area suitable for the production of natural or cultivated pastures with Underground Water Potential, high agroecological quality or bioecological value	High	3

Weighting	Variable 2: Altitude		
40%	Buffer area (<3500 masl)	Low	1
	Potential area for resilient PUNA project (>3500masl)	High	3

11.2. Surface area suitable for EbA 6 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
PUNO	**197.48**	**447,843.23**	**6,296.70**	**454,337.41**
NUÑOA		135,198.21		135,198.21
CRUCERO		60,479.27		60,479.27
ANTAUTA		58,195.79	6.25	58,202.04
POTONI		55,819.98		55,819.98
MACUSANI		45,850.78	4,847.48	50,698.25
AJOYANI		34,191.35	32.87	34,224.21
SANTA ROSA		28,051.75		28,051.75
CORANI		14,342.48		14,342.48
ANANEA		12,564.39		12,564.39
CUYOCUYO	197.48	3,149.22	1,410.10	4,756.80
AREQUIPA	**382.20**	**319,458.13**	**80,260.52**	**400,100.86**
CAYARANI		93,584.62	13,291.52	106,876.13
CHACHAS	159.48	73,220.80	8,901.36	82,281.64
CHOCO	207.01	42,607.91	7,770.60	50,585.52
ORCOPAMPA		36,879.94	9,842.49	46,722.43
SAN ANTONIO DE CHUCA		21,116.15	24,898.77	46,014.92
YANQUE	15.71	30,397.85	8,817.66	39,231.23
SAN JUAN DE TARUCANI		21,204.97	6,707.71	27,912.68
PUYCA		398.75	29.74	428.49
SALAMANCA		47.13	0.68	47.81
CUSCO	**19,823.87**	**224,913.68**	**49,690.32**	**294,427.86**
CHECACUPE	6,872.88	40,329.38	4,219.98	51,422.24
SANTO TOMAS	4,714.11	35,868.43	6,855.96	47,438.50
PITUMARCA	2,614.98	29,868.36	3,146.83	35,630.17
OCONGATE	303.13	21,010.15	5,419.10	26,732.38
SICUANI	281.96	19,079.57	5,656.20	25,017.73
SAN PABLO	3,952.53	19,177.55	1,525.83	24,655.92
LAYO	2.52	14,854.78	1,967.89	16,825.19
MARCAPATA	14.59	8,309.25	7,178.26	15,502.10
MARANGANI	783.88	8,087.92	2,674.43	11,546.23
LARES		5,258.86	3,965.18	9,224.03
OLLANTAYTAMBO	7.00	4,103.70	1,929.44	6,040.15
CUSIPATA	275.12	2,103.89	853.95	3,232.96
PAUCARTAMBO		2,005.51	926.55	2,932.05
CALCA		2,256.00	591.03	2,847.04
CCARHUAYO		1,739.54	1,051.34	2,790.88
CHALLABAMBA		2,208.77		2,208.77
QUIQUIJANA		1,605.55	595.19	2,200.74
PISAC		1,724.96		1,724.96
ACOMAYO		1,632.88	69.14	1,702.02
LAMAY		1,584.06		1,584.06
HUAROCONDO		701.01	778.48	1,479.49
LIMATAMBO		1,084.92	285.53	1,370.45

District	Low (ha)	Medium (ha)	High (ha)	Total general
SAN SALVADOR	1.16	318.63		319.79
APURIMAC	**90.35**	**285,106.01**		**285,196.37**
OROPESA	5.95	84,676.34		84,682.29
ANTABAMBA		38,934.69		38,934.69
HAQUIRA		33,170.24		33,170.24
CHUQUIBAMBILLA		30,811.65		30,811.65
HUAQUIRCA		27,078.53		27,078.53
LAMBRAMA	59.92	25,713.64		25,773.56
PROGRESO	21.51	20,486.88		20,508.39
PATAYPAMPA	0.32	12,414.52		12,414.84
ABANCAY	2.66	9,684.66		9,687.32
TAMBURCO		2,134.86		2,134.86
LIMA	**0.08**	**66,197.06**		**66,197.14**
TOMAS		26,548.07		26,548.07
LARAOS		22,920.81		22,920.81
MIRAFLORES		11,419.19		11,419.19
CARANIA	0.08	5,308.99		5,309.07
Total general	**20,493.98**	**1,343,518.12**	**136,247.54**	**1,500,259.63**

12. EbA 7: Conservation agriculture

12.1. Variables used for geospatial analysis and their weighting

This assessment was based on the agriculture layer and took into account three essential variables: the intensity of erosion, the diversity of crops, and the hydrogeology. The areas of highest importance for agriculture conservation were those where severe erosion intensity exists, have a mix of three crop types, and have significant aquifer infiltration capacity. The primary determining factor in this evaluation was erosion, carrying a weight of 50%, followed by crops at 30%, and finally, hydrogeology with a weighting of 20%.

Weighing	Variable 1: Intensity of soil erosion		
50%	light	Low	1
	moderate	Half	2
	severe	High	3

Weighing	Variable 2: Variety of crops (potato, corn,)		
30%	Low (1 type)	Low	1
	Media (2 types)	Half	2
	High (3 types)	High	3

Weighing	Variable 3: Hydrogeology		
20%	Aquitard (slow filtration semi-permeable)	Low	1
	Aquifer (good permeability for water seeding)	High	3

12.2. Surface area suitable for EbA 7 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
CUSCO	**11,979.76**	**67,132.37**	**20,119.18**	**99,231.31**
OCONGATE	817.98	8,030.97	265.04	9,113.99
PAUCARTAMBO	281.32	8,822.82		9,104.14
LAYO	584.34	8,083.50		8,667.84
SICUANI	774.94	4,420.43	2,380.02	7,575.39
LIMATAMBO	187.71	5,450.32	1,123.14	6,761.17
QUIQUIJANA	376.38	5,609.81	638.53	6,624.72
CHALLABAMBA	2,577.91	3,189.21		5,767.12
HUAROCONDO	523.50	2,500.75	2,529.22	5,553.47
OLLANTAYTAMBO	1,240.65	3,805.61	467.44	5,513.70
SANTO TOMAS	1,934.65	2,133.68	651.19	4,719.53
MARANGANI	193.64	1,901.42	2,369.62	4,464.68
CALCA	16.71	2,669.65	786.17	3,472.53
SAN SALVADOR		327.06	3,013.38	3,340.44
PISAC	999.81	700.14	1,288.76	2,988.71
ACOMAYO		2,671.05		2,671.05
SAN PABLO	169.86	1,368.83	1,118.30	2,656.99
CUSIPATA	55.20	880.73	1,687.90	2,623.84
CHECACUPE		1,372.73	791.15	2,163.88
LARES	1,041.56	509.54		1,551.10
LAMAY	5.72	625.76	740.96	1,372.45
CCARHUAYO	127.60	1,224.68		1,352.28
PITUMARCA		833.65	268.35	1,102.00
MARCAPATA	70.28			70.28
APURIMAC	**2,770.60**	**24,403.41**	**14,699.19**	**41,873.20**
ABANCAY	153.48	3,561.62	6,324.55	10,039.66
HAQUIRA	162.76	4,618.68	4,574.19	9,355.62
LAMBRAMA	54.65	4,206.54	1,510.45	5,771.64
CHUQUIBAMBILLA	386.91	4,579.03	487.02	5,452.97
ANTABAMBA	837.22	2,238.47		3,075.68
HUAQUIRCA	187.38	2,215.22	307.19	2,709.78
TAMBURCO		320.04	1,424.79	1,744.83
OROPESA	905.10	731.59		1,636.69
PATAYPAMPA	23.73	1,104.02		1,127.75
PROGRESO	59.37	828.20	71.00	958.58
PUNO	**1,883.47**	**24,021.47**	**85.38**	**25,990.32**
SANTA ROSA	1,718.30	10,427.29	12.40	12,157.99
NUÑOA		6,677.92	72.98	6,750.90
MACUSANI		2,092.82		2,092.82
ANTAUTA		1,983.81		1,983.81
POTONI		1,159.67		1,159.67

District	Low (ha)	Medium (ha)	High (ha)	Total general
CRUCERO		1,029.55		1,029.55
CUYOCUYO	165.17	599.42		764.59
CORANI		50.99		50.99
AREQUIPA	**746.19**	**11,252.00**	**3,567.39**	**15,565.58**
COTAHUASI		1,785.93	535.25	2,321.18
CAYARANI	309.86	1,288.39	375.32	1,973.57
ORCOPAMPA	164.66	1,728.14		1,892.80
SALAMANCA	241.57	1,329.72	273.37	1,844.66
HUAYNACOTAS		1,658.96	119.86	1,778.82
PAMPAMARCA	30.10	426.09	1,311.87	1,768.06
PUYCA		1,417.86		1,417.86
YANQUE		736.13	535.54	1,271.67
CHACHAS		420.57	229.20	649.77
CHOCO		439.78	186.98	626.76
SAN JUAN DE TARUCANI		20.44		20.44
LIMA		**473.09**	**895.13**	**1,368.23**
CARANIA		198.07	452.80	650.87
MIRAFLORES		94.67	317.00	411.67
LARAOS		180.35	75.06	255.40
TOMAS			50.28	50.28
Total general	**17,380.02**	**127,282.34**	**39,366.28**	**184,028.63**

13. EbA 8: Agroforestry

13.1. Variables used for geospatial analysis and their weighting

This assessment is derived from the layer encompassing agricultural and forest crops, in which three key variables were considered. These variables include the existence and high number of agricultural species (potatoand corn), the forest condition (deemed suitable where no cover exists or they are relict), and the altitude (considered suitable above 3500 masl). Among these variables, the crop concentration (over 17 species) had the highest weight at 40%, while the other two variables are equally weighted at 30% each.

Weighting	Variable 1: Existence of agricultural species (potato, corn)		
40%	Under 17	Low	1
	Over 17	High	3

Weighting	Variable 2: Forest - type		
30%	Mountainous forest	Low	1
	Interandean forest	Half	2
	No forest and relict forest	High	3

Weighting	Variable 3: Altitude (masl)		
30%	Buffer area (<3500 masl)	Low	1

	Potential area of the PUNA project (>3500 masl)	High	3

13.2. Surface area suitable for EbA 8 per district and region

District	Low (ha)	Medium (ha)	High (ha)	Total general
CUSCO	**47,826.64**	**41,936.45**	**50,694.39**	**140,457.48**
LIMATAMBO	3,831.04	7,653.47	1,266.22	12,750.73
PAUCARTAMBO	26,773.48	6,113.03	3,554.76	36,441.28
CHALLABAMBA	2,963.41	5,004.41	729.84	8,697.67
OLLANTAYTAMBO	319.21	3,500.38	1,784.13	5,603.72
HUAROCONDO		2,559.04	2,312.50	4,871.55
SAN SALVADOR		2,102.33	691.58	2,793.91
MARCAPATA	12,752.92	1,963.28	9.42	14,725.63
QUIQUIJANA		1,831.56	3,465.27	5,296.83
CALCA	69.10	1,771.02	392.76	2,232.88
CUSIPATA		1,643.84	785.96	2,429.80
ACOMAYO		1,436.38	1,518.24	2,954.62
SAN PABLO		1,148.99	1,368.62	2,517.60
CHECACUPE		1,082.25	827.12	1,909.37
LARES	1,117.47	1,063.31	732.17	2,912.95
SICUANI		1,059.76	5,857.06	6,916.82
PISAC		769.79	1,744.60	2,514.38
SANTO TOMAS		561.69	3,729.81	4,291.49
LAMAY		483.22	618.68	1,101.90
CCARHUAYO		153.05	509.36	662.41
OCONGATE		31.30	5,923.68	5,954.98
MARANGANI		4.33	3,810.41	3,814.75
LAYO			8,170.14	8,170.14
PITUMARCA			892.07	892.07
APURIMAC	**1,530.24**	**17,011.13**	**15,979.03**	**34,520.41**
ABANCAY	461.11	6,827.53	786.74	8,075.38
LAMBRAMA	1,069.13	3,074.80	906.01	5,049.95
HAQUIRA		2,193.43	6,052.79	8,246.22
TAMBURCO		1,814.68	267.21	2,081.89
CHUQUIBAMBILLA		1,623.18	2,901.73	4,524.91
HUAQUIRCA		634.84	901.11	1,535.95
OROPESA		482.96	658.09	1,141.05
ANTABAMBA		260.85	1,782.75	2,043.60
PATAYPAMPA		54.02	842.71	896.73
PROGRESO		44.85	879.89	924.74
PUNO	**387.37**	**2,062.50**	**24,936.67**	**27,386.54**
NUÑOA		1,597.30	6,747.43	8,344.73
CUYOCUYO	387.37	465.20	649.14	1,501.71
CORANI			50.99	50.99

District	Low (ha)	Medium (ha)	High (ha)	Total general
SANTA ROSA			11,263.18	11,263.18
POTONI			1,159.67	1,159.67
ANTAUTA			1,943.90	1,943.90
CRUCERO			1,029.55	1,029.55
MACUSANI			2,092.82	2,092.82
AREQUIPA		**14,972.06**	**6,076.26**	**21,048.32**
CHOCO		4,653.69	106.11	4,759.79
YANQUE		3,190.45	447.78	3,638.23
COTAHUASI		1,427.85	189.45	1,617.30
HUAYNACOTAS		1,405.81	274.85	1,680.65
CHACHAS		1,103.69	7.70	1,111.38
SALAMANCA		1,029.47	408.65	1,438.12
PAMPAMARCA		924.54	62.88	987.43
PUYCA		570.14	1,008.83	1,578.97
SAN ANTONIO DE CHUCA		569.03		569.03
CAYARANI		97.07	1,772.61	1,869.67
SAN JUAN DE TARUCANI		0.34	20.44	20.78
ORCOPAMPA			1,776.98	1,776.98
LIMA		**1,917.35**	**845.76**	**2,763.10**
LARAOS		1,253.29	169.24	1,422.53
CARANIA		471.08	338.70	809.78
MIRAFLORES		192.98	287.53	480.51
TOMAS			50.28	50.28
Total general	**49,744.25**	**77,899.49**	**98,532.11**	**226,175.85**

14. EbA 9: Forest restoration with native species

14.1. Variables used for geospatial analysis and their weighting

This assessment is centred around the vegetation cover of relict forests, as the primary objective is to restore existing forests rather than creating new forest areas. Essentially, two key variables are applied: the type of forest (with high Andean relict forest being the most suitable) and the altitude. The determining variable in this context is the vegetation cover, carrying a weight of 70%, while the remaining variables hold a weight of 30% collectively.

Weighting	Variable 1: Vegetation cover (forest)		
70%	Mesoandean relict forest	Half	2
	high Andean relict forest	High	3

Weighting	Variable 2: Altitude (masl)		
30%	Buffer area (2300-3500masl)	Low	1
	Potential area of the PUNA project (>3500 masl)	High	3

14.2. Surface area suitable for EbA 9 per district and region

District	Medium (ha)	High (ha)	Total general
AREQUIPA	**91.68**	**4,402.94**	**4,494.62**
CHOCO	49.15	1,812.71	1,861.87
YANQUE		1,436.39	1,436.39
SAN ANTONIO DE CHUCA		565.31	565.31
CHACHAS		436.91	436.91
SALAMANCA	42.53	142.07	184.60
HUAYNACOTAS		9.20	9.20
SAN JUAN DE TARUCANI		0.34	0.34
LIMA	**12.47**	**1,605.58**	**1,618.05**
LARAOS	12.47	1,159.10	1,171.57
CARANIA		322.18	322.18
MIRAFLORES		124.30	124.30
APURIMAC	**1,196.73**		**1,196.73**
ABANCAY	586.08		586.08
TAMBURCO	581.66		581.66
LAMBRAMA	29.00		29.00
CUSCO	**96.48**	**533.80**	**630.28**
OLLANTAYTAMBO	25.77	244.10	269.86
CALCA	42.26	85.96	128.22
LARES	28.45	55.54	83.99
SAN SALVADOR		79.21	79.21
PISAC		68.99	68.99
Total general	**1,397.36**	**6,542.32**	**7,939.68**

15. EbA 10: *Andenes/* terraces restoration

15.1. Variables used for geospatial analysis and their weighting

Weighing	Variable 1: Platform status		
70%	In use	Half	2
	Abandoned	High	3

Weighing	Variable 2: Platform size		
15%	Less than 1ha	Low	1
	1-2ha	Half	2
	Greater than 2ha	High	3

Weighing	Variable 2: Altitudinal (masl)		
15%	Buffer area (2300-3500masl)	Low	1
	Potential area of the PUNA project (>3500 masl)	High	3

15.2. Surface area suitable for EbA 10 per district and region

District	Medium (ha)	High (ha)	Total general
CUSCO	**17,258.72**	**5,595.47**	**22,854.19**
PAUCARTAMBO	2,827.28	370.01	3,197.28
LARES	1,491.39	864.02	2,355.41
OLLANTAYTAMBO	1,309.73	975.94	2,285.66
QUIQUIJANA	1,829.67	423.63	2,253.29
CHECACUPE	1,396.12	103.05	1,499.17
CALCA	867.36	461.88	1,329.25
ACOMAYO	1,005.09	237.34	1,242.43
LAMAY	933.52	163.81	1,097.33
PISAC	735.73	309.47	1,045.20
LIMATAMBO	704.80	241.48	946.28
SANTO TOMAS	410.15	512.40	922.55
SAN SALVADOR	611.32	306.13	917.45
CHALLABAMBA	698.91	125.70	824.61
HUAROCONDO	525.73	82.12	607.86
CUSIPATA	526.23	61.04	587.27
CCARHUAYO	475.51	62.29	537.80
SICUANI	243.52	136.78	380.30
SAN PABLO	171.36	84.23	255.60
MARANGANI	226.95	14.06	241.00
PITUMARCA	131.57	40.95	172.53
OCONGATE	80.31	8.17	88.47
MARCAPATA	45.48	10.98	56.46
LAYO	10.99		10.99
APURIMAC	**5,130.44**	**2,866.50**	**7,996.94**
LAMBRAMA	1,262.27	810.16	2,072.44
CHUQUIBAMBILLA	1,073.28	626.16	1,699.44
HAQUIRA	1,192.96	329.86	1,522.82
HUAQUIRCA	391.17	498.49	889.66
ANTABAMBA	329.97	173.54	503.51
OROPESA	213.97	282.20	496.17
ABANCAY	277.26	45.31	322.57
TAMBURCO	265.86	11.24	277.09
PATAYPAMPA	114.06	51.72	165.78
PROGRESO	9.63	37.82	47.46
AREQUIPA	**6,714.00**	**1,259.97**	**7,973.98**
PUYCA	1,578.42	178.83	1,757.25
HUAYNACOTAS	1,030.78	246.88	1,277.66
PAMPAMARCA	864.31	285.23	1,149.54
SALAMANCA	925.74	39.67	965.41
COTAHUASI	869.88	34.41	904.29
CHACHAS	475.91	279.18	755.10
CHOCO	435.60	180.67	616.28
YANQUE	533.35	15.09	548.45

District	Medium (ha)	High (ha)	Total general
LIMA	**2,242.97**	**702.12**	**2,945.09**
LARAOS	779.20	348.50	1,127.69
CARANIA	698.84	135.14	833.99
MIRAFLORES	653.73	158.26	811.98
TOMAS	111.20	60.22	171.43
PUNO	**828.05**	**103.76**	**931.81**
CUYOCUYO	808.29	91.74	900.02
CORANI	10.42	6.91	17.32
NUÑOA	3.38	3.86	7.24
ANTAUTA	5.97	0.90	6.87
MACUSANI		0.36	0.36
Total general	**32,174.19**	**10,527.82**	**42,702.01**

The following sections will present the results of the analysis of Step 3: the multicriteria analysis to determine the areas more suitable for the implementation of relevant EBAs that will enhance value chain resilience. Please refer to the cartographies of this analysis in Supplementary Material-Maps folder submitted with this analysis.

16. Value Chain 1: Alpacas/Vicuñas

16.1. EbAs appropriate for Value Chain 1

EbA Measure	Weight
EbA 1: *Bofedal* conservation and restoration	2
EbA 2: *Qochas*	2
EbA 5: Infiltration trenches	2
EbA 6: Sustainable grassland management	2
EbA 9: Forest restoration with native species	1
EbA 10: Andenes/terraces restoration	1

16.2. Suitable hectares per district and region for Value Chain 1

In the case of the "Alpacas and Vicuñas" value chain, the department with the largest number of "very favourable" hectares within the districts prioritized by the PUNA RESILIENT project is Puno, with 59,821ha, followed by the Department of Cuzco, with 57,665ha. This is followed by Apurimac (26,697ha), Arequipa (21,408ha) and, finally, the Department of Lima with 3310ha. In the table below, the total of “favourable” and “very favourable” hectares have been grouped.

Region	Favourable (ha)	Very favourable (ha)	Total	% of territory with best suitability
PUNO	398,523.82	59,821.65	458,345,47	31.0%
CUSCO	327,817.65	57,665.63	385,483,28	26.1%
APURIMAC	297,550.88	26,697.45	324,248,33	22.0%
AREQUIPA	216,532.43	21,408.28	237,940,71	16.1%
LIMA	66,830.78	3310.64	70,141,42	4.8%
			1,476,159.21	100.0%

Districts	Not favourable (ha)	Slightly unfavourable (ha)	Slightly favourable (ha)	Favourable (ha)	Very favourable (ha)	Total general
PUNO	**108,978.67**	**18,747.80**	**215,799.45**	**398,523.82**	**59,821.65**	**801,871.38**
NUÑOA	18,331.77	1,965.66	66,301.07	113,575.17	20,921.18	221,094.85
SANTA ROSA	14,432.95	2,620.42	26,065.44	24,796.35	12,801.06	80,716.23
MACUSANI	17,250.31	3,368.38	29,385.07	42,728.77	9,431.06	102,163.60
ANTAUTA	3,340.72	695.20	5,320.22	52,121.98	4,360.59	65,838.72
POTONI	1,554.43	882.54	3,764.09	52,985.08	3,353.27	62,539.41
CUYOCUYO	11,622.06	4,171.59	17,134.51	15,914.66	2,743.45	51,586.27
CORANI	31,209.77	652.66	41,991.37	12,451.79	2,740.40	89,045.98
CRUCERO	8,940.23	4,310.64	19,741.15	51,016.04	2,032.31	86,040.36
AJOYANI	2,296.42	80.70	6,096.53	32,933.98	1,438.32	42,845.96
CUSCO	**452,871.88**	**29,671.07**	**515,394.54**	**327,817.65**	**57,665.63**	**1,383,420.78**
PITUMARCA	32,630.36	4,863.93	33,956.40	31,297.51	6,737.85	109,486.05
MARCAPATA	39,940.37	1,023.86	59,936.21	23,362.49	6,285.04	130,547.97
CHECACUPE	21,037.67	3,215.42	19,755.20	44,226.04	5,803.58	94,037.91
OCONGATE	35,600.86	7,306.25	22,047.84	24,831.52	5,301.97	95,088.44
LAYO	4,184.30	21.95	14,522.10	19,345.17	5,094.92	43,168.44
SICUANI	18,532.14	8.67	15,097.08	26,557.77	4,676.80	64,872.45
SANTO TOMAS	95,915.97	9,240.44	43,016.56	38,089.77	4,490.18	190,752.92
LARES	18,992.90	459.50	43,061.13	6,840.43	3,961.93	73,315.89
LIMATAMBO	25,110.45	903.70	15,026.57	6,712.35	2,898.34	50,651.40
OLLANTAYTAMBO	25,687.95	7.15	24,235.67	5,520.49	2,541.83	57,993.09
MARANGANI	11,891.10	347.66	17,398.89	12,090.54	2,304.07	44,032.26
SAN PABLO	10,829.89	1,263.12	15,583.28	22,608.32	2,200.99	52,485.59
HUAROCONDO	8,760.37		9,726.00	2,532.20	1,041.68	22,060.25
CUSIPATA	7,269.87	312.77	12,629.43	3,108.84	1,000.57	24,321.48
QUIQUIJANA	13,422.78		17,110.51	5,304.08	678.68	36,516.05
CALCA	13,939.46		13,780.24	2,924.88	658.13	31,302.70
PAUCARTAMBO	12,090.71	414.66	62,220.45	34,133.96	563.91	109,423.70
CCARHUAYO	9,746.34	0.76	17,260.14	2,974.96	443.95	30,426.15
CHALLABAMBA	23,892.44	47.03	41,271.16	6,116.04	243.48	71,570.15
PISAC	6,005.23	197.01	5,062.74	3,295.51	242.05	14,802.56
ACOMAYO	6,096.48		4,867.07	2,959.97	240.41	14,163.93
SAN SALVADOR	6,600.99	1.26	5,173.70	884.94	172.15	12,833.03
LAMAY	4,693.25	35.91	2,656.18	2,099.88	83.12	9,568.35
APURIMAC	**90,534.29**	**24.57**	**14,236.41**	**297,550.88**	**26,697.45**	**429,043.61**
ABANCAY	4,851.07		4,063.70	14,119.92	5,635.13	28,669.82
HAQUIRA	6,662.11		2,071.18	35,058.95	4,682.46	48,474.70
OROPESA	26,991.33	12.63	1,941.07	84,367.75	3,860.65	117,173.43

Districts	Not favourable (ha)	Slightly unfavourable (ha)	Slightly favourable (ha)	Favourable (ha)	Very favourable (ha)	Total general
CHUQUIBAMBILLA	6,635.60		859.17	31,559.57	3,513.77	42,568.12
ANTABAMBA	17,653.02	11.22	957.15	39,003.19	2,667.25	60,291.83
HUAQUIRCA	5,140.49	0.72	101.49	28,095.78	1,757.26	35,095.73
LAMBRAMA	17,672.37		4,037.78	29,464.70	1,416.90	52,591.75
TAMBURCO	986.04		110.56	2,986.38	1,376.67	5,459.65
PATAYPAMPA	1,166.24		61.86	12,327.92	1,094.66	14,650.68
PROGRESO	2,776.02		32.46	20,566.71	692.71	24,067.89
AREQUIPA	**542,707.65**	**243,881.91**	**367,014.32**	**216,532.43**	**21,408.28**	**1,391,544.58**
CHOCO	30,361.23	372.20	34,064.82	20,806.49	4,839.59	90,444.32
SAN ANTONIO DE CHUCA	65,061.52	32,769.23	25,895.67	27,035.75	3,808.04	154,570.21
CAYARANI	19,467.06	4,124.09	69,718.14	42,754.82	3,416.97	139,481.09
YANQUE	43,585.16	19,528.28	22,175.04	23,196.43	3,009.54	111,494.46
CHACHAS	21,785.77	4,253.78	49,154.20	42,662.13	1,904.83	119,760.71
ORCOPAMPA	17,484.62	3,648.57	25,512.93	25,120.62	1,195.42	72,962.16
PUYCA	82,676.73	18,107.28	43,703.76	5,149.09	843.00	150,479.86
SALAMANCA	76,583.58	38,554.61	5,219.85	3,050.97	756.38	124,165.39
SAN JUAN DE TARUCANI	73,331.47	104,811.62	40,542.67	19,898.27	551.39	239,135.41
COTAHUASI	11,531.27	2,714.32	972.41	1,034.23	426.41	16,678.64
PAMPAMARCA	50,331.63	8,848.16	16,333.06	2,903.29	378.59	78,794.74
HUAYNACOTAS	50,507.61	6,149.76	33,721.78	2,920.33	278.11	93,577.60
LIMA	**31,161.50**	**12.85**	**1,140.30**	**66,830.78**	**3,310.64**	**102,456.08**
LARAOS	15,144.66	12.61	372.97	23,710.08	1,693.20	40,933.52
CARANIA	5,880.88		256.46	5,455.07	608.71	12,201.12
TOMAS	2,149.15		251.19	26,217.61	522.16	29,140.11
MIRAFLORES	7,986.81	0.25	259.68	11,448.02	486.56	20,181.32
Total general	**1,226,253.99**	**292,338.20**	**1,113,585.03**	**1,307,255.55**	**168,903.66**	**4,108,336.42**

17. Value Chain 2: High Andean crops

17.1. EbAs appropriate for Value Chain 2

EbA Measure	Weighting
EbA 1: *Bofedal* conservation and restoration	2
EbA 2: *Qochas*	2
EbA 3: Integrated soil fertility management	2
EbA 10: Andenes/terrazas restoration	2
EbA 5: Infiltration ditches	1
EbA 4: Contour farming	1
EbA 8: Agroforestry	1

Eba 7: Conservation agriculture	1
EbA 9: Forest restoration with native species	1

17.2. Suitable hectares per district and region for Value Chain 2

Region	Not favourable (ha)	Slightly unfavourable (ha)	Slightly favourable (ha)	Very favourable (ha)	Total
LIMA	29,518.83	21,421.67	48,967.25	2,579.24	102,486.99
AREQUIPA	539,386.32	790,820.70	46,170.24	15,167.32	1,391,544.58
APURIMAC	89,419.83	201,138.63	93,659.53	44,826.14	429,044.12
PUNO	108,910.06	377,574.67	270,214.41	45,172.24	801,871.38
CUSCO	425,850.55	685,735.46	169,476.78	107,765.89	1,388,828.68
Total	**1,193,085.59**	**2,076,691.13**	**628,488.21**	**215,510.83**	**4,113,775.76**

In the case of the "High Andean Crops" value chain, the department with the highest number of "very favourable" hectares within the districts prioritized by the PUNA RESILIENT project is Cusco, with 107,765ha, followed by the Puno, with 45,172ha. This is followed by Apurimac (44,826ha), Arequipa (15,167ha) and Lima (2579ha).

DISTRITOS	Not favourable (ha)	Slightly unfavourable (ha)	favourable (ha)	Very favourable (ha)	Total (ha)
APURIMAC	**89,419.83**	**201,138.63**	**93,659.53**	**44,826.14**	**429,044.12**
ABANCAY	4,836.50	10,045.60	3,733.23	10,054.49	28,669.82
ANTABAMBA	17,580.05	27,760.56	11,502.98	3,448.24	60,291.83
CHUQUIBAMBILLA	6,441.10	8,953.15	21,337.38	5,836.48	42,568.12
HAQUIRA	6,597.09	19,333.97	12,978.13	9,566.03	48,475.22
HUAQUIRCA	5,075.14	18,268.97	8,889.99	2,861.64	35,095.73
LAMBRAMA	17,115.00	21,621.23	7,959.07	5,896.44	52,591.75
OROPESA	26,912.45	79,464.47	7,834.99	2,961.53	117,173.43
PATAYPAMPA	1,133.39	6,586.31	5,679.09	1,251.89	14,650.68
PROGRESO	2,743.06	9,087.83	11,086.73	1,150.27	24,067.89
TAMBURCO	986.04	16.53	2,657.95	1,799.13	5,459.65
AREQUIPA	**539,386.32**	**790,820.70**	**46,170.24**	**15,167.32**	**1,391,544.58**
CAYARANI	19,402.35	105,947.64	12,098.53	2,032.57	139,481.09
CHACHAS	21,654.89	84,823.88	12,652.71	629.22	119,760.71
CHOCO	30,041.82	52,612.50	6,778.03	1,011.97	90,444.32
COTAHUASI	10,858.54	3,394.14	296.72	2,129.24	16,678.64
HUAYNACOTAS	50,147.34	41,351.27	444.80	1,634.19	93,577.60
ORCOPAMPA	17,440.17	52,638.18	1,060.31	1,823.51	72,962.16
PAMPAMARCA	49,382.36	27,372.02	366.34	1,674.02	78,794.74
PUYCA	82,548.29	65,470.39	984.81	1,476.36	150,479.86
SALAMANCA	75,950.61	46,021.89	633.81	1,559.08	124,165.39
SAN ANTONIO DE CHUCA	65,061.52	84,820.04	4,686.84	1.81	154,570.21
SAN JUAN DE TARUCANI	73,331.46	164,225.07	1,555.78	23.10	239,135.41
YANQUE	43,566.96	62,143.68	4,611.56	1,172.25	111,494.46
CUSCO	**425,850.55**	**685,735.46**	**169,476.78**	**107,765.89**	**1,388,828.68**
ACOMAYO	5,144.64	4,572.69	1,754.49	2,692.11	14,163.93

DISTRITOS	Not favourable (ha)	Slightly unfavourable (ha)	favourable (ha)	Very favourable (ha)	Total (ha)
CALCA	11,708.95	14,033.43	2,050.39	3,509.93	31,302.70
CCARHUAYO	8,796.31	19,677.62	1,033.39	918.83	30,426.15
CHALLABAMBA	23,550.37	41,693.49	576.08	5,750.22	71,570.15
CHECACUPE	20,158.95	44,963.58	24,820.42	4,094.97	94,037.91
CUSIPATA	6,322.61	12,233.06	2,968.94	2,796.87	24,321.48
HUAROCONDO	7,728.66	7,590.04	1,430.60	5,310.94	22,060.25
LAMAY	3,740.96	3,428.87	986.90	1,411.63	9,568.35
LARES	17,054.66	50,915.01	3,613.35	1,732.88	73,315.89
LAYO	3,966.85	18,413.14	11,585.90	14,609.97	48,575.85
LIMATAMBO	23,131.89	14,388.93	7,470.29	5,660.29	50,651.40
MARANGANI	11,228.55	19,700.11	8,333.71	4,769.89	44,032.26
MARCAPATA	39,938.60	84,458.93	5,787.10	363.33	130,547.97
OCONGATE	33,170.46	38,368.60	14,486.62	9,062.76	95,088.44
OLLANTAYTAMBO	24,253.50	24,896.22	4,155.41	4,688.44	57,993.57
PAUCARTAMBO	10,414.85	88,111.76	2,252.96	8,644.12	109,423.70
PISAC	4,795.64	6,581.34	522.06	2,903.52	14,802.56
PITUMARCA	32,322.31	59,299.33	15,356.12	2,508.29	109,486.05
QUIQUIJANA	10,560.33	16,884.54	3,067.29	6,003.89	36,516.05
SAN PABLO	10,544.64	16,808.52	21,643.43	3,489.00	52,485.59
SAN SALVADOR	5,451.86	3,597.40	434.59	3,349.18	12,833.03
SANTO TOMAS	94,830.46	77,333.98	13,546.75	5,041.73	190,752.92
SICUANI	17,034.49	17,784.90	21,599.97	8,453.08	64,872.45
LIMA	**29,518.83**	**21,421.67**	**48,967.25**	**2,579.24**	**102,486.99**
CARANIA	5,520.19	3,854.53	2,153.97	693.85	12,222.54
LARAOS	14,333.61	9,341.44	16,594.97	663.50	40,933.52
MIRAFLORES	7,620.68	7,139.45	4,803.59	627.10	20,190.82
TOMAS	2,044.35	1,086.25	25,414.72	594.79	29,140.11
PUNO	**108,910.06**	**377,574.67**	**270,214.41**	**45,172.24**	**801,871.38**
AJOYANI	2,296.42	11,028.85	28,375.36	1,145.33	42,845.96
ANTAUTA	3,340.72	18,707.49	40,189.46	3,601.05	65,838.72
CORANI	31,201.09	44,196.80	11,476.43	2,171.67	89,045.98
CRUCERO	8,940.23	70,968.92	4,779.73	1,351.48	86,040.36
CUYOCUYO	11,621.42	37,059.62	2,054.38	850.85	51,586.27
MACUSANI	17,250.31	50,762.45	30,005.30	4,145.54	102,163.60
NU ├æOA	18,331.77	89,853.17	96,082.25	16,827.67	221,094.85
POTONI	1,554.43	17,562.29	41,264.80	2,157.89	62,539.41
SANTA ROSA	14,373.67	37,435.08	15,986.71	12,920.77	80,716.23
Total general	**1,193,085.59**	**2,076,691.13**	**628,488.21**	**215,510.83**	**4,113,775.76**

18. Value Chain 3: Community-based Tourism

18.1. EbAs appropriate for Value Chain 3

EbA measure	Weighting
EbA 1: *Bofedal* restoration and conservation	2
EbA 10: *Andenes/*terraces restoration	2
EbA 9: Forest restoration with native species	1

18.2. Suitable hectares per district and region for Value Chain 3

For this value chain, surface area was classified into 3 categories:

Category	Description
Unfavourable	No EbA measures
Favourable	With one EbA “High” or “medium”
Very favourable	With more than one EbA “High or Medium”

In the case of the "Community-based Tourism" value chain, the region with the largest number of hectares both "Favourable" and "very Favourable" within the districts prioritized by the PUNA RESILIENTE project is Arequipa, with 93,823ha, followed by the Department of Cuzco, with 79,706ha. This is followed by Puno (55,984ha) and, finally, the Department of Lima with 7886ha. This is shown in the table below:

Region	Unfavourable (ha)	Favourable (ha)	Very favourable (ha)	Total
AREQUIPA	1,297,720.95	93,806.25	17.63	1,391,544.83
CUSCO	1,303,338.12	79,628.84	77.20	1,383,044.17
PUNO	745,887.36	55,921.76	62.27	801,871.39
APURIMAC	404,610.46	24,432.52	1.14	429,044.12
LIMA	94,600.07	7,817.14	69.78	102,486.99
Total	**3,846,156.97**	**261,606.52**	**228.02**	**4,107,991.51**

Region and Districts	Unfavourable (ha)	Favourable (ha)	Very favourable (ha)	Total general (ha)
APURIMAC	**404,610.46**	**24,432.52**	**1.14**	**429,044.12**
ABANCAY	27,352.61	1,317.21		28,669.82
ANTABAMBA	57,361.45	2,930.38		60,291.83
CHUQUIBAMBILLA	40,112.34	2,455.62	0.16	42,568.12
HAQUIRA	45,835.57	2,639.65		48,475.22
HUAQUIRCA	33,269.60	1,826.14		35,095.73
LAMBRAMA	49,429.61	3,162.14		52,591.75
OROPESA	109,250.09	7,922.36	0.98	117,173.43
PATAYPAMPA	13,937.50	713.18		14,650.68
PROGRESO	23,529.14	538.75		24,067.89
TAMBURCO	4,532.56	927.09		5,459.65
AREQUIPA	**1,297,720.95**	**93,806.25**	**17.63**	**1,391,544.83**
CAYARANI	128,771.41	10,709.67		139,481.08
CHACHAS	110,619.47	9,139.93	1.30	119,760.71
CHOCO	84,134.85	6,309.47		90,444.32
COTAHUASI	15,567.45	1,111.19		16,678.64
HUAYNACOTAS	87,663.34	5,914.26		93,577.60
ORCOPAMPA	68,174.81	4,786.15	1.21	72,962.17
PAMPAMARCA	72,697.15	6,097.59		78,794.74
PUYCA	136,899.81	13,565.37	14.68	150,479.86
SALAMANCA	119,173.86	4,991.53		124,165.39
SAN ANTONIO DE CHUCA	140,588.48	13,981.73		154,570.21

Region and Districts	Unfavourable (ha)	Favourable (ha)	Very favourable (ha)	Total general (ha)
SAN JUAN DE TARUCANI	230,001.32	9,134.34		239,135.66
YANQUE	103,428.99	8,065.03	0.44	111,494.46
CUSCO	**1,303,338.12**	**79,628.84**	**77.20**	**1,383,044.17**
ACOMAYO	12,734.32	1,429.61		14,163.93
CALCA	29,442.74	1,858.72	1.24	31,302.70
CCARHUAYO	29,356.97	1,069.18		30,426.15
CHALLABAMBA	70,244.67	1,325.48		71,570.15
CHECACUPE	85,533.86	8,502.87	1.18	94,037.91
CUSIPATA	23,179.57	1,139.24	2.67	24,321.48
HUAROCONDO	21,207.64	852.61		22,060.25
LAMAY	8,292.54	1,275.81		9,568.35
LARES	69,313.20	4,002.70		73,315.89
LAYO	38,694.40	4,094.15	2.79	42,791.34
LIMATAMBO	49,298.53	1,352.87		50,651.40
MARANGANI	41,062.18	2,966.95	3.13	44,032.26
MARCAPATA	127,743.35	2,804.62		130,547.97
OCONGATE	88,509.94	6,575.33	3.18	95,088.44
OLLANTAYTAMBO	54,683.59	3,309.98		57,993.57
PAUCARTAMBO	105,711.57	3,712.12		109,423.70
PISAC	13,470.72	1,305.89	25.95	14,802.56
PITUMARCA	99,313.16	10,156.89	16.01	109,486.05
QUIQUIJANA	33,334.03	3,182.02		36,516.05
SAN PABLO	49,673.53	2,812.07		52,485.59
SAN SALVADOR	11,768.65	1,049.26	15.12	12,833.03
SANTO TOMAS	181,162.36	9,589.20	1.36	190,752.92
SICUANI	59,606.63	5,261.24	4.58	64,872.45
LIMA	**94,600.07**	**7,817.14**	**69.78**	**102,486.99**
CARANIA	10,987.83	1,231.59	3.12	12,222.54
LARAOS	36,767.43	4,099.44	66.65	40,933.52
MIRAFLORES	18,780.47	1,410.34		20,190.82
TOMAS	28,064.34	1,075.77		29,140.11
PUNO	**745,887.36**	**55,921.76**	**62.27**	**801,871.39**
AJOYANI	41,017.58	1,828.15	0.23	42,845.96
ANTAUTA	62,258.45	3,579.07	1.20	65,838.72
CORANI	84,475.27	4,570.36	0.36	89,045.98
CRUCERO	81,925.43	4,114.93		86,040.36
CUYOCUYO	48,427.18	3,159.10		51,586.28
MACUSANI	95,500.78	6,659.50	3.31	102,163.60
NU ├æOA	200,663.07	20,374.61	57.17	221,094.85
POTONI	59,161.72	3,377.69		62,539.41
SANTA ROSA	72,457.88	8,258.34		80,716.23
Total general	**3,846,156.97**	**261,606.52**	**228.02**	**4,107,991.51**

19. Value chain Comparison

Comparison of the results of territorial suitability for the value chains "Alpacas and Vicuñas" (1), "High Andean Crops" (2), and "Community-based Tourism" (3), shows that the value chain with the most "very favourable" or "favourable" territory is the chain

associated with camelids, “Alpacas and Vicuñas” (1) in all regions. On the other hand, the value chain with the least amount of “very favourable” or “favourable” territory is the “community-based tourism” chain (3).

Figure 4- Bar chart comparing suitability per value chain and region

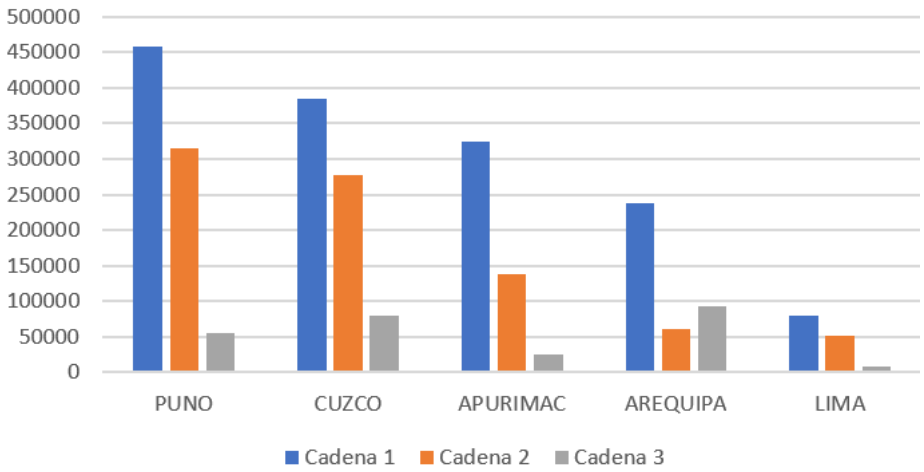


Table 7- Total number of suitable hectares per region per value chain

Region	Value Chain 1 (ha)	Value Chain 2 (ha)	Value Chain 3 (ha)
Puno	458,346.47	315,386.65	55,984.03
Cuzco	385,483.28	277,242.67	79,796.04
Apurímac	324,248.33	138,485.67	24,433.66
Arequipa	237,940.71	61,337.56	93,823.88
Lima	79,141.42	51,546.49	7886.92
TOTAL	1.485.160,21	843.999,04	261.924,53

Appendix 1: Illustrative example of generated EbA maps

The maps below show the suitability of the landscape for the implementation of all 10 EbAs for the Pitumarca district in Cusco. The PDF file below has been embedded, and also submitted under the folder “Supplementary Materials_Maps”.

Ejemplo Cartografías EBA- Cusco.pdf

Appendix 2- Technical workshop participants

The workshop took place on the 27th of June where inputs were received to determine suitability of the territory for EbA measures and financing resilient value chains. The government departments have been left in Spanish for ease of identification.

Institution	Scope	Name
MIDAGRI	Direccion General de Desarrollo Ganadero	Marco Enciso Maria Angelica Lagos David Soriano Carla Marquina
	Oficina de Cooperación Internacional	Janett Pacheco Alan Segundo Noemi Marmanillo
MINAM	Dirección de Adaptación al Cambio Climático	Lizzy Kanashiro
	Direccion General de Economia y Financiamiento Ambiental	Daniel Mattos
SERNANP	Dirección de Gestión de las Áreas Naturales Protegidas	Deyvis Huamán Claudia Pasquel Nadesda Cortes Daniella
	Oficina de Cooperación Internacional	Leslie Urbina Ivet Diaz
PROFONANPE	CEO Dirección de Innovación y Gestión Estratégica	Anton Willems Claudia Godfrey Pamela Reyes
INSTITUTO DE MONTAÑA	Dirección Ejecutiva	Mirella Gallardo Florencia Zapata
GIZ	Equipo de preparación	Ana Bublazky Alejandra Muñoz Margarita Cespedes Sara Reyna Dorothea Kallenberger Valeria Biffi Paula Paredes
External Consultants	Escritor del Funding Proposal	Carlos Ludena
NDA Representative	Ministerio de Economia y Finanzas	Gonzalo Rivera Edward Escobar Mirkala Ramos

Institution	Scope	Name
Cooperación canadiense		Chrisitan Clement Alberic Hibon Catherina Montes Karen Suarez