ADAPTATION FUND BOARD SECRETARIAT TECHNICAL REVIEW OF PROJECT/PROGRAMME PROPOSAL

PROJECT/PROGRAMME CATEGORY: Regional Project Concept

Countries/Region**: Chile, Colombia, Peru**
Project Title: **Enhancing Adaptive Capacity of Andean Communities through Climate Services (ENANDES)**
Thematic Focal Area: **DRR and EWS**
Implementing Entity: **World Meteorological Organization (WMO)**
Executing Entities: **National Meteorological and Hydrological Services of Colombia (IDEAM), Chile (DMC) and Peru (SENAMHI), and the WMO Regional Climate Centre for Western South America (CIIFEN)**
AF Project ID: **LAC/MIE/DRR/2018/2**
IE Project ID:
Requested Financing from Adaptation Fund (US Dollars): **7,398,000**
Reviewer and contact person: **Martina Dorigo**
Co-reviewer(s): **Saliha Dobardzic**
IE Contact Person: **Jean-Paul Gaudechoux**

Review Criteria	Questions	Comments	Responses
Country Eligibility	1. Are all of the participating countries party to the Kyoto Protocol?	Yes.	

	2. Are all of the participating countries developing countries particularly vulnerable to the adverse effects of climate change?	Yes, the participating countries are developing countries and the region is under the influence of El Nino Southern Oscillation (ENSO) phenomenon and the Inter Tropical Convergence Zone (ITCZ). This impacts the spatial-temporal distribution of precipitation, cloud cover, availability of solar and wind resources, as well as food production and agricultural waste. Climate Change is accelerating the progressive retreat of the glaciers in the Andes that host more than 95% of the world's tropical glacier, providing water for drinking, small farms, etc.	
n	1. Has the designated government authority for the Adaptation Fund endorsed the project/programme?	Yes, the LOE of all participating countries have been provided.	

	2. Does the regional project / programme support concrete adaptation actions to assist the participating countries in addressing the adverse effects of climate change and build in climate resilience, and do so providing added value through the regional approach, compared to implementing similar activities in each country individually?	Likely. The overall issue to be addressed is described adequately and the regional approach is informed. The project will address the current limitations of the participant countries to produce and deliver relevant climate information to a complex multi-institutional framework, sectorial stakeholders, national, subnational and local authorities in support of risk management and adaptation plans at the community level in the Andean region. It will do so by strengthening the capacities of the National Meteorological and Hydrological Services (NMHS) to better meet the needs of their countries. The resulting strengthened operational system will support climate services delivery in selected local communities affected by climate change. Nevertheless, the proposal should include concrete actions that lead to producing visible and tangible results on the ground. **CR 1**: The proposal should explain, in line with the Adaptation Fund mandate and as much as possible, the concrete aspects of the different components and associated outputs, emphasizing on the expected visible and tangible results on the ground. **CR 2**: Please describe the criteria that were used to identify the pilot areas in each participating country.	**CR1:** A better and more comprehensive description of the actions is provided. Efforts to describe more concrete actions in Part 2A should put in evidence the logical link among components, outputs and expected results on the pilot areas. **CR2:** New paragraphs have been added in Part 2A to provide a list of criteria for the selection of pilot areas in each of the participating countries.

	3. Does the project / programme provide economic, social and environmental benefits, particularly to vulnerable communities, including gender considerations, while avoiding or mitigating negative impacts, in compliance with the Environmental and Social Policy of the Fund	Yet to be demonstrated. This proposal identified the total population that it will seek to directly benefit: Chile: 95,665 people; Colombia: 96,519 people; Peru: 7,605,742 people. **CR 3**: Kindly revise or confirm if the number of beneficiaries in Peru in the Rimac river basin is correct. **CR 4**: The proposal should include information on the indigenous communities that are present in target areas, and specify the particular benefits that the proposed project would provide to such groups. **CR 5**: In accordance with the Adaptation Fund Gender Policy (GP), please demonstrate that the proposed interventions would allow women to participate as sufficiently visible actors and decision-makers.	**CR 3:** The Rimac river basin in Peru includes the city of Lima and its habitants as indirect beneficiaries. Interventions will be focused in the Matucana District with 5000 direct beneficiaries. **CR4:** Additional information on indigenous communities present in the pilot areas is provided in Part 2C. The percentage is low compared to the total population and, according to the latest census, they are mainly supporting their households with agriculture and farming in the rural areas. **CR5:** Part 2C now includes more information on specific gender interventions. In accordance with the Adaptation Fund Gender Policy, the project will assure gender equity and women's empowerment. The project aims at developing capacity building specifically for women within the rural communities. They will be able to use tools and products to empower their actions in the productive activities and their leadership in the community associations.

	4. Is the project / programme cost-effective and does the regional approach support cost-effectiveness?	It is sufficiently demonstrated at this stage. At fully-developed stage, the proposal should provide a clear description of alternative options to the proposed measures, to allow for a good assessment of the project/programme cost effectiveness.	
	5. Is the project / programme consistent with national or sub-national sustainable development strategies, national or sub-national development plans, poverty reduction strategies, national communications and adaptation programs of action and other relevant instruments? If applicable, it is also possible to refer to regional plans and strategies where they exist.	Yes, the project is consistent with the following plans/strategies: - The NAPAs and NDCs for Colombia, Peru and Chile, define priority sectors, being water management, and agriculture priority areas for all three participating countries. This proposal will address CCA in the water sector and its interaction with agriculture and hydropower. - The National Development Plans; - National plans on DRR/DRM; etc.	

	6. Does the project / programme meet the relevant national technical standards, where applicable, in compliance with the Environmental and Social Policy of the Fund?	Not demonstrated. It is not sufficient to say that the project will work with NMHS, which are compliant with WMO technical standards for data management and services delivery. The relevant national technical standards need to be identified, and compliance stated in a logical manner. These standards include Environmental Impact Assessments (EIAs), building codes, water quality regulations, and sector-specific regulations. Regarding EIAs, all proposed projects/programmes shall undertake a screening of environmental and social risks and demonstrate compliance with the environmental and social principles as outlined in the Environmental and Social Policy. **CR 6**: Kindly provide relevant information.	**CR6:** More information has been provided in Part 2F. The ENANDES project has been found to meet all the Environmental and Social Policy principles all of which will be continually monitored throughout project implementation to ensure that no negative social or environmental affects emerge as a result of the project. All project activities will be implemented in close collaboration with the National Meteorological and Hydrological Services (NMHS's) and the relevant Ministries of Agriculture, Livestock, Environment and Energy together with the National Water Authorities so as to ensure compliance with the relevant standards and technical guidelines in each of the target countries (see Part III_ A).
	7. Is there duplication of project / programme with other funding sources?	No, the proponent indicated the list of projects undergoing and the possible synergies with these initiatives.	
	8. Does the project / programme have a learning and knowledge management component to capture and feedback lessons?	Yes. However, at the full proposal stage a detailed knowledge management system and its implementation should be explained.	

	9. Has a consultative process taken place, and has it involved all key stakeholders, and vulnerable groups, including gender considerations?	Unclear. Consultations have been taken place in the three countries at national and local levels. Local consultations were conducted in July 2018 in Chile, Colombia and Peru, and the outcomes of these were shared. For what it concerns consultations at national level, the proposal mentions consultations conducted in 2017. **CR 7**: Kindly specify the outcomes of those consultations and all the stakeholders involved in each of the participating countries.	**CR7:** A new table in English has been added in Part 2I summarising the reports in Annex 1 of the community consultations carried out in July 2018 in some of the pilot areas. Those reports are currently in Spanish.
	10. Is the requested financing justified on the basis of full cost of adaptation reasoning?	Yes, the proponent provided detailed information (table 9).	
	11. Is the project / program aligned with AF's results framework?	Not demonstrated. The indicators provided in the project results framework, should be the ones of the project. In this section the proponent doesn't have to report on the alignment with the AF results framework. **CAR 1**: Kindly include the alignment with the AF results framework by filling this table in the corresponding section of the proposal.  Results-framework-alignment-table-Sep20	**CAR 1:** Table 13 in Part 3E has been amended as suggested to include the project Key Performance Indicators
	12. Has the sustainability of the project/programme outcomes been taken into account when designing the project?	Sufficiently informed at this stage. The climate service provision value chain will set up an example for the larger region that could be later	

		scaled up to other countries supported by CIIFEN, such as: Bolivia, Ecuador and Venezuela. This project could also set an example to be scaled up in other world regions.	
	13. Does the project / programme provide an overview of environmental and social impacts / risks identified?	Not adequate. The proposal should state the category in which the screening process has classified the project/programme. **CAR 2**: Kindly assign a risk category to the project in accordance with the ESP of the Fund. The risks findings presented in Table 10 (p. 67) generally lack the required substantiation of the findings as required by the ESP. This will need to be addressed during the preparation of the full proposal. E.g., risks have been found for marginalized and vulnerable groups. However, those will not be identified, not even during implementation, but generic measures such as "*traditional practices will be implemented to reach these groups especially women, girls, elderly, physically challenged individuals*." are included to mitigate the otherwise unassessed impacts. Indigenous population is said to be consulted also during project preparation but the conclusions is already that there are no ESP related risks. Suggestions for compliance with this principles of the ESP are included in the ESP Guidance	**CAR 2:** Table 10 has been amended as suggested and the categorization of the project in accordance with the ESP of the fund is not stated in Part 2L. ENANDES project anticipates a categorization C with low to no adverse environmental and social risks. This categorization will be justified through a comprehensive Environmental and Social screening at full-developed proposal stage.

		document. In general, the risks that have been identified are limited to direct impacts risks. Many of the risks associated with the project are likely to be indirect, secondary or cumulative, and thereby require a safeguard approach to minimize such risks. This aspect should be explicitly taken into account in the risk identification of the full project proposal. This e.g. relates to the stated project beneficial outcome of improved management of hydropower generation but that may equally exacerbate environmental and social impacts associated with these plants. During preparation of the full proposal, please describe how WMO as IE will ensure oversight and compliance with the ESP and GP for the Executing Entities, including its own CIIFEN.	
	14. Does the project promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms?	Likely. The proposal will innovate the ways of connectivity between the national, local and community level to ensure the cascading of climate information. There will be an improved use and access to weather and data, remote sensing and modelling, to use by intensive and extensive agriculture; services provided to the energy sector (databases, forecasts and scenarios for long term climatic variables,	

		instrument calibration, etc.); and water use based on resource monitoring and impact-oriented forecasts.	
Resource Availability	1. Is the requested project / programme funding within the funding windows of the pilot programme for regional projects/programmes?	Yes.	
	2. Are the administrative costs (Implementing Entity Management Fee and Project/ Programme Execution Costs) at or below 20 per cent of the total project/programme budget?	Yes, the administrative fees correspond to 16% of the total requested budget for this proposal.	
Eligibility of IE	3. Is the project/programme submitted through an eligible Multilateral or Regional Implementing Entity that has been accredited by the Board?	Yes, WMO is an MIE of the Adaptation Fund.	
Implementation Arrangements	1. Is there adequate arrangement for project / programme management at the regional and national level, including coordination arrangements within countries and among them? Has the potential to partner with national institutions, and when possible, national implementing entities (NIEs), been considered, and included in the management arrangements?	n/a at concept stage	
	2. Are there measures for financial and project/programme risk management?	n/a at concept stage	

	3. Are there measures in place for the management of for environmental and social risks, in line with the Environmental and Social Policy of the Fund? Proponents are encouraged to refer to the Guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social Policy, for details.	n/a at concept stage	
	4. Is a budget on the Implementing Entity Management Fee use included?	n/a at concept stage	
	5. Is an explanation and a breakdown of the execution costs included?	n/a at concept stage	
	6. Is a detailed budget including budget notes included?	n/a at concept stage	
	7. Are arrangements for monitoring and evaluation clearly defined, including budgeted M&E plans and sex-disaggregated data, targets and indicators?	n/a at concept stage	
	8. Does the M&E Framework include a break-down of how implementing entity IE fees will be utilized in the supervision of the M&E function?	n/a at concept stage	
	9. Does the project/programme's results framework align with the AF's results framework? Does it include at least one core outcome indicator from the Fund's results framework?	n/a at concept stage	
	10. Is a disbursement schedule with time-bound milestones included?	n/a at concept stage	

Technical Summary	The overall objective of this regional project is to reduce vulnerability and increase resilience of the Andean communities in Colombia, Peru and Chile to climate variability and change by

	implementing climate-smart decision-making networks for better disaster risk, hydropower generation and agriculture management. It will aim to achieve this objective by: • Increasing the technical capacity of the NMHSs of Colombia, Peru and Chile to generate and disseminate end-to-end and communities demand-driven weather, climate and hydrological services. • Enhancing national and local inter-institutional/sectorial stakeholder networks to co-design and co-produce sector specific climate information in support of disaster risk management, long-term adaptation and water, food, and energy security. • Empowering local communities to use the weather and climate information for local risk management and adaptation plans. • Strengthening regional cooperation for mutual technical assistance among NMHSs, alignment with other complementary initiatives in the Andean region, and foster capacity building on data management, climate prediction, and tailored sectorial information that can be expanded to other countries such as Bolivia, Ecuador and Venezuela. The initial technical review finds that the proponent needs to address the following Clarification Requests (CRs) and Corrective Actions Requests (CARs): **CR 1**: The proposal should explain, in line with the Adaptation Fund mandate and as much as possible, the concrete aspects of the different components and associated outputs, emphasizing on the expected visible and tangible results on the ground; **CR 2**: Please describe the criteria that were used to identify the pilot areas in each participating country; **CR 3**: Kindly revise or confirm if the number of beneficiaries in Peru in the Rimac river basin is correct; **CR 4**: The proposal should include information on the indigenous communities that are present in target areas, and specify the particular benefits that the proposed project would provide to such groups; **CR 5**: In accordance with the Adaptation Fund Gender Policy (GP), please demonstrate that the proposed interventions would allow women to participate as sufficiently visible actors and decision-makers; **CR 6**: Kindly identify all the relevant national technical standards, and specify how this proposal will meet them; **CR 7**: Kindly specify the outcomes of those consultations and all the stakeholders involved in each of the participating countries; **CAR 1**: Kindly include the alignment with the AF results framework by filling the table provided in the corresponding comment; **CAR 2**: Kindly assign a risk category to the project in accordance with the ESP of the Fund.

Date:	24 August, 2018

ADAPTATION FUND

REGIONAL PROJECT/PROGRAMME CONCEPT NOTE

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	**Enhancing Adaptive Capacity of Andean Communities through Climate Services (ENANDES)**
Countries:	Chile, Colombia, Peru
Thematic Focal Area[1]:	Disaster Risk Reduction and Early Warning Systems
Type of Implementing Entity:	MIE
Implementing Entity:	World Meteorological Organization (WMO)
Executing Entities:	National Meteorological and Hydrological Services of Colombia (IDEAM), Chile (DMC) and Peru (SENAMHI), and the WMO Regional Climate Centre for Western South America (CIIFEN)
Amount of Financing Requested:	7,398,000 (in U.S Dollars Equivalent)

Project / Programme Background and Context:

The Andean Region

The Andean mountain chain is located in western South America, where it runs continuously from Colombia to the extreme south of Chile. Its average altitude is around 4,000 meters above sea level (m.a.s.l.) with the highest peaks at almost 7,000 m.a.s.l., and its length reaches more than 7,000 km. Due to these characteristics the Andean mountain chain is the longest and one of the highest in the world. Along its coverage the area is subjected to diverse climate influences: the Amazon forest to the east, the displacement of the Inter-Tropical Convergence Zone (ITCZ), the Bolivian High and the Trade Winds to the north. At higher elevations, the subtropical jet stream and the permanent high-pressure system of the South Pacific and South Atlantic are also important (Garreaud, 2009[2]; Tedeschi et al., 2013[3]; Mo & Berbery, 2011[4]; Stäubli et al., 2018[5]).

The availability of water is fundamental for the Andes and for the adjacent areas, as it contributes to 9.5% of the world's fresh water reserves and plays the pivotal role in feeding

1 Thematic areas are: Food security; Disaster risk reduction and early warning systems; Transboundary water management; Innovation in adaptation finance.

2 Garreaud, R. D. (2009). The Andes climate and weather. Advances in Geosciences, 22, 3-11.

3 Tedeschi, R. G., Cavalcanti, I. F., & Grimm, A. M. (2013). Influences of two types of ENSO on South American precipitation. International Journal of Climatology, 33(6), 1382-1400.

4 Mo, K. C., & Berbery, E. H. (2011). Drought and persistent wet spells over South America based on observations and the US CLIVAR drought experiments. Journal of Climate, 24(6), 1801-1820.

5 Stäubli, A., Nussbaumer, S. U., Allen, S. K., Huggel, C., Arguello, M., Costa, F. Hergarten, C., Martínez, R., Soto, J., Vargas, R., Zambrano, E. & Zimmermann, M. (2018). Analysis of weather-and climate-related disasters in mountain regions using different disaster databases. In Climate Change, Extreme Events and Disaster Risk Reduction (pp. 17-41). Springer, Cham.

the majority of South American watersheds. The hydrological cycle of the region depends on the geo-ecosystems found at around and above 4,000 m.a.s.l. (paramos, wetlands and glaciers). In these zones, the water is absorbed and stored in solid and liquid form within the mountains, and then is released regularly throughout the year, feeding the majority of the rivers, which discharge in the Pacific and Atlantic oceans. Those rivers provide water for cities such as La Paz (4,000 m.a.s.l.), Bogota (2,600 m.a.s.l.) and Lima (at sea level), for irrigated agricultural areas and hydropower generation.

All these mentioned features, and some others like cultural characteristics, have led the United Nations Framework Convention on Climate Change (UNFCCC) to recognize the countries in this region especially vulnerable to climate change. Some specific vulnerable zones are those exposed to floods, drought, desertification, landslides, high atmospheric pollution, and economies that, to a large extent, depend on the agriculture and hydropower generation.

Climate variability is also playing a role in modifying the normal climate conditions. In terms of inter-annual variability, both the El Niño and La Niña phases of El Niño-Southern Oscillation (ENSO) influence the temporal and spatial distributions of precipitation, cloud cover and wind patterns, which generally have an impact on food production, agricultural waste (biomass) and power generation with significant socio-economic consequences over much of South America (Skansi et al., 2013[6]; FAO, 2016[7]; Martín, 2016[8]). For example, over the Colombian-Andes region, El Niño events bring below normal precipitation, whereas the opposite happens during La Niña. In the same way, in some regions of the Peruvian-Andes, El Niño events are often (but not always) associated with droughts while La Niña with above normal precipitation. However, this relationship is not always true, if the ENSO peak phase occurs early (or late) in relation to the austral summer wet season, its influence will be much reduced (Garreaud, 2009[9]; Vicente-Serrano et al., 2011[10]).

The above characteristics have been modulated due to climate change trends, and it is expected to continue in the future. The extreme hydro-meteorological events have been increasing in the last decades and the projections indicate that they might increase more in both frequency and magnitude, especially for droughts and floods.

Based on these facts and scientific analysis, it is imperative to strengthen the adaptive capacity of three countries of the Andean region: Colombia, Peru and Chile. Given the diversity of the climate variability and climate change manifestation and the different degree of vulnerability and resilience in the three target countries, the project will focus on the following pilot areas of the Andean region (figure 1):

- **Colombia:** upper Magdalena - Cauca river basin (Departments of Cauca, Tolima and Caldas);
- **Peru:** mid and upper Rímac, Huallaga and upper Apurimac basins;
- **Chile:** central region of the country (Valparaiso, Metropolitana, O'Higgins and Maule provinces) where important river basins like Aconcagua, Tinquiririca and Maule are located.

6 Skansi M., Brunet M., Sigró J., Aguilar E., Arévalo J., Bentancur O., Castellón Y., Correa R., Jácome H., Malheiros A., Rojas C., Pasten A., Mitro S., Villaroel C., Martínez R., Alexander L., Jones P.D., (2013). Warming and wetting signals emerging from analysis of changes in climate extreme indices over South America, Global and Planetary Change, 100, 295-307. ISSN 0921-8181, 10.1016/j.gloplacha.2012.11.004.

7 FAO (2016). 2015-2016 El Niño. Early action and response for agriculture, food security and nutrition. Food and Agriculture Organization of the United Nations. pp44.

8 Martín, L. (2016). ¡Es Niño!: Impacto económico en la Región Andina. Inter-American Development Bank.

9 Garreaud, R. D. (2009). The Andes climate and weather. Advances in Geosciences, 22, 3-11.

10 Vicente-Serrano, S. M., López-Moreno, J. I., Gimeno, L., Nieto, R., Morán-Tejeda, E., Lorenzo-Lacruz, J., Benguería, S. Azorin-Molina, C. (2011). A multiscalar global evaluation of the impact of ENSO on droughts. Journal of Geophysical Research: Atmospheres, 116(D20).

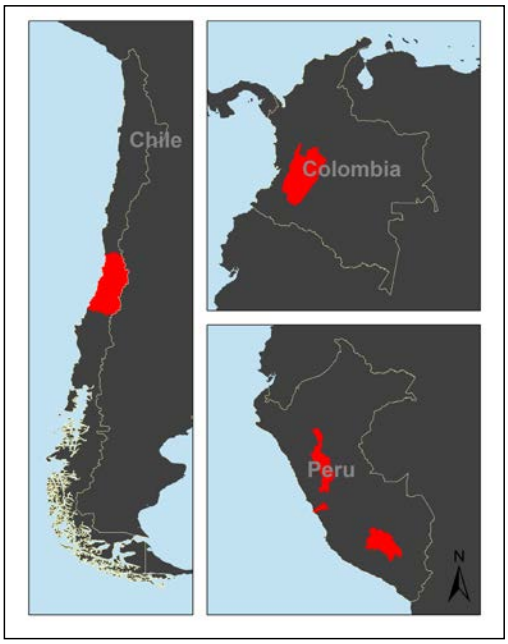


Figure 1. *Pilot areas of the project are highlighted in red for each country (Chile, Colombia and Peru).*

In these areas, the increase in temperature, the reduction of glacier and other environmental indices show that the impacts of climate change are already tangible and probably going to impact the population of the region if no adaptation measures are put in place.

Colombia, Peru and Chile, as well as many other countries, have committed to limit the impacts of climate change through specific adaptation measures as detailed in their National Adaptation Programs of Action (NAPAs) where the governments priority actions by sectors are outlined. The proposed adaptation measures provide the most vulnerable sectors with tools and support in order to reduce the impacts generated by extreme weather events and hydrometeorological variable trends, as well as to take advantage of positive outcomes in favour of sustainable development.

Moreover, the UNFCCC, through the agreement established at the Conference of the Parties (COP) in Paris in 2015, requested the signatory countries to present their Nationally Determined Contributions (NDCs) for both adaptation and mitigation. These documents describe the countries contributions and commitments to reduce greenhouse gases and to implement adaptation measures to climate change. Based on these documents, the priority sectors indicated by Colombia, Peru and Chile are listed in Table 1.

Table 1. *List of priority sectors for adaptation to climate change considered in the NAPAs and NDCs for Colombia, Peru and Chile*.

Sector	Colombia	Peru	Chile
Forest		+	+
Water management	+	+	+
Agriculture	+	+	+
Fishery		+	+
Health		+	+
Industry		+	
Energy	+		+
Transport			
Regional planning	+		
Education	+		
Environment	+		+
Institutional capacities	+		
Risk management	+		
Cities			+
Tourism			+

Source: MMA (2015[11]); Gobierno de Chile (2015[12]); Gobierno del Perú (2015[13]); MINAM (2010[14]); DNP (2012[15]); Gobierno de Colombia (2015[16]).

National Contexts

Colombia – General Characteristics

Geography

Colombia is located in the northern region of South America, has a land and sea area of 2,070,408 km^2 and borders with the Caribbean to the north, the Pacific Ocean to the west, Brazil and Venezuela to the east and Ecuador and Peru to the south. It is a country of great territorial diversity, from the coastal area in the Caribbean region and the Pacific, to the Andes (mountain) and the Amazon (forest) regions. The estimated population for 2005 was 48,474,708 inhabitants, and the main economy sectors are the extraction of crude oil, generation of electric power, manufacturing production and agriculture. In terms of economic growth, Colombiashowed an increase of Gross Domestic Product (GDP) in the last eight years, sometimes reaching values of almost 7% (2014), although in the last two years the growth was much lower, with averages of around 2% (IDEAM et al., 2017[17]).

11 MMA (2015). Plan Nacional de Adaptación al Cambio Climático. Departamento de Cambio Climático del Ministerio del Medio Ambiente, Santiago, Chile.

12 Gobierno de Chile (2015). Contribución Nacional Tentativa de Chile (INDC) para el Acuerdo Climático París 2015. Gobierno de Chile, Santiago, Chile.

13 Gobierno del Perú (2015). Contribución Prevista y Determinada a Nivel Nacional de la República del Perú.

14 MINAM (2010). Plan de Acción de Adaptación y Mitigación frente al Cambio Climático. Ministerio del Ambiente, Lima, Perú.

15 DNP (2012). Plan Nacional de Adaptación al Cambio Climático. Departamento Nacional de Planeación, Bogotá, Colombia.

16 Gobierno de Colombia (2015). Contribución Prevista y Determinada a Nivel Nacional de Colombia. Gobierno de Colombia, Bogotá, Colombia.

17 IDEAM, PNUD, MADS, DNP & CANCILLERÍA (2017). Resumen ejecutivo. Tercera Comunicación Nacional de Colombia a La Convención Marco de Las Naciones Unidas Sobre Cambio Climático (CMNUCC). Tercera Comunicación Nacional de Cambio Climático. IDEAM, PNUD, MADS, DNP, CANCILLERÍA, FMAM. Bogotá D.C., Colombia.

Climate

The rainfall and temperature climatology in Colombia varies on the region. In the Caribbean region, the seasonal rainfall cycle is well defined, with intermediate values between May and November and higher volumes between October and November, coinciding with the easterly waves and tropical cyclones season. The Andean region presents a bimodal variation that depends on the Inter-tropical Convergence Zone (ITCZ) and concentrates the rains between the months of April-May, and October-November. In the eastern region, rainfall occurs throughout the year; however, they are more intense between April and June and less intense between November and February. In the region of the Pacific coast, rainfall remains constant throughout the year. Air temperature, on the other hand, is directly related to the variation of altitude, since the country is located at low latitudes and therefore, does not present many seasonal variations. The thermal zones are used to describe temperature with high altitudes associated with lower temperature and vice versa. Due to the geographical variety, and especially the presence of the Andes mountain range, there is a wide variety of thermal zones in the country, ranging from warm (temperatures above 24 °C) to snow (below 1.5 °C) (IDEAM, et al., 2015[18]).

Climate variability and change

Climate variability acrossthe country occurs at different time scales. At the intra-seasonal level, extreme events are strongly related to the Madden-Julian Oscillations (MJO). On the inter-annual scale, the different manifestations of ENSO and the cycle of the Quasi-Biennial Component (QBO) are responsible for modulating the climate of Colombia. Among these phenomena of climate variability, the one that generates most impacts in Colombia is ENSO, where during the warm phase (El Niño) an increase in temperature and a decrease in rainfall is observed, especially in the center-north region of the country. Wheras, with the presence of La Niña, the Colombian territory, especially in the Andean region and the Caribbean, shows a decrease in temperature and increase in rainfall (IDEAM & UNAL, 2018[19]).

Regarding climate trends, from the second half of the 20th century, it has been observed that precipitation in the Andean and Caribbean areas has decreased by up to 30%. The adjacent areas however, the Pacific coast, presents an increase of up to 30%, which shows the great climate diversity of the territory (Marín et al., 2017[20]). Climate change scenarios project rainfall reductions of up to 40% in the southeastern regions and in the northern Caribbean region, while an increase by up to 40%, are projected to occur in the Andean region and near the Pacific coast. For the air temperature, as well as the global average, the projections indicate increases in values, which can vary from 0.5-1.0 °C in the average period to 2040, and up to 3.0 °C in the period to 2100 (figure 2 IDEAM et al., 2015[21]).

18 IDEAM, PNUD, MADS, DNP & CANCILLERÍA (2015). Escenarios de Cambio Climático para Precipitación y Temperatura para Colombia 2011-2100. Herramientas Científicas para la Toma de Decisiones – Estudio Técnico Completo: Tercera Comunicación Nacional de Cambio Climático. Bogotá D.C., Colombia.

19 IDEAM & UNAL (2018). Variabilidad y Cambio Climático en Colombia. Bogotá D. C., Colombia.

20 Marín, J. P. (2017). Dinámica de los eventos hidroclimáticos extremos en la cuenca del Río Chinchiná por efecto de la variabilidad climática. Master thesis. Universidad Nacional de Colombia, Manizales.

21 IDEAM, PNUD, MADS, DNP, CANCILLERÍA (2015). Nuevos Escenarios de Cambio Climático para Colombia 2011-2100. Herramientas Científicas para la Toma de Decisiones – Enfoque Nacional-Regional: Tercera Comunicación Nacional de Cambio Climático.

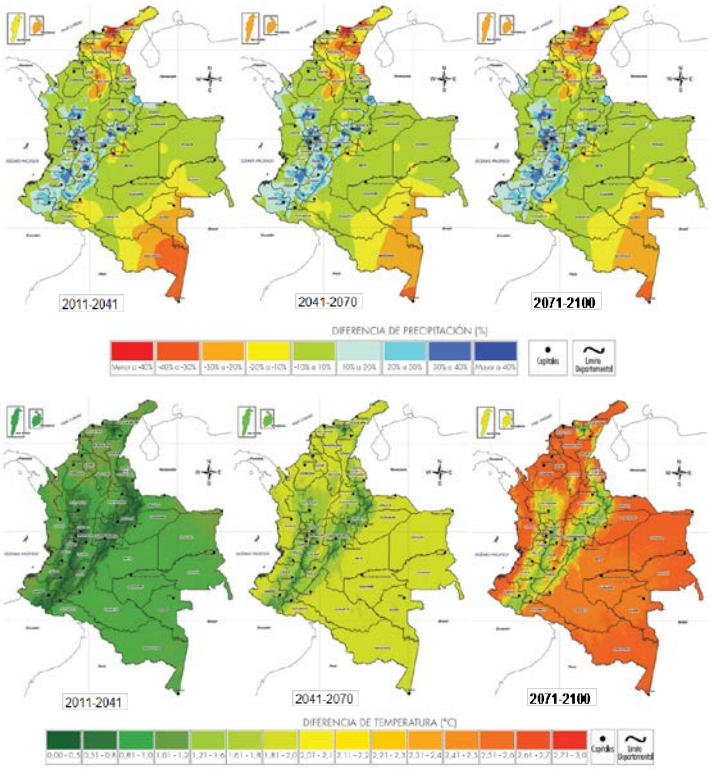


Figure 2. *Both maps are an estimate of the mean projections of climate change (average for all Representative Concentration Pathways (RCPs) scenarios) for the 2011-2041, 2041-2070 and 2071-2100 periods for Colombia, respectively. Up: percentage changes in precipitation. Down: temperature rising. Source: IDEAM et al., (2015[22]).*

Climate vulnerability

Colombia is a developing country that has its industrial activity concentrated in large cities or geographical areas with easy transportation access, such as port regions. As well as in other countries in the Andean region, activities such as agriculture and livestock provide food security and contribute to the economy of the small municipalities. Due to the biogeographic characteristics of the Andean region, these countries have specialized in the production and exportation of some products such as coffee, bananas, potatoes, cocoa and others.

Adverse climate has a direct impact on agricultural production and negative consequences for the economy (Pabón, 2004[23]). For example, in 2011, during La Niña phase, the National Planning Department reported 2.4 million people affected by significant losses in properties,

22 IDEAM, PNUD, MADS, DNP, CANCILLERÍA (2015). Nuevos Escenarios de Cambio Climático para Colombia 2011-2100. Herramientas Científicas para la Toma de Decisiones – Enfoque Nacional-Regional: Tercera Comunicación Nacional de Cambio Climático.

23 Pabón, J. D. (2004). Aplicación de la información sobre el clima en la agricultura en la región Andina. Acta de Reunión Técnica – Servicios de Información y Predicción del Clima y Aplicaciones agrometeorológicas para los países Andinos. World Meteorological Organization, WMO. Geneva, Switzerland.

schools and, above all, agriculture and livestock (Ángel, 2012[24]). This was declared the worst environmental tragedy of the latest 50 years.

The Colombian electric system depends heavily on the availability of water as well. The 2015-16 intense El Niño phase had a major impact on the electricity production, with an observed reduction in hydroelectric generation up to 43% of its historic values for the period of September 2015 to March 2016. The deficit led to higher operational costs and larger CO_2 emissions than in typical years. In the same period severe damages to important crops as coffee, potatoes and rice were also experienced (Martínez et al., 2017[25]).

Observations are suggesting that climate change is increasing the frequency and magnitude of extreme events and, therefore, droughts are expected during years in which the positive phase of ENSO is present. Wheras, in years when La Niña is present, floods and landslides are expected to occur (IDEAM et al., 2015[26]).

Over the long-term, an increase of temperatures would result in an accelerate melting of glaciers and decrease of snowfalls, as well as a retreat to the paramos in altitude. These two ecosystems are important sources of water storage for the region, as they contribute to agricultural productivity and hydroelectric production. These impacts added to the degradation of soils, could increase the processes of desertification and the occurrence of forest fires, with a consequent reduction in soil productivity. Additionally, the lack of water would affect the hydroelectric sector, compromising the production of electricity in the area. Moreover the extreme excesses of precipitation would affect even harder those areas that are exposed to high risk events such as landslides and floods.

Introduction to the pilot area: upper Magdalena – Cauca river basin

Geographical, socioeconomic and ecosystem contexts

The proposed pilot area for Colombia is the Magdalena - Cauca river basin, one of the most productive areas of the country, which represents 17% of the national territory. This basin crosses the country from south to north between the eastern and central mountain ranges and forms a corridor that goes from the Andean region to the Caribbean coast. The river has a length of 1,528 km and starts at 3,685 m.a.s.l. The entire surface of the basin area is almost 200,000 km^2 (Olmos & Hernández, 2015[27]).

24 Ángel J. D. Á. (2012). Sedimentos del Río Magdalena, reflejo de la crisis ambiental. Propiedad Pública, Universidad Eafit.

25 Martínez, R., Zambrano, E., Nieto, J. J., Hernández, J. & Costa, F. (2017). Evolución, vulnerabilidad e impactos económicos y sociales de El Niño 2015-2016 en América Latina. Investigaciones Geográficas, (68), 65-78. https://doi.org/10.14198/INGEO2017.68.04

26 IDEAM, PNUD, MADS, DNP, CANCILLERÍA (2015). Nuevos Escenarios de Cambio Climático para Colombia 2011-2100. Herramientas Científicas para la Toma de Decisiones – Enfoque Nacional-Regional: Tercera Comunicación Nacional de Cambio Climático.

27 Olmos, L. M. B., & Hernández, L. C. T. (2015). Estimación de caudales mensuales en la cuenca alta del Magdalena, usando métodos de transferencia. Universidad Distrital Francisco José de Caldas. Bogotá, Colombia.

Figure 3. *Map of Colombia and all the levels of Cauca-Magdalena basin.*

The Cauca-Magdalena basin can be divided into upper, medium and low areas (figure 3), with the upper basin crossing the departments of Cauca, Tolima and Caldas, with a total population approaching 1.5 million people. This territory has an area of more than 20,000 km^2 with a population density of 70 inhabitants per km^2 (Gamarra & Nieto, 2013[28]).

The upper basin ecosystem of the Magdalena River extends from the humid paramo, where the river starts, to the tropical dry forest, characteristic of the Honda area, at the bottom of the valley. The forest that originally covered the deep part in the valley and consisted mainly of the tropical dry forest, has been removed due to agricultural activities and the demand for firewood (Olmos & Hernández, 2015[29]).

All these historical characteristics have made Magdalena River well known for trade, exchange of goods, fishing and fertility of its territory. Currently the entire basin has an impact on approximately 35 million Colombians, and represents about 75% of the country's agro-industrial production. In addition, the water of the river serves to produce electricity for industrial and domestic consumption.

Climate characteristics and vulnerability

The basin is located in the tropical zone where the amount of radiation does not have much seasonal variation and the temperatures are dependent on the altitude. The complex

28 Gamarra, A. H. & Nieto, L. H. B. (2013). Caracterización física, demográfica, social y económica de los municipios ribereños de la jurisdicción de la corporación autónoma regional del Río Grande de la Magdalena. CORMAGDALENA.

29 Olmos, L. M. B., & Hernández, L. C. T. (2015). Estimación de caudales mensuales en la cuenca alta del Magdalena, usando métodos de transferencia. Universidad Distrital Francisco José de Caldas. Bogotá, Colombia.

orography of the valleys and mountains generates a regional and local circulation of air (Vargas, 2015[30]).

As most of the Andean region, this basin is influenced by the Trade Winds, which converge the ITCZ and regulate the cloudiness and precipitation. Other phenomena from the Atlantic side influencing the area are the permanent high-pressure centers, the subtropical high,, the Eastern Waves and the Tropical Cyclones. In the Upper Basin, the temperatures are more continental and the influence of the Amazon forest is a source of moisture in the air.

In the mountainous area, the spatial distribution of rainfall is conditioned by topography. The inter-Andean valleys show relatively low rainfall with values of 1,000 to 1,500 mm/year, but from the piedmont to an altitude of 1,000 to 1,500 m.a.s.l. the precipitation increases till around 2,000 to 2,500 m.a.s.l. In the valley, there is a predominance of dry warm climate, while in the middle elevations, a colder and more humid climate is observed.

Frost events at heights greater than 2,400 m.a.s.l. have resulted in significant economic losses in the agricultural sector in the past, from diminishing yields to total destruction of crops. The observed trends in air temperature, however, shows an increase of 0.10 to 0.25 °C per decade. One of the clearest signs of climate variability in the region is the ENSO cycle, which especially affects the area with a considerable deficit of precipitation and high temperatures during El Niño events, while the cold phase (La Niña) has generally manifested increases in precipitation. The three strong El Niño events recorded in 1972-73, 1976-77, and 1991-93 coincided with droughts conditions. The data record of rainfall in the Andean and Caribbean area presents a rainfall deficit trend over the years (IDEAM, 2001[31]).

The hydrological processes responding to the meteorological variability within the basin can be extreme factors of large soil detachments, landslides, torrential floods, mudflows and other events that, in many cases reached catastrophic proportions. Excessive rainfall has caused flooding and overflows in the Magdalena River (Olmos & Hernández, 2015[32]).

In addition to natural climate variability, the climate change signal negatively affects the Cauca-Magdalena river basin with an estimated increase of air temperatures by 1.0 °C and precipitation by 10-20% by the end of the century (IDEAM, 2015[33]) in the upper basin.

In addition to the direct impacts of climate, the basin is also affected by land use/modification pressure. It has been estimated that forest coverage has been reduced by more than 40% just between the 1970s and 1990s, and its current coverage represents a mere 10% of the original. An estimated 50% of soil erosion is caused by natural factors that can be explained by hydrological variables, relief, climate and geology. These impacts are more important in areas of human settlements and infrastructure locations. The upper basin also has some fragile ecosystems, such as deserts and arid areas. These are especially vulnerable, since, apart from the climate, they also suffer from anthropogenic pressure (Ángel, 2012[34]).

The current context, as described, calls for policies oriented towards actions for vulnerability reduction and adaptation measures to climate change, particularly in mountain areas and in larger human settlements. In addition, the watershed management plan for this river basin

30 VARGAS, W. (2015). Una breve descripción de la vegetación, con especial énfasis en las pioneras intermedias de los bosques secos de la jagua, en la cuenca alta del río magdalena en el Huila. Colombia, 18(1), 47-70.

31 IDEAM (2001). Estudio Ambiental de la Cuenca Magdalena - Cauca y elementos para su ordenamiento territorial. Instituto de Hidrología, Meteorología y Estudios Ambientales. Bogotá, Colombia.

32 Olmos, L. M. B., & Hernández, L. C. T. (2015). Estimación de caudales mensuales en la cuenca alta del Magdalena, usando métodos de transferencia. Universidad Distrital Francisco José de Caldas. Bogotá, Colombia.

33 IDEAM (2015). Escenarios de Cambio Climático para Precipitación y Temperatura para Colombia 2011-2100 Herramientas Científicas para la Toma de Decisiones – Estudio Técnico Completo: Tercera Comunicación Nacional de Cambio Climático. Instituto de Hidrología, Meteorología y Estudios Ambientales. Bogotá, Colombia.

34 Ángel J. D. Á. (2012). Sedimentos del Río Magdalena, reflejo de la crisis ambiental. Propiedad Pública, Universidad Eafit.

aims to increase the generation of hydroelectric energy, strengthen sustainable human development, and increase touristic and recreational areas of the river, highlighting its environmental, landscape and recreational importance. It will also seek to recover the quality and quantity of water to manage flows and ensure purification, irrigation, natural and hydro-biological resources, giving priority to the attention to urbanized settlements in the basin. Finally, a flood mitigation plan is also prepared. Thus, it is critical to strength the supply of information and knowledge of the natural processes and interaction with socioeconomic and cultural processes. To solve all these problems, it is imperative to have in-depth knowledge about the climate conditions in the basin and about all the effects of climate variability (CORMAGDALENA, 2007[35]).

Peru – General Characteristics

Geography

Peru is located in the central-western region of South America, has a territorial area of 1,285,215.6 km^2 and shares borders with Colombia and Ecuador to the north, Brazil and Bolivia to the east, Chile to the south and the Pacific Ocean to west. The Andean mountain range crosses the country longitudinally, dividing it into three major natural regions: coast, Andes and rainforest. In 2015, the total population was estimated at 31.1 million. Of this population, 54.6% is located in the coastal region, whose territory accounts for 11.7% of the national territory; 32% of the population is located in the Andean region, which has 28% of the national territory; and finally the Amazon, which represents 58.9% of the national territory and has 13.7% of the population. In regards to the economy, Peru has shown economic growth in recent years, with GDP growing by 9.1% in 2008 and 2.4% in 2014. The sectors that have made the most contribution were services, manufacturing, mining, hydrocarbons, trade, construction and agriculture (MINAM, 2016[36]).

Climate

The climate in Peru is diverse due to its location and the geographic variety of the territory. For precipitation, the northern rainforest is the region where the highest values are observed, with a moderate annual variability. Precipitation is low along the coast, with seasonal increases between December and May. The values are moderate in the Andean region, with more seasonal variations and also has an increase between December and May. The Andean region climatology is strongly modulated by the altitudinal gradient along the cordillera. In the inter-Andean valleys at intermediate altitude (2,500-3,500 m.a.s.l), the annual average temperature varies between 11°C and 16°C and precipitation between 50 and 1000 mm[37]. The air temperatures also present characteristics according to the region and the season, where the highest values are observed in the northern region of the rainforest and coast between the months of December to May. The lowest values are found in the central and southern highlands, and are lower between June to August (MINAM, 2016).

Climate variability and change

The main inter-annual changes observed in the Peruvian climate are due to the influence of the El Niño and La Niña phenomenon, which changes air temperature and precipitation patterns significantly. The most significant changes in precipitation are observed mainly in the northern coastal region, where, during strong events of El Niño, excessive rainfall has been observed, meanwhile during La Niña conditions, rainfall is below normal. In the Andean

35 CORMAGDALENA (2007). Plan de manejo de la cuenca del Río Magdalena – Cauca. Segunda Fase. Corporación Autónoma Regional del Río Grande de la Magdalena Empresa Industrial y comercio del Estado. Bogotá, Colombia.

36 MINAM (2016). Tercera Comunicación Nacional del Perú a la Convención Marco de las Naciones Unidas sobre el Cambio Climático. Ministerio del Ambiente. Lima, Perú.

37 SENAMHI,2009: Escenarios Climáticos en el Perú para el año 2030, Lima.

regions, the changes in precipitation are opposite, with deficits in El Niño events and increases in La Niña.

In terms of climate trends, precipitation has shown a decrease in recent decades, while both maximum and minimum temperatures have increased for the same period. In the future, the climate scenarios made for the country indicate that climate change would affect precipitation with a high spatial variability, with both increasing and decreasing trends, even between nearby points. The exception would be in the northwest region of the country where the projections mark a definite increase in rainfall (figure 4). On the other hand, the air temperature, both for the maximum and the minimum, would increase throughout the territory, with minimum temperatures increasing more than the maximum. The highest increases would be in the highland region, with maximum heating values of up to 4 °C (figure 5) (MINAM, 2016).

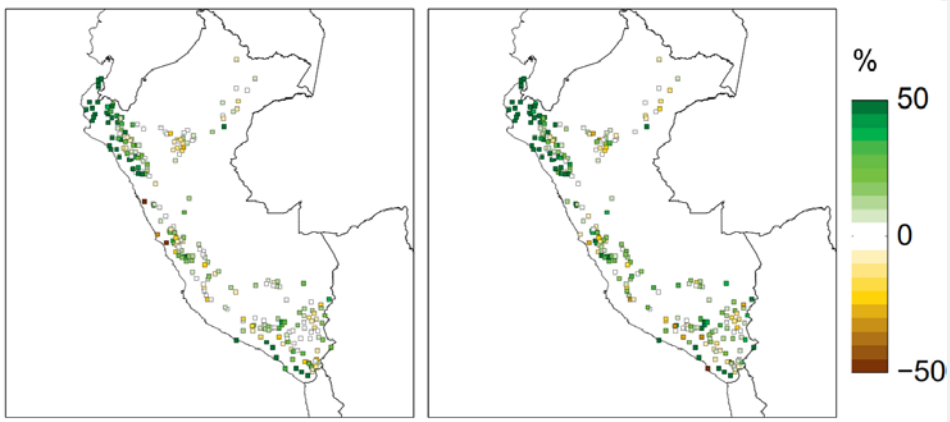


Figure 4. *Precipitation changes for the 2036-2065 period for RCP 4.5 (left) and 8.5 (right). Source: MINAM, (2016)[38].*

38 MINAM (2016). Tercera Comunicación Nacional del Perú a la Convención Marco de las Naciones Unidas sobre el Cambio Climático. Ministerio del Ambiente. Lima, Perú.

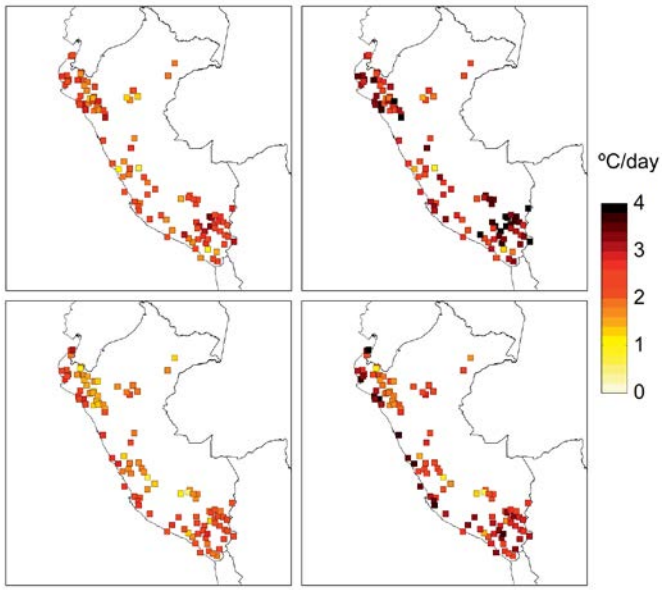


Figure 5. *Changes in maximum (up) and minimum (down) temperatures for the 2036-2065 period for RCP 4.5 (left) and 8.5 (right). Source: MINAM, (2016).*

Climate vulnerability

The geography and climate of Peru make it one of the most diverse countries on the planet. It has the fourth highest forest coverage in the world and has 71% of the world's tropical glaciers. All these diversities also cause a great cultural heterogeneity and make the country especially vulnerable. In addition, water in Peru is divided into two regions: the Atlantic slope, which has 97% of the resource and 33% of the population, and the Pacific slope that has 3% of water and 67% of the population. Therefore, although Peru is the country with the greatest availability of fresh water per inhabitant of Latin America, unequal distribution of water generates a shortage problem. In addition, the inefficient management of the resource ends up aggravating the problem.

The main climate impacts observed in the Peruvian territory are associated with ENSO, where last occurrences have affected the fisheries, agriculture, forestry , health and transportation sectors. For example, in mid-February 2017, the country began to suffer the consequences of an El Niño event that occurred over the Peruvian coast, which was called Coastal El Niño. This phenomenon brought excessive precipitation, which affected the entire coastal region of the country, generating significant losses in the north, where floods affected homes and crops. In the Lima region, impacts on water supply were also observed due to the overflow of several rivers, including the Rímac. According to the National Convention of Peruvian Agriculture (CONVEAGRO, Spanish acronym), the floods in April 2017 caused losses of nearly USD 645 million in the agriculture and livestock sectors throughout the country (MINAM, 2016[39]).

39 MINAM (2016). Tercera Comunicación Nacional del Perú a la Convención Marco de las Naciones Unidas sobre el Cambio Climático. Ministerio del Ambiente. Lima, Perú.

Drought events predominantly affect the southern Andean region of Peru, having an impact on agriculture, as this activity is mainly dependant on rainfall. Furthermore, another impact observed in this country is associated to frost events, which occur between the months of June and August and are more frequent in regions with higher elevations. In addition, climate change scenarios indicate significant reduction of glaciers and intensification of droughts, which would affect further water availability. Furthermore, it is also expected that extreme climate events, generated by occurrences of El Niño, will increase their frequencies and intensities, which, as has already been observed in the historical records. Such trends already affected agricultural activities in the country and put food security and public health at risk (MINAM, 2016).

To deal with this situation, firstly, it is recommended to understand and disseminate knowledge on regular climate and its extremes in the regions of interest. The local governments are the first level for emergency response during disasters through civil defence groups; however, these should also be more involved in managing risk reduction of disasters. On many occasions, this development is limited due to a lack of incentives and recognition of their role in this effort. In addition to these problems, there is still a common problem in developing countries, which is the low technical capacity or weakness in the relations between science and politics (Venkateswaran et al., 2017[40]).

Figure 6. *Huallaga, Rímac and upper Apurimac basin.*

40 Venkateswaran, K., MacClune, K. and Enríquez, M.F. (2017). Coastal El Niño: The 2017 Floods in Peru. Zurich Flood Resilience Alliance.

Introduction to the pilot areas: Huallaga, Rímac and Apurimac basins

The identified hydrographic basins for this project in Peru are especially vulnerable to climate variations and climate change, thus making them good pilot areas to test the impacts on the project investment and the potential for upscaling to the entire region (figure 6). The selection of these areas was done in consultation with the national institutions that will be involved in the implementation of the project. The Huallaga Basin is an Andean-Amazonian region particularly vulnerable to floods.

Deleted: a

Huallaga Basin

Geographical, socioeconomic and ecosystems contexts

The Huallaga River originates in the department of Pasco in the Huascacocha lagoon at 4,710 m.a.s.l. and has a length of 1,389 km. It crosses the departments of Pasco, Huánuco, La Libertad, San Martín and Loreto. The basin forms part of the Marañón basin, which in turn forms part of the Amazon basin, and therefore forms part of the Atlantic Ocean slope. The basin can be divided into three: upper, with altitudes from 4,700 to 3,600 m.a.s.l.; medium, with altitudes from 3,600 to 800 m.a.s.l.; and low, from 800 to 100 m.a.s.l. The upper zone begins in Pasco lagoon; the low area ends at the Marañón River. The entire basin covers an area of 95,000 Km^2 and the population is over 1.7 million inhabitants.

Climate characteristics and vulnerability

The climate variability is considerable due to the size of the basin and the contrasts between the Amazon plain in the lower parts and the Andean region in the highlands. The water resource in this region is important due to the potential agricultural production and the high capacity for land use (65%), which secures food for its population. Some of the most important products in the region are sugarcane, bananas, some citrus fruits and the raising of pigs and poultry. The basin also stands out for sustaining other sources of work for native communities through forest products, trout farming, tourism and human water use. In addition, it has important ecosystems that are vulnerable to extreme climate events such as paramos and humid and dry forests (Ferreyra, 1996[41]; MTC, 2005[42]).

The main extreme climate events in the basin have been droughts and floods, with the latter having been reported more frequently and intensely in the last two decades (ANA, 2015[43]).

Rímac Basin

Geographical, socioeconomic and ecosystem contexts

The Rímac River, the most important in the department of Lima, is also partially located in the department of Junín. It originates in the central mountain range of the Andean at an altitude of approximately 5,000 m.a.s.l., and its basin has a total area of 3,532 km^2. Its natural runoff is modulated by the seasonal rainfall that occurs in the upper basin and the presence of snow in the area.

The total population in the basin reaches almost 7 million inhabitants, because it includes the population of the capital, Lima. The main activities in the basin are the exploitation of minerals, industry and agricultural activity. The water resource of this basin is extremely important since it provides water for the entire population of Lima. The accelerated population growth in Lima has increased the water demand. The Peruvian government is working on

41 Ferreyra, R. H. (1996). Comunidades vegetales de la cuenca superior de los ríos: Marañón, Huallaga y Ucayali. Iquitos, Perú.

42 MTC (2005). Estudio de la navegabilidad del Río Huallaga en el tramo comprendido entre Yurimaguas y la confluencia con el Río Marañón. Ministerio de Transporte y Comunicaciones. Lima, Perú.

43 ANA (2015). Evaluación de Recursos Hídricos en la cuenca de Huallaga. Resumen ejecutivo. Autoridad Nacional del Agua.

major infrastructure for water storage and transfer in the Rimac river basin. The water flow of the river is insufficient to meet the water demand of the metropolitan area of Lima during the dry period (May-November). About 40% of water availability during this period comes from the Mantaro River basin transfer above 4,000 m.a.s.l. The regulated system details of Rímac river are shown in the table below:

PROJECT	CONTRIBUTING SOURCES	Q(m3/s)	OPERATION START	DETAILS
Phase I (Marcapomacocha - Milloc)	Lagoons: Marcapomacocha, Antacoto, Marcacocha, Pucrococha, Tucto y Milloc.	6.0	Concluded in 1966	Main objective was to cover electric demand in Lima city.
Phase II (Derivación Pomacocha - Río Blanco)	Lagoons: Pomacocha y Huallacocha. Quebrada Pucullo.	4.0	Not built yet	Main objective was to cover the increasing water demand in Lima city.
Phase III (Afianzamiento del sistema Marcapomacocha)	Slopes:Cusurcocha y Casacanchan	3.0	Concluded in 1999	Main objective was to consolidate Phase I.
Phase IV (Huascarcocha -Rímac)	Lagoons: Huascarcocha, Sheque, Huaroncocha, Quimacocha, Naticocha, Yanamachay.	2.4	Concluded in 2012	Main objective was to increase caudal in Phase III.
Phase V (Embalse Casacancha)	RiverCarispaccha	1.8	Planned for 2030	Main objective is to contribute with more water during dry periods for water plants Atarjea and Huachipa

Climate characteristics and vulnerability

This region is prone to landslides events. In the past, several episodes of flash floods and overflows, as well as landslides and mudslides, many of which were caused by the occurrence of El Niño events, occurred. Added to these geological and climate threats, the basin suffers from human interventions that increased its vulnerability.

In order to reduce the impacts of these extreme events in the basin, it is recommended to strength the local risk management and disaster prevention capacities, as well as the capacities of coordination instances for the integral management of the territory (MINAGRI, 2010[44]; Rengifo, 2016[45]).

44 MINAGRI (2010). Estudio hidrológico y ubicación de la red de estaciones hidrométricas en la cuenca del Río Rímac. Ministerio de Agricultura. Lima, Perú.

45 Rengifo, J. M. (2016). Diagnóstico de Vulnerabilidad y Riesgo en la Cuenca del Río Rímac. Foro Regional: Evaluación del Impacto del Fenómeno El Niño y Perspectivas de Recuperación. Chosica, Perú.

Apurimac Basin

Geographical, socioeconomic and ecosystem contexts

The Apurimac river basin has an area of 27,548.06 km^2, and is partially located in the Cusco, Apurimac and Ayacucho Departments. It starts in the Mismi glacier in the Andean mountain at more than 5,500 m.a.s.l., and is located about 160 km from Lake Titicaca. It has a diversity of environments where it is possible to identify, for example, the Andean dry forest, the Andean forest, and pre-montane tropical forest. The main sources of water are lagoons, where the population draws for household consumption; however, the glaciers also are important suppliers of water in dry periods. This hydrographic basin can be divided into upper and low, where the upper territory alone has an area of 3,818 km^2 and sums 25,290 inhabitants. Their principal economic activities are mining, agriculture and livestock (Pacheco et al., 2007[46]; Montesinos, 2012[47]).

Climate characteristics and vulnerability

Due to altitude variations, the Apurimac basin has different climate characteristics and risks. The upper region, which is located between 4,000 and 5,000 m.a.s.l., has an annual average precipitation that varies between 300 and 900 mm, and air temperatures between 1.5 and 6 °C. However, the climate variability affects these regular conditions, where the most common impacts observed have been associated with intense rainfall, landslides, frosts and snowfall. In addition, some human actions such as overgrazing and an improper water management have negatively affected the soil (Pacheco et al., 2007[48]; Montesinos, 2012[49]).

Chile – General Characteristics

Geography

Chile is located in the southwestern region of South America, has a land area of 2,006,096 km^2 and borders Peru to the north, Bolivia and Argentina to the west, and the Pacific Ocean to the east. The political-administrative organization is structured in three levels, the largest areas being defined as regions, then provinces, and finally communes. The population in 2010 was 17,066,142, where the great majority is concentrated in the central region, in the Metropolitan Region of Santiago, where the capital of Chile is located. The economy is stable and has grown in the last twenty years, with the country's GDP tripling between 1990 and 2015. The main economic activities that contribute to the country's GDP are the extraction of natural resources and primary goods, services, manufacturing industry and mining (MMA, 2016[50]).

Climate

The climate in Chile varies according to altitude and latitude, since the territory covers a wide range of latitude and large Andean elevations over short distances. These characteristics separate the country into natural geographical regions that present similar biogeographic,

46 Pacheco, V., Salas, E., Cairampoma, L., Noblecilla, M., Quintana, H., Ortiz, F., Palermo, P., & Ledesma, R. (2007). Contribución al conocimiento de la diversidad y conservación de los mamíferos en la cuenca del río Apurímac, Perú. Revista peruana de Biología, 14(2), 169-180.

47 Montesinos, M. S. (2012). Análisis de la gobernanza del recurso hídrico en la cuenca alta del río Apurímac, Perú. Master thesis. Centro Agronómico Tropical de Investigación y Enseñanza, CATIE. Turrialba, Costa Rica.

48 Pacheco, V., Salas, E., Cairampoma, L., Noblecilla, M., Quintana, H., Ortiz, F., Palermo, P., & Ledesma, R. (2007). Contribución al conocimiento de la diversidad y conservación de los mamíferos en la cuenca del río Apurímac, Perú. Revista peruana de Biología, 14(2), 169-180.

49 Montesinos, M. S. (2012). Análisis de la gobernanza del recurso hídrico en la cuenca alta del río Apurímac, Perú. Master thesis. Centro Agronómico Tropical de Investigación y Enseñanza, CATIE. Turrialba, Costa Rica.

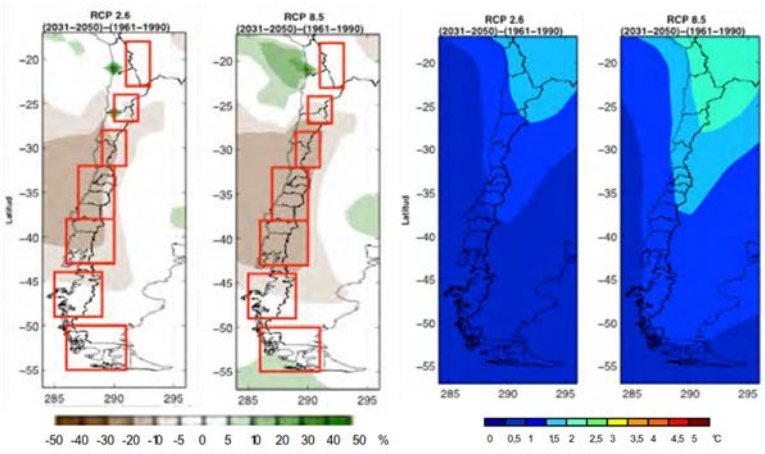
50 MMA (2016). Tercera Comunicación Nacional de Chile ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. Ministerio del Medio Ambiente, Chile.

hydrological and vegetation conditions. The northern region is divided in two, the first being a desert region, where one of the lowest annual rainfalls in the world is observed. The second region presents sub-humid conditions on the coast and semi-arid inland. Then, the central region is characterized by warm temperate climates, with winter precipitation higher in its southernmost portion, where the seasons have a well-defined annual cycle. Finally, in the Southern region of the country, rainfall is more abundant. In regards to air temperature, since is close to Antarctica, it becomes colder (MMA, 2016[51]).

Some features determine these climate characteristics as the South Pacific High, the marine influence and the relief. The effect of the cold Humboldt Current and the sea cause Chilean temperatures to be lower than those that are observed in other countries with the same latitude. On the other hand, the influence of the Andean mountains produces an average temperature range between 7 and 20 °C, depending on the area of the country and the season of the year. In general, Chile has cool nights due to fresh sea winds and cold air masses that descend from the Andean region (Novoa et al., 1989[52]).

Climate variability and change

In the last century, changes in precipitation have shown important inter-decadal and inter-annual variabilities that are associated with the Pacific Decadal Oscillation (PDO) and El Niño-Southern Oscillation (ENSO) phases, respectively. The warm phase of ENSO is usually associated with above-normal precipitation, while during the cold phase, La Niña, there are is below-normal precipitation. However, in general, the center-south region of the country has shown a downward trend in rainfall in recent decades. In terms of air temperature, until 2010 the main trend observed was warmer temperatures in the central valleys and in the Andean region, and on the other hand cooler temperatures were observed in the coastal region, which coincides with the cooling of the Sea Surface Temperature (SST) due to the variability of the PDO (figure 7).



51 MMA (2016). Tercera Comunicación Nacional de Chile ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. Ministerio del Medio Ambiente, Chile.

52 Novoa, R., Villaseca, S., Del Canto, P., Rouanet, J., Sierra, C., & Del Pozo, A. (1989). Mapa agroclimático de Chile. Instituto de Investigaciones Agropecuarias, Santiago, Chile. Vargas, W. (2015). Una breve descripción de la vegetación, con especial énfasis en las pioneras intermedias de los bosques secos de la Jagua, en la cuenca alta del Río Magdalena en el Huila. Colombia forestal. ISSN 012-0739.

Figure 7. *Both maps are an estimate of the climate change projections for two scenarios (RCP 2.6 and 8.5) for the 2031-2050 period for Chile. Left: percentual changes in precipitation. Right: temperature rising. Source: MMA (2016[53]).*

A reduction in precipitation is expected for the future, in comparison with the historical average. The projections indicate a decrease between 5 and 15% in the central region of the country. For temperature, the projections present warming throughout the country, being more intense in the plateau, and lower in the southern regions (MMA, 2016[54]).

Climate vulnerability

According to the UNFCCC, Chile is considered a country especially vulnerable to changes in climate, as it has a low coastal edge, arid and semi-arid zones, forest cover and areas exposed to forest deterioration. In addition, it has areas prone to drought and desertification, urban areas with air pollution problems and fragile ecosystems, especially in mountainous systems.

Some regions in Chile are regularly affected by severe drought, where, on some occasions, water shortages have exceeded 50%. For example, since 2010 the central region has experienced an uninterrupted sequence of dry years (30 to 70% rainfall deficit) that have coincided with the warmest decade recorded.

The precipitation deficit diminished the Andean snowpack and resulted in amplified declines (up to 90%) of river flow, reservoir volumes and groundwater levels. Climate change is also accelerating the progressive retreat of the tropical glaciers in the Andean region, which provides water for drinking, for small farms, hydroelectric power generation, and transnational mining operations. In the past 30 years, the glaciers have lost over 30% of their ice and snow, which will lead to severe water shortages in the future (Rudnick et al., 2011[55]).

From a climate point of view, it is imperative to strengthen the environmental monitoring network in order to monitor these conditions in the future, and thus, adjust the analysis and projections. The prospect is looming since the decrease of precipitation and increase in temperature results in the reduction of water availability and an earlier defrost process, which would make the dry season much longer and intense. These effects will continue to negatively impact various economic sectors in the region, especially the agricultural productivity. In the same way, under these conditions, forest fires will also increase, both in frequency and in extension (MMA, 2014[56]).

Concerned about this scenario, Chile has addressed the issue of climate change through its national strategy. The main objective is to minimize the impacts through integrated actions to determine the vulnerability of the country and adaptation measures to address them adequately. In the same way, the Ministry of Agriculture constituted the Council of Climate Change and Agriculture, with the mission of supporting the definition of the main guidelines and priorities to be considered in a program of adaptation and mitigation of climate change for forestry and agriculture (González et al., 2011[57]). From an international perspective, the strategy for disaster reduction has suggested some steps to be taken to reduce the impacts,

53 MMA (2016). Tercera Comunicación Nacional de Chile ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. Ministerio del Medio Ambiente, Chile.

54 MMA (2016). Tercera Comunicación Nacional de Chile ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. Ministerio del Medio Ambiente, Chile.

55 Rudnick, A., Ferreiro, C., Willumsen, H., Farías, F., Kleysteuber, A., & Canales, G. (2011). Segunda Comunicación Nacional de Chile ante la Convención Marco de Las Naciones Unidas sobre Cambio Climático.

56 MMA (2014). Plan de Adaptación al Cambio Climático. Oficina de Cambio Climático del Ministerio del Medio Ambiente. Santiago, Chile.

57 González, M. E., Lara, A., Urrutia, R., & Bosnich, J. (2011). Cambio climático y su impacto potencial en la ocurrencia de incendios forestales en la zona centro-sur de Chile (33º-42º S). Bosque (Valdivia), 32(3), 215-219.

where the identification of the nature, intensity and probability of the threat, together with the vulnerability, can be highlighted (Irarrázaval et al., 2016[58]).

The demand for water will continue to grow, and as in the rest of the world, the main factors that explain this constant increase are the greater social development and the economic growth itself that is forecasted for the future. Consequently, the main challenge is to ensure the availability of water for all the inhabitants of the country and, at the same time, allow the sustainable development of the economy (Aravena et al., 2017[59]).

Introduction to the pilot area: central region

Geographical, socioeconomic and ecosystem contexts

The central zone of Chile is a natural division which includes some of the most important regions, such as Valparaíso, the Metropolitan Region (Santiago), O'Higgins, Maule and part of Biobío, where the three main urbanizations in the country are located: Santiago, Valparaíso and Concepción. It also concentrates 80% of the total population, due to its favourable Mediterranean and continental climate. It is surrounded by the Andean mountain range to the east and by the south Pacific coast to the west. Historically it has been the main economic zone of the country due to its high percentage of economic productivity. An important factor for this development is the location of the main ports, although, various productive sectors are also located in this region, such as mining. Another extremely important activity for the region is agriculture with the production of wheat, corn, rice, potatoes and various fruits. It is also worth noting the production of wine in this region, which is one of the most important in South America. The fauna and flora also presents endemic species due to the presence of very dry summers and rainy winters (Santibáñez, 2018[60]).

Three important hydrographic basins are located in the central region of Chile, Aconcagua, Tinguiririca and Maule (figure 8).

Aconcagua Basin: has an estimated area of 7,337 km^2 and has a mixed glacial-pluvial source, where its flow depends both on the snow-covered peaks of the region and of the rainfall.

Tinguiririca Basin: rises in the Andean mountains, in the Tinguiririca glacier volcano and has an area of 4,730 km^2.

Maule Basin: has an area of 20,295 km^2, being the fourth largest in the country. It originates in the Maule Lagoon at 2,200 m.a.s.l., where the glaciers of the region are also located.

The central zone of Chile concentrates 54.68% of the Gross Domestic Product for the Silvoagricultural Sector. The main areas of the central zone are the horticultural and vineyards[61]. The regional panorama is presented below[62]:

- The Valparaíso region contains 3.5% of the national area devoted to crops (154,988.8 hectares), according to information from the 2007 Census. The main uses correspond to forest plantations, with 37.6% of said total; fruit plantations, with 34.1%, and forage plants, with 10.6%. These three uses concentrate 82.3% of the cultivation soils of the

58 Irarrázaval, S., Becerra, E., Ruiz, L., Gómez, G., Román, P., Monsalve, N., Flores, F., Lagos, A. & Moreno, C. (2016). Estudio Diagnóstico para desarrollar Plan de Riego en Tinguiririca. Informe final.

59 Aravena, W. M., Gajardo, L. G. H., Ugarte, C. B., Hube, M. V., Jorquera, B. C., Henríquez, M. M., Baeza, J. P. & Pool, P. S. (2017). Estudio Básico "Diagnóstico para desarrollar Plan de Riego Cuenca del Maule". Informe final.

60 Santibáñez Q. F. (2018). Tomo III Regiones de Valparaíso, Metropolitana, del Libertador Bernardo O'Higgins y del Maule.

61 Chilean Agriculture Overview, 2015. Office of Agriculture Policies, Trade and Information, www.odepa.gob.cl

62 Agricultural and Forestry Census, 2007

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region.

- The Metropolitan Region of Santiago covers 3.4% of the national surface dedicated to the different forestry and livestock sectors. The main uses correspond to fruit trees (35.7% of the total), followed by vegetables (16.9%), forage plants (14.3%), cereals (10.7%) and vineyards and vineyards (8.2%). These five uses concentrate 85.8% of the cultivated soils of the region. With regard to the participation of the region at the national level, the agriculture of the region is important in five areas: nurseries (26.9%); vegetables (26.5%); fruit trees (17.3%); seedbeds and nurseries (10.9%) and vineyards and vineyards (9.4%).
- The O'Higgins region covers 8.2% of the national surface devoted to forestry and livestock, according to information from the 2007 Agricultural and Forestry Census. Its main uses are forest plantations (38.8%), fruit plantations (21, 5%), cereals (15.6%) and vineyards and vineyards (9.9%). These four uses concentrate 85.8% of the agricultural and forestry lands of the region.
- The Maule Region concentrates 17.2% of the national surface dedicated to forestry and livestock, according to the 2007 Census, its main use being forest plantations, followed by cereals, fruit trees, forage plants and vineyards and vineyards. These items, together, account for 93.9% of the area of crops in the region.

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Climate characteristics and vulnerability

The societal and economic sectors operating in the central zone, as in other parts of the country, have frequently faced extreme events, which caused serious damage to the population and the productive systems. It is worth mentioning that the climate characteristics existing in Chile, in addition to La Niña and El Niño phenomena, produce natural disasters of hydro-meteorological origin that already generated agricultural emergencies due to catastrophes that range from floods to water scarcity and long-term droughts in the valleys (Badilla et al., 2016[63]).

In terms of floods, Chile has a zonal pattern of fluvial flood types related to the distribution of climate domains. These floods are classified into four main types: landslides, glacial processes, volcanic processes and precipitation. The intensity or persistence of precipitation explains the occurrence of 71% of flooding during the latest years (Aravena et al., 2017[64]). For example, in the middle basin of the Tinguiririca, there is a high concentration of floods recorded, which have been caused by excessive rainfall, saturation of soil, shallow water table, poor drainage, or channel overflows (Irarrázaval et al., 2016[65]; Aravena et al., 2017[66]).

63 Badilla, M. H., Espinoza, L., Gomez, J. L., Bustamante, A. M., Navarro, A. M., Bustos, A., Riffo, A., Zamora, G., Reyes, G., Gajardo, G., Bruno, S., Villa, P., Quezada, F., Herrera, A., Parra, N. L., & Castro, M. V. (2016). Diagnóstico para desarrollar plan de riego en cuenca de Aconcagua. Informe Final.

64 Aravena, W. M., Gajardo, L. G. H., Ugarte, C. B., Hube, M. V., Jorquera, B. C., Henríquez, M. M., Baeza, J. P. & Pool, P. S. (2017). Estudio Básico "Diagnóstico para desarrollar Plan de Riego Cuenca del Maule". Informe final.

65 Irarrázaval, S., Becerra, E., Ruiz, L., Gómez, G., Román, P., Monsalve, N., Flores, F., Lagos, A. & Moreno, C. (2016). Estudio Diagnóstico para desarrollar Plan de Riego en Tinguiririca. Informe final.

66 Aravena, W. M., Gajardo, L. G. H., Ugarte, C. B., Hube, M. V., Jorquera, B. C., Henríquez, M. M., Baeza, J. P. & Pool, P. S. (2017). Estudio Básico "Diagnóstico para desarrollar Plan de Riego Cuenca del Maule". Informe final.

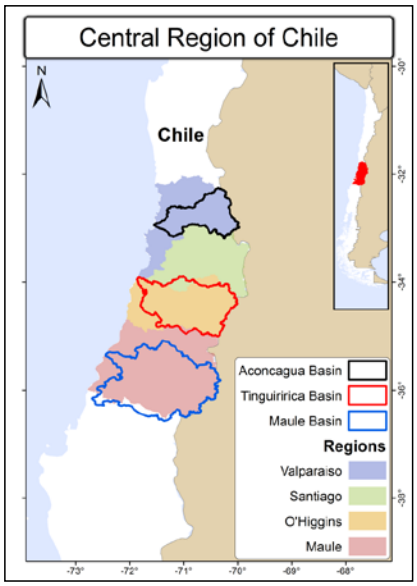

Figure 8. *Central region of Chile where the Aconcagua, Tinguiririca and Maule Basins are located, as well as the administrative region of Valparaiso, Santiago, O'Higgins and Maule.*

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In most basins of the country, as the Aconcagua, recent observations indicate that reductions in precipitation along, with the exponential increases in demand for water, have led to a current scarcity of the resource. This disadvantage is reflected in tributaries with lower flow rates, reservoirs with little stored volume and drying of wells, which generates problems of drought and water scarcity despite being close to main rivers and estuaries. In this region, there is also an increasing demand for water, which is driven by the modernization and growth of agriculture, the installation of agro-industries, growing urbanization of rural areas, growing needs of the communities, and the generation of energy.

In addition, to the current situation of drought and increasing in water demand, are some internal problems of water use, which highlight the lack of organization, where some infrastructures of accumulation and distribution are weakened and without adequate maintenance. This drawback causes problems in the irrigation infrastructure, which also is affected by the excessive subdivision of land, especially in the urban sectors, where the construction of houses and private structures are carried out without considering the network of established channels.

Drought also makes forest fires more common in this region. The occurrence of prolonged dry summers and the presence of vegetation with high igniting power make this region most susceptible, especially in areas located in interfluves, coastal slopes, in sectors with forest patches or forest plantations, and in piedmont areas of the mountain, where native forests are present.

For the future, it is estimated that changes in climate due to greenhouse gases, increase the air surface temperature throughout the continental country. For the coast, the warming could be between 0.5 and 1.0 °C, while over the mountain range these changes could be up to 5 °C in some regions. The minor coastal heating would probably be due to the effect of the

southern winds. There is also a slight differentiation between the seasons of the year, where warming of over 4 °C extend over the Andes is expected during the summer. In winter, the warming would be more intense, with values up to 5 °C, but concentrated in the central Andean region. For precipitation, changes are more difficult to quantify because it shows a more inter-annual variability. The projections indicate that the centre-south zone would present significant reductions, with values of up to 100 mm/decade. However, in other regions, the negative trends were not significant to the point of excelling on the great variability of precipitation of El Niño/La Niña events (Garreaud, 2011[67]).

It is also estimated that climate change will increase the intensity of extreme events, such as high and low temperatures, wind, intense storms, hail and drought. Lower rainfall, as expected in the future, would also increase the problem with the availability of water and, in this way, agriculture would face competition with other sectors of the economy (Badilla et al., 2016[68]).

Proposal

Global context

The Latin American region, due to its location and natural characteristics, has been affected by many disasters due to extreme weather events and climate change. Furthermore, this region comprises many developing countries that, in some cases, do not have the necessary capacities to manage these risks. To help improve the national capacity to understand and predict the climate, the World Meteorological Organization (WMO) together with international partners has launched the Global Framework for Climate Services (GFCS) as an authoritative, integrative and unique platform for guiding and supporting activities implemented within climate-sensitive investment areas. As a partnership with broad participation and reach, GFCS serves as a catalyser for activities, complementing the existing programs and initiatives that contribute to climate services, building on existing capacities and potentials, and providing momentum and tangible progress towards this fast-growing field. As such, it is directly contributing to the achievement of global and national goals identified in policy frameworks, such as the Paris Agreement adopted under the UNFCCC in 2015, the Sendai Framework for Disaster Risk Reduction 2015-2030, and the United Nations 2030 Agenda for Sustainable Development.

This framework focuses on developing and delivering services in five priority areas presenting immediate opportunities to bring benefits and wellbeing, especially in Latin America: agriculture and food security, disaster risk reduction, energy, health, and water. These priority areas were chosen due to their sensitivity to climate variability and change and also because they are the sectors where the strategies of adaptation and mitigation are prioritized. To achieve the development of specific climate services for these areas, it is necessary to have processes that include the collection of climate data, the generation and provision of climate information from the past, present and future, the development of products that help to understand the climate in its simplest form and its impacts on natural and human systems. Nonetheless, simply generating this information is not enough, but applying it correctly and turning it into a product for decision-making at all levels of society (WMO, 2016[69]).

67 Garreaud, R. (2011). Cambio Climático: Bases físicas e impactos en Chile. Revista Tierra Adentro–INIA, 93, 13-19.

68 Badilla, M. H., Espinoza, L., Gomez, J. L., Bustamante, A. M., Navarro, A. M., Bustos, A., Riffo, A., Zamora, G., Reyes, G., Gajardo, G., Bruno, S., Villa, P., Quezada, F., Herrera, A., Parra, N. L., & Castro, M. V. (2016). Diagnóstico para desarrollar plan de riego en cuenca de Aconcagua. Informe Final.

69 WMO (2016). Climate Services for Supporting Climate Change Adaptation. Supplement to the Technical Guidelines for the National Adaptation Plan Process. World Meteorological Organization, WMO. Geneva, Switzerland.

Current situation of the region

An analysis of the technical and technological capacities of the National Meteorological and Hydrological Services (NMHSs) in the region, carried out through surveys with the countries, highlighted some of the critical problems that the institutions have and that restrict the production of sectorial climate services. For example, in terms of data management some NMHSs have mentioned that many data are not yet digitized, while some others are not homogenized, or have no quality control or metadata. However, the greatest weakness in the region is in the production of climate services, as there is still reported difficulty in generating specialized products for each sector, and when it is finally generated, it is not adequate enough for decision-making.

The main causes of this difficulty, and at the same time the priorities identified to improve them, have been the low number of personnel dedicated exclusively to this work, the inadequate computer infrastructure, inefficient databases and observation network. The ways to overcome these difficulties, according to the NMHSs, would be through partnerships with other NMHSs, the Regional Climate Centers (RCCs) and the WMO, as well as the engagement in partnerships and alliances with the private sector.

In this way, Colombia has taken an important step among the countries of Latin America, since it was the first to achieve the implementation of the National Framework of Climate Services (NFCS). The Colombian Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) came together with other institutions to improve the production of hydro-meteorological information and co-produce specific information for all productive sectors of the country, such as health, agriculture, energy, and transport (WMO[70]; IDEAM[71]). In addition, Peru and Chile have requested support to implement nationally the Global Framework for Climate Services (GFCS) and develop climate services for reducing the vulnerability of key societal and economic sectors of their territories (Table 2) . Therefore, this project proposal responds to these requests and facilitate WMO technical support to regional and countries partners.

Table 2. *GFCS status and priorities for each country.*

Country	GFCS priorities	NFCS implementation status
Chile	1) Disaster Risk Management: due to social and economic impacts. 2) Agriculture: key economic sector for the associated PIB/GDP. 3) Hydrological resources: availability and access to water is a problem clearly related to climate change. 4) Energy: the country is heading to clean energies through diversification of the energy matrix. 5) Health: a joint work has started however there is a	Internal consultations just started. Key information gathering in order to lead the activities for the establishment of the national baseline. The DMC is assessing its operational capabilities to respond to the NFCS implementation challenges, beginning with agriculture sector. It is expected by 2019 to begin the identification and key stakeholders mapping in order to determine intermediate and final users; and also the potential partners in the priority sectors.

70 https://public.wmo.int/es/media/noticias/colombia-pionero-en-servicios-clim%C3%A1ticos-para-latinoam%C3%A9rica

71 http://www.ideam.gov.co/web/tiempo-y-clima/marco-nacional-de-servicios-climaticos

	necessity of major interaction with different sectors.	
Colombia	1) Agriculture and food security 2) Water resources 3) Health 4) Climate Risk Management 5) Energy	IDEAM initiated the implementation of the NFCS in 2017, as per the guidelines of the GFCS. In the first stage consisted of an assessment of national capabilities to provide climate services. This included the review of data, products and services developed and delivered by IDEAM. The second stage was a National consultation developed in September-October 2107 and a comprehensive identification of needs, sectorial priorities and the key elements of climate information value chains. The NFCS of Colombia was officially launched from 1st to 3rd of November 2017. During 2018, several activities has been developed: 1) The preparation of an institutional and legal framework for climate services for the agriculture sector. 2) The preparation of a document with a diagnostic of the state of the art in climate services for agriculture. 3) A deeper analysis of information requirement of farmers and associations. 4) An inventory of current climate services provided by IDEAM to the agriculture sector. 5) A prioritization of sectoral requirements. IDEAM is expected to develop an Operations Plan for NFCS implementation.
Peru	1) The NDC framework includes different priorities for health, water, agricultural, forest and fishing. Adaptation priorities that are being	1) Peru is member of the WMO Expert Team for the NFCS. 2) The MINAM is beginning coordination with WMO to support the NFCS process.

	checked by multi-sectorial work group (GTM, RSN 005-2016-MINAM). 2) The PPR 068 (Presupuesto por Resultados) includes vulnerability reduction and emergency attention for disasters risk management. 3) The multi-sectorial program for frost (PMHF) guides different institutional actions to cope with low temperatures events from national institutions to vulnerable districts. 4) The SDG-6 monitoring project (GEMI) recommends multi-sectorial and progressive evaluations in order to obtain data to calculate the indicators related to the strengthening of public policies. 5) OCDE participation through the national program launched at 2014 has focused on economic growth, governance, fight against corruption, productivity and human capital and environment. 6) National policies related to GFCS priorities are: promotion of food safety, sustainable development and environment management, science and technology development and the agricultural and rural development policies.	3) Based on CLIMANDES experience the preliminary stakeholders mapping has been systematized. 4) National Climate Outlook Fora (NCOF) will be institutionalized as an interaction space for users to know the climate information limits, needs and decision-making process. 5) Identification of strategic partners and legal frameworks to begin the process through an NFCS. The national system for disaster risk reduction (SINAGERED) represents the potential interface platform to connect all the users into the Disaster Risk Management (DRM) area.This platform is an inter-istitutional, dynamic, decentralized, trasversal and participatory system created in 2011 through the #29664 Law. The main objective is to identify and reduce risks related to multiple hazards, mitigate the negative effects and preparedness for disaster response 6) The National Emergency Operations Center- EOC, is the platform that allows an information exchange related to hazards, emergencies and disasters between all institutions in real time period which facilitates joint coordination for decision making at national level. This national and multi-sectorial network allows the interaction of climate services products. 7) Climate change involves hydroclimatic extreme events which has a bigger demand of climate information services. The SENAMHI is working on different actions to provide specific information for the National Climate Change Strategy – ENCC. The National Strategy on Climate Change (ENCC) incorporates approaches that contribute to achieve a satisfactory and sustainable development for society, based on a low carbon economy

Strengthening of capacities

The innovative pillars of the GFCS for strengthening the capacity to deliver actionable climate information are: The Climate Services Information System (CSIS) and the User Interface Platform (UIP).

The Climate Services Information System (CSIS) is the mechanism through which climate information is collected, stored and processed to generate products and services that inform

decision-making across a wide range of climate-sensitive activities. Climate data includes past and present climate data (historical climate summaries, reanalysis and data rescue) as well as future climate (forecasts and projections) for use in mitigation, planning and adaptation. The CSIS comprises global, regional and national centres and other institutions that generate or process climate information and a network of computers and communication channels for the exchange of data and products through existing internationally-agreed systems. A key aim of the CSIS is to enhance the capacity of national and regional centres for effective use of global and regional inputs in national level operations. The Climate Services Toolkit (CST)[72], one of key instruments for CSIS implementation, promotes the development and provision of reliable, consistent and high-quality information and products to end-users. It will improve efficiency and raise capacities of service providers by facilitating the production, communication and application of climate information products. (WMO, 2014[73]).

Climate services often do not reach their target, the decisions-makers. The User Interface Platform (UIP) is a structured means for users, climate researchers and information providers to interact. Its purpose is to ensure that the information, products and communications relevant to user needs are applicable, actionable, timely, and easily understood. The User Interface Platform is the most novel GFCS component and reflects the fact that the involvement of users is crucial in helping to establish the needs, develop appropriate products, identify capacity development requirements and influence the direction of observational investments and research efforts. UIPs foster interaction among users, user representatives, service providers and researchers, through regional climate outlook forums, sector collaborations and expert study groups. The sustainability of this whole process is important to ensure that there is monitoring and evaluation of the processes (WMO, 2014a[74]).

The present proposal will seek to help Colombia achieve its objectives with the implementation of the NFCS and support Peru and Chile to establish the NFCS in their respective countries. It also thrives to strengthen the WMO Regional Climate Centre (RCC) as Centre of Excellence, to serve as the CSIS steward at the regional level by producing operational climate monitoring and prediction products, facilitating climate data services, and conducting regional and in-country training activities and to facilitate climate services network and play an instrumental role in the organization of Regional Climate Outlook

Regarding the priority sectors, this project will address climate variability and change in the water sector and its interaction with agriculture and hydropower. This approach addresses climate risk reduction through the enhancement of the design, production and provision of tools and products for early warnings of extreme events, water management (e.g. by cities, towns, and for irrigation), resilient food production, hydropower generation, and ecosystem and biodiversity conservation as part of the on-going climate adaptation, mitigation and sustainable development efforts. An analysis of the direct beneficiaries of this project is presented in Table 3.

Table 3. Analysis of the direct beneficiaries and sectors in the pilot areas

Country/ location	Number of beneficiaries (men, women, etc.)	Crops and communities	Hydric infrastructure/power Dams
Chile	The 2017 national census at Quillota	On the low basin of Aconcagua, the intensive agriculture systems	According to national census of watersheds

[72] http://www.wmo.int/cst/

73 WMO (2014). Anexo al Plan de ejecución del Marco Mundial para los Servicios Climáticos – Componente del Sistema de información de servicios climáticos. World Meteorological Organization, WMO. Geneva, Switzerland.

74 WMO (2014a). Anexo al Plan de ejecución del Marco Mundial para los Servicios Climáticos – Componente de la plataforma de interfaz de usuario. World Meteorological Organization, WMO. Geneva, Switzerland.

	province registers: Total population: Male: 43.537 Female: 46.980 Farmers population: 5.148 Male:3.572 Female: 1.576	are about 60% of fruit trees and 25% horticulture. The low basin of Aconcagua is the most important area of the country for avocado production. The horticulture is about: tomato, lettuce, carrot, kidney beans, all related to small farmers. The animal breeding is focus on: poultry (63% national production of turkeys). The small producer concentrates 40% of this production.	updated on 2016 in Quillota province there are 38 watersheds, where 10 of them are tailings, 12 are for irrigation and 16 non-identified uses. The channel network of Quillota province there are 109 with 665.564 lineal meters (665,5 km) in which 6 of them represent 40% belongs to: MAUCO: 55.4 km WADDINGTON: 55.1 km OVALLE: 52.8 km EL MELON: 43.5 km PURUTUN: 34.4 km SERRANO: 24.6 km There is currently a total of 7,055 MW of installed hydropower capacity in the Maule and Bio-Bio regions. National Energy Strategy (ENE) has targets for 45-48 % of electricity generation to be sourced from hydropower by 2024.
Colombia	Cauca department Population: 35,758 inhabitants, Female: 17,213 Male: 18,545 Caldas department Population: 23,784 inhabitants, Female: 11,274 Male: 12,510 Tolima department Population: 36,977 inhabitants, Female: 17,910 Male: 19,087	Department of Cauca: Organic coffee, fruit trees, vegetables and potato. Indigenous Reserves of Popayán, Puracé and Totoró where there is an association of farmers. Department of Caldas: Coffee, fruit trees, vegetables, avocado and plantain. Department of Tolima: rice, corn, cotton and fruit trees	Department of Cauca: Aqueduct Company of Popayan Department of Tolima: Irrigation district of the Coello river, Usoguamo, Torres I district, and there is pumping activity of the Mangada River. The 2,400 MW Ituango hydropower project, in the Cauca River, will become the largest hydropower plant in Colombia when it is completed
Peru	Lima: Rimac river basin Population: 7´605,742 inhabitants, Female: 51.2%	The river basin of Rímac, on the highlands area presents: Agricultural surface: 44,540.2 ha Producers: 4,041 Farmer communities: 28	In the Rímac zone there are Huinco - Sheque dam (270 MW) and Matucana – Tamboraque dam (140 MW).

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*Nehuenco I (1999). Power source: gas. Power: 368.4 MW¶
*Nehuenco II (2003). Power source: gas. Power: 398.3 MW.¶
*Nehuenco III (2002). Power source: gas. Power: 108 MW.¶
*San Isidro (1998). Power source: gas, petroleum and diesel. Power: 379 MW.¶
*San Isidro (2009). Power source: gas, petroleum and diesel. Power: 353 MW.¶
*Tomaval 2 (2012). Power source: gas. Power: 1.6 MW.¶
*Bio Cruz (2012). Power source: gas. Power: 1.8 MW.¶
*Los Vientos (2007). Power source: gas. Power: 125 MW. ¶
*Las Vegas (2007). Power source: petroleum and diesel. Power: 2.1 MW.

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	Male: 48.8% Intervention areas: Matucana district in Huarochiri region. Population 5,000 The inter-basin high Apurímac has 110,000 inhabitants concentrated at Espinar and Canas provinces. The Huallaga river basin is especially vulnerable to flooding events. Total population is 77,416 inhabitants. Interventions are prioritized in the district of Picota and Campanilla in the San Martin region.	The main crops are: fruit trees (9,081 ha), cultivated pastures (22,536 ha), cereals (3,877 ha), Andean tubers and roots (3,798 ha). The most cultivated fruit trees are: cherimoya, avocado, mango, apple and tuna; cultivated pastures: alfalfa and pastures are sown; cereals: wheat, maize corn and starchy corn; and tubers, white and yellow potatoes. High basin of Apurímac with: agricultural surface: 2´300,000 ha.; producers: 89,504 farmers communities: 700 Main crops: cultivated pastures: alfalfa, cereals: wheat, starchy corn and corn, tubers: white and yellow potatoes; and legumes: peas, beans. Of the 1,107,356.54 ha of agricultural area in the San Martin Region: 62% (686, 561.1 ha) corresponds to the study area (Huallaga Central, Bajo Mayo and Bajo Huallaga), 56.2% of the Agricultural Units (UA) has agricultural area and 68.1% with natural pastures. The annual crops are: hard yellow corn, rice, plantains and yucca.	Huallaga has the Chaglla dam (456 MW). 22 hydropower plants are under construction In all cases the dams are operated by private enterprises.

The project will address the current limitations of the participant countries to produce and deliver relevant climate information to a complex multi-institutional framework, sectorial stakeholders, national, subnational and local authorities in support of risk management and adaptation plans at the community level in the Andean region.

Project / Programme Objectives:

The overall objective of the project is to *reduce vulnerability and increase resilience of the Andean communities in Colombia, Peru and Chile to climate variability and change by implementing climate-smart decision-making networks for better disaster risk, hydropower generation and agriculture management.*

The sub-objectives of the project, which are in line with the project components below, and the Adaptation Fund outcomes, are:

- Increased technical capacity of the NMHSs of Colombia, Peru and Chile to generate and disseminate end-to-end and communities demand-driven weather, climate and hydrological services.

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- Enhanced national and local inter-institutional/sectorial stakeholder networks to co-design and co-produce sector specific climate information in support of disaster risk management, long-term adaptation and water, food, and energy security.
- Empowered local communities to use the weather and climate information for local risk management and adaptation plans.
- Strengthened regional cooperation for mutual technical assistance among NMHSs, alignment with other complementary initiatives in the Andean region, and foster capacity building on data management, climate prediction, and tailored sectorial information that can be expanded to other countries such as Bolivia, Ecuador and Venezuela.

The theory of change of the ENANDES project is shown in the figure 9:

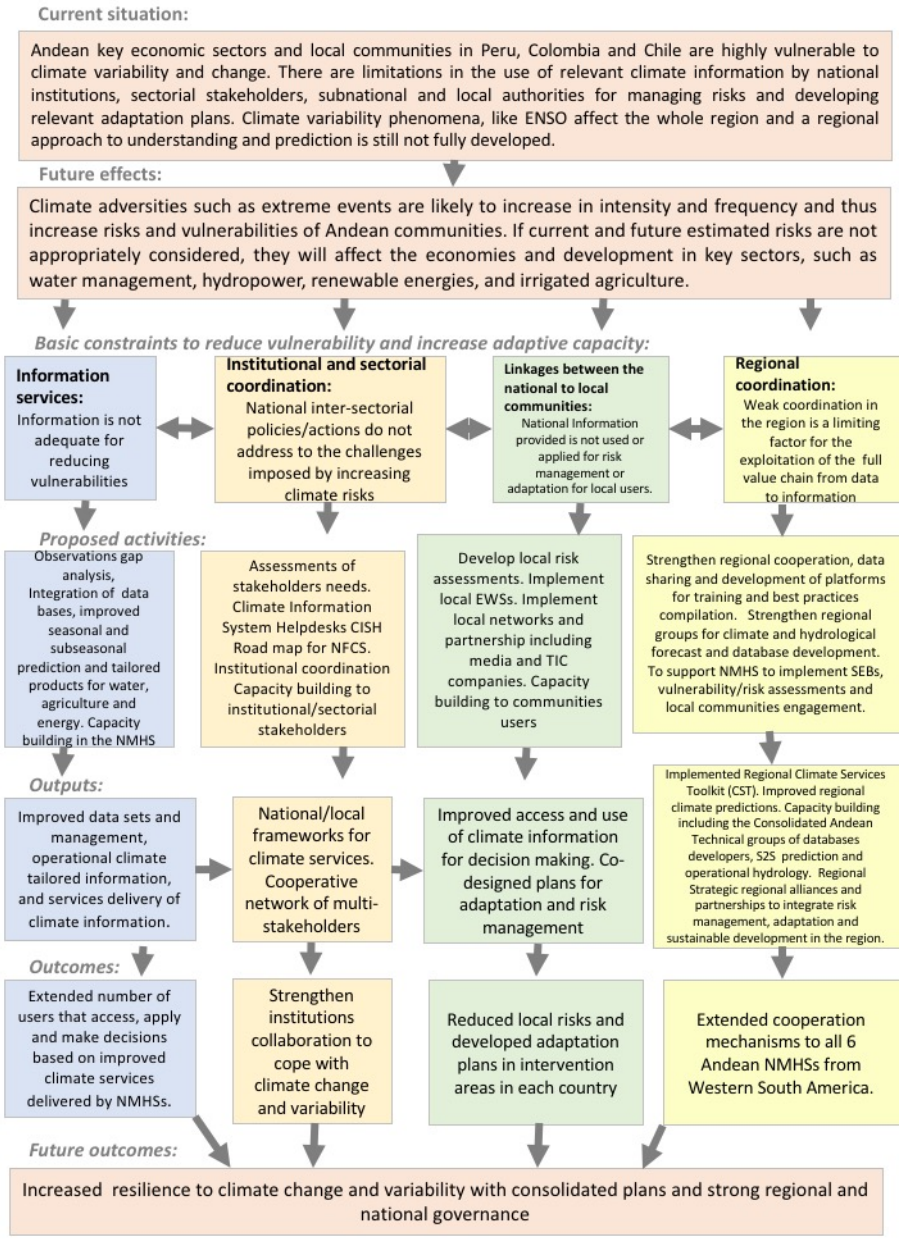

Figure 9. *Theory of change of ENANDES Project*

Project / Programme Components and Financing

Table 4. *Project components, expected outcomes and outputs*

Project Components	Expected Outcomes	Expected Outputs	Countries	Amount (US$)
1. Improvement of the national and local operational weather, climate and hydrological services system.	Extended number of users that access, apply and make decisions based on improved climate services delivered by NMHSs.	1.1 Updated national data management systems, archives, and integrated regional hydrological and meteorological databases. 1.2 Improved weather, climate and hydrological predictions and projections by establishing an optimized cascading system involving the regionalization of global forecast products. 1.3 Sustained delivery of weather and climate-related advisories to support decision-making for national and local water, agriculture and energy stakeholders. 1.4 End-to-end service through customization of climate information, communication and user feedback system.	Chile, Colombia, Peru	1,800,000
2. Implementation of national and local inter-institutional/ sectorial stakeholder networks.	Implemented contributions to start and consolidate the National frameworks of Climate Services.	2.1 Implemented contributions for the establishment and consolidation of National Frameworks for Climate Services in each country. 2.2 Implemented/improved sectorial local multi-stakeholder networks to support the co-design and co-production of tailored climate services.	Chile, Colombia, Peru	900,000

3. Engagement and empowerment of local communities to use the climate information for local risk management, and adaptation plans and projects.	Local stakeholders manage risks that arise from climate variability and change and develop adaptation plan, especially in pilot intervention areas.	3.1 Strengthened capacities of local stakeholders and communities to access, use and apply climate information for risk management and adaptation.	Chile, Colombia, Peru	1,800,000
		3.2 Co-designed local climate risk management and adaptation plans with local authorities and the support of public and private institutions/stakeholders.		
4. Strengthening of regional cooperation among NMHSs from the Andean region.	Extended cooperation mechanisms to all 6 Andean NMHSs from Western South America.	4.1 Implemented the Regional Climate Services Toolkit (CST).	Chile, Colombia, Peru	1,700,000
		4.2 Consolidated Andean Technical groups of data base developers, S2S[75] prediction and operational hydrology.		
		4.3 Implemented Strategic regional alliances and partnerships for sustained capacity building.		
5. Project/Programme Execution cost				6,850,000
6. Total Project/Programme Cost				548,000
7. Project/Programme Cycle Management Fee, charged by the Implementing Entity (if applicable)				650,000
Amount of Financing Requested				7,398,000

Project Duration: Three years and six months (2019 to mid-2022)

Projected Calendar:

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Table 5.

Milestones	Expected Dates
Start of Project/Programme Implementation	March-2019
Mid-term Review (if planned)	January-2021
Project/Programme Closing	September-2022
Final Evaluation	November-2022

75 Seasonal to sub-seasonal

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project / programme components, particularly focusing on the concrete adaptation activities, how these activities would contribute to climate resilience, and how they would build added value through the regional approach, compared to implementing similar activities in each country individually.

The project is advancing a multi-sectoral climate risk reduction approach to reduce the vulnerability of Andean communities and to increase their adaptive capacity to climate variability and change. Given the diversity of the climate variability and climate change manifestation and the different degree of vulnerability and resilience in the three target countries (Chile, Peru and Colombia), the project will conduct pilot testing on the dissemination, use and feedback of tailored climate products and tools in areas of the Andean region involving representatives of the major groups of beneficiaries (figure 1 and table 3):

- **Colombia:** upper Magdalena - Cauca river basin (Departments of Cauca, Tolima and Caldas);
- **Peru:** mid and upper Rímac, Huallaga and upper Apurimac basins;
- **Chile:** central region of the country (Valparaiso, Metropolitana, O'Higgins and Maule provinces) where important river basins like Aconcagua, Tinquiririca and Maule are located.

These pilot areas where identified by the participating countries based on the following criteria:

1) Evidence that increases in temperature, sustained decrease of precipitation, reduction of glaciers and other environmental indices are impacting the population of the areas, and these impacts will adversely affect the societal and economic development if no adaptation measures are put in place;

2) High concentration of agricultural activities that support rural communities and small farming enterprises. Communities and farmers that are specifically vulnerable to climate impacts because of lack of preparedness and adapting measures;

3) Areas with a strong interdependency between water, energy and agriculture;

4) Existing collaboration between NMHSs and water, energy and agriculture national and local authorities; and

5) Areas where specific barriers have been identified that prevent the use of climate information for mitigating risks and adaptation plans.

The first three components aim to strengthen the national value chain for climate services linking climate knowledge to action. The fourth component will enhance the regional coordination between the participating countries by facilitating the exchange of knowledge, harmonization of data and further scalability.

The activities are indicative at this concept stage describing the main focus of interventions in the countries and per each output and component. The initial consultation process (see Annex 1) identified the barriers to resilience to climate variability and change, and disaster risks as follow:

- Lack of national capacity to produce and update relevant climate information and vulnerability analysis;
- Lack of institutional capacity for cross-sectoral coordination, co-design and co-production of information;
- Lack of technical capacity to generate and disseminate climate and early warning information;
- Lack of capacity to understand and use climate information for decision-making

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- Lack of capacity to integrate climate change information to produce climate resilient territorial policies and plans; and
- Lack of harmonization and coordination of data and info management.

The connectivity and interactions between the different components and their corresponding outcomes are shown in the Figure 10.

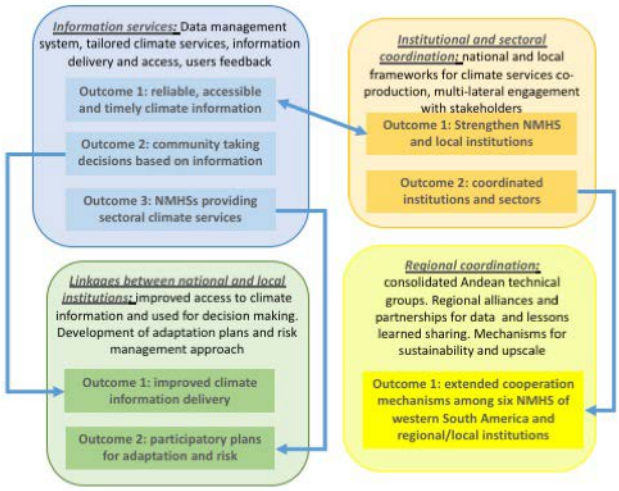

Figure 10. *Scheme of the component inter-linkages in ENANDES Project*

Component 1: Improvement of national and local operational weather, climate and hydrological services system

One of the strategies that has been identified to promote climate change adaptation within vulnerable communities is the appropriate use of accurate climate information to guide decisions for the use of natural resources for production activities. This component is designed to enhanced the capacity of the NMHS to provide improved climate information at national and sub-national level through interventions targeted at enhancing hydrometeorological observations, data management, improved climate forecasts and analysis.

The Andean countries are known to have large meteorological and hydrological data gaps. The project will assess the existing observations network and data sources in terms of space and time coverage, availability, quality, and readiness for all parameters needed for the delivery of the improved information services. The analysis will also address the integration of other sources of data (e.g. other national departments, academia, private sector), the use of available satellite data (this would need to cover the development of the capacity to ingest, interpret, and process satellite data, including required agreements for access), standardization of observation methods and data exchange. The findings will determine specific actions within the framework of the WMO Integrated Global Observing System

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(WIGOS) to achieve an integrated, coordinated and comprehensive observing system to satisfy, in a cost-effective and sustained manner, the evolving observing requirements of countries in delivering their weather, climate, water and related environmental services.

The project will ensure homogenization of data streams such as meteorological and hydrological databases through technical developments (e.g. Hydex[76] and others) in each NMHSs to improve quality control and standardization of data sets within the weather, climate, and hydrology departments. This activity underpins the provision of weather and climate services for Early Warning Systems (EWS), floods and drought prevention, and deliver more consistent information to risk managers and planners.

Key activity of this component is the national generation of improved weather, climate, and hydrological predictions and projections through an optimized cascading system involving the regionalization of global long-range forecast products. Subsequent integration of hydrometeorological prediction system, will result in an improved hydrological risk map in the selected basins. It is expected to optimize and extend the use of software tools previously implemented in the Andean NMHSs, such as SmartMet[77], through capacity building efforts at a regional and national scale.

The current climate model representation of the ENSO signal in the Andean region is currently very poor due to sub-optimal integration of topographic effects of the Andes, land-ocean boundary interactions etc. Considering the increased demand of seasonal and subseasonal predictions for risk management and sectorial planning, the project will support the implementation of experimental/operational hybrid[78] models for seasonal to subseasonal (S2S) predictions, including skill assessment and operational verification. This will also include models for climate impact forecasts, which are inexistent in Andean countries at present, and will represent a significant step towards increase resilience.

The project will support the sustained delivery mechanisms of weather and climate-related advisories in each NMHS to national and local water, agriculture and energy stakeholders. This will be achieved through a participatory process with sectorial end-users. In order to expand the current information service and increase its application in the sectorial planning and climate change adaptation, the project will support the development of Impact-Based Forecast (IBF) products together with the development of new communication channels based on mobile technology for the effective communication of alerts, advisories, and other information to users.

To consolidate the products developments, the project will promote specific actions to establish a system for “end-to-end” service through the customization of climate information, communication and user feedback system. The system will include the implementation of full climate information chain trough formal arrangements between national, local and sectorial institutions and the co-design and co-development of protocols and communication mechanisms.

Outcome 1: Extended number of users that access, apply and make decisions based on improved climate services delivered by NMHSs.

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76 Open source software developed for the Andean countries under PRASDES Programme. http://www.prasdes-ciifen.org/index.php/publicaciones/cat_view/12-documentos/26-hydex

77 https://github.com/fmidev/smartmet-server

78 “Hybrid” seasonal predictions based on the predicted state of ENSO, which can be forecasted relatively skillfully, together with observed local relationships with ENSO to be explored.

The outcome will focus on delivering regular generation of improved tailored seasonal climate forecasts and climate change projections for the near future, training and capacity building in downscaling techniques, high resolution seasonal forecast downscaling and establishment of historical climate baseline statistics and trends, including mapping out historical and future areas of concern (hot spots) for selected Andean communities;

Output 1.1: Updated national data management systems, archives, and integrated regional hydrological and meteorological databases.

Activities under output 1.1

Activity 1.1.1: Conduct an observation gap analysis for observational needs to support climate services. Develop national observing strategy to improve an strengthen national observing networks in alignment with the WMO Integrated Global Observing System.

Activity 1.1.2: Digitalization of national meteorological and hydrological data, where necessary and integration of additional required data available at regional and global data centers.

Activity 1.1.3: Implementation of Data Management System in each participating country

Activity 1.1.4: Assess the available IT equipment (computers, servers, etc.) in the NMHSs services and other relevant services. Purchase additional equipment if necessary.

Activity 1.1.5: Publication of regular, quality controlled authoritative information on the status of climate for national policies and adaptation plans. Baseline products will be generated and made available to each pilot location. Organization of regional and national workshops for creating awareness.

Output 1.2: Improved weather, climate, and hydrological predictions and projections by establishing an optimized cascading system involving the regionalization of global forecast products.

Activities under output 1.2:

Activity 1.2.1: Delivery of a comprehensive hydrometeorological prediction by integrating hydraulic forecasts and flood mapping in selected basins.

Activity 1.2.2: Generate monthly, seasonal and longer scale climate predictions, using both empirical and dynamical approaches

Activity 1.2.3: Generation of value-added forecasts products for national scales based on RCC and GPC products

Activity 1.2.4: Participation to RCOFs so as to contribute in generating the required climate forecasts at various scales, and to refine seasonal outlooks and climate change projections for initial downscaling to national and sub-national levels

Activity 1.2.5: training and capacity building in downscaling techniques and communication of uncertainties. Development of manuals and platforms

Output 1.3: Sustained delivery of weather and climate- related advisories to support decision making for national and local water, agriculture, and energy stakeholders.

Activities under output 1.3:

Activity 1.3.1: Conduct regular consultations with water, agriculture and energy users to identify requirements for, and provide advice on, climate information and adequate and viable products for their applications

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Activity 1.3.2: Create a database for extension service providers and other intermediary information disseminators. These baselines will constitute basis for measuring and quantification of the impact of project interventions within the participating communities.

Activity 1.3.3: Establishment of formal agreements with national, local and sectorial institutions for the exploitation of the full climate information value chain

Activity 1.3.4: Development of impact-based forecast (IBF) products to help in decision support services in the areas of weather, disaster risk reduction, water, energy, and agriculture.

1.4 End-to-end service through customization of climate information, communication and user´s feedback system.

Activities under Output 1.4:

Activity 1.4.1: Review or establish a feedback mechanism for continuous improvement of the climate products. Action plan on how to improve feedback collection and integration

Activity 1.4.2: Design a cost effective communication and feedback channels jointly tested and validated with users. An integrated tool that allows use of available ICT technology including use of internet, mobile phones etc… will be evaluated for efficacy. Lessons will be shared with ongoing similar projects from the region.

Activity 1.4.3: Identification of institutional, financial and cooperation mechanisms to ensure the sustainability of the climate information delivery.

This overall component of the project will strengthen the current operational capabilities of the NMHS from Chile, Colombia and Peru to produce and deliver suitable climate services for informed adaptation activities. The services delivery will set up the technical and operational basis to contribute at different levels to prevention, preparedness and a better response to climate extreme events, and have more and better-informed adaptation plans at different geographic scales.

The existent interaction and coordination between the NMHS of Chile, Colombia, Peru and CIIFEN, as well as the WMO Regional Climate Center for Western South America (RCC-WSA) ensure optimization of resources and the transfer of know-how for the improvement and/or development of data management, prediction services and information management.

Component 2: Implementation of national and local inter-institutional/ sectorial stakeholder networks.

All countries are facing difficulties in coping with the increasing effects of hydrometeorological hazards and resulting disasters, whether through a growth in the number of severe events, increased exposure, heightened vulnerability, limited capacities or a combination of all factors. Financial and technical efforts have to be directed towards strengthening capacities at national and local levels, drawing on international support where necessary. Critical steps are need to be taken to create enabling mechanisms that support development decisions with respect to mitigation, as well as building resilience of countries to cope with future climate risks. This component focuses on the establishment of a multi stakeholders dialogue at national level to assist the regular production of seasonal agriculture, water and energy planners, and disaster risk advisories. The activities listed herein concern the implementation/consolidation of the NFCS as the proposed mechanism to foster the co-

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Activity 1.4.2: Development mechanisms to incorporate users' feedback and customer satisfaction into the product development.¶

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production and the inter-sectorial dissemination of climate information as well as enable its penetration at different territorial governance levels (from national to subnational–local).

These institutional interlinkages will underpin the governance structures and the information needed to support adaptation plans while contributing with the institutional development and their empowerment to enable the necessary changes for climate resilience. The involvement of users in helping to establish the needs, co-develop appropriate products, identify capacity development requirements and influence the direction of observational investments and research efforts is crucial in achieving the project goal (figure 11).

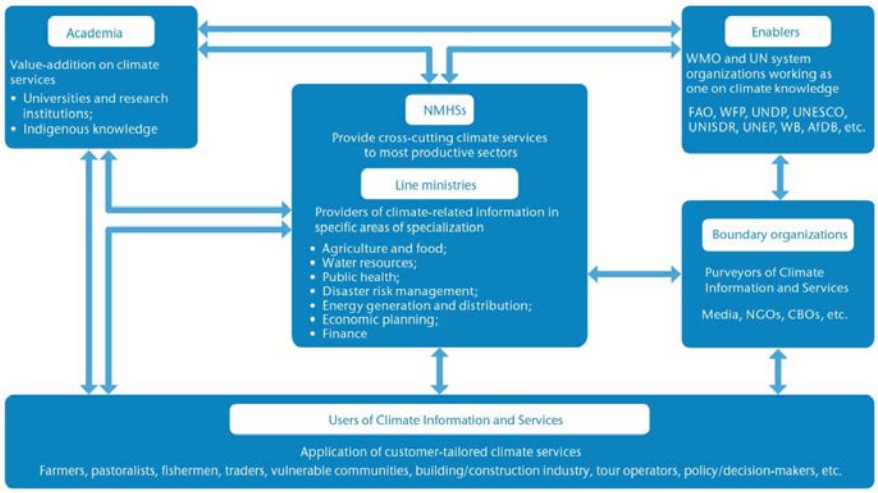

Figure 11. *Schematic representation of an NFCS showing interlinkages among partner institutions acting together as one on climate knowledge.*

Outcome 2: Contributions implemented to start/consolidate the National Climate Services frameworks

The project will support the establishment/consolidation of a NFCS in Chile, Colombia and Peru in accordance with GFCS Guidelines[79]. Several prerequisites for the successful development of the NFCS will be addressed during the project such as the engagement of national sectorial stakeholders (water, energy, agriculture, and risk management) involved in the production, tailoring, communication and utilization of climate services, the establishment of a national dialogue around climate services provision, identification of weather, hydrology and climate information needs and a blueprint strategic Plan for the implementation of the National Climate Services Framework for each country. Along with these processes, a National Climate Information System Helpdesks (CISH) will be implemented.

A similar process will be performed at a local level with for local sectorial stakeholders (water, energy, agriculture and risk management). The project will support participatory processes in the intervention areas to contribute in the co-design, delivery and use of climate services. This will be accompanied by a well-structured capacity building process aimed towards all the

79 Guidelines for Establishing a National Climate Services Framework, published by WMO in 2018

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stakeholders and users with a particular emphasis on women participation and empowerment.

The key stakeholders in climate services include: users, providers, co-producers, communicators, boundary organizations, enablers and partners. They are interconnected partners with complementary roles, and make up the national chain of climate services for linking climate knowledge to adaptation action on the ground.. Figure 12 displays a schematic diagram of the value chain for climate services at the national level. At the centre of the value chain mapping process is the belief that different stakeholders and communities of practice operating at the national level have a tremendous amount of knowledge to learn from each other and to contribute to each other. This will advance their shared interests of reducing adverse impacts of climate-related risks while maximizing the socioeconomic benefits gained by receiving advance information of weather, water and climate parameters. All stakeholders with a role in the climate services value chain, from production, co-development through to use at the local level, should be involved.

The Global Climate Services Framework assigns an important role to the WMO-RCCs in supporting the implementation of NFCS. The interaction among the technical staff and the institutions from the region provides a valuable space for mutual learning, sharing lessons and good practices, and fostering south-south cooperation.

Output 2.1: Contributions implemented for the establishment/consolidation of National Climate Services Frameworks in each country.

Activities under output 2.1:

Activity 2.1.1: Conduct national dialogues with national agriculture, water and energy stakeholders

Activity 2.1.2: Identification of existing gaps in the full value chain of operational climate services. Identification of climate related impacts and Socio-Economic Benefits of climate services in water, energy and agriculture sectors

Activity 2.1.3: Co-development of a comprehensive vulnerability mapping of water, energy, agriculture and raise risk perception.

Activity 2.1.4: Co-development/Improvement of national climate plan responses and adaptation measures.

Activity 2.1.5: Implementation of National Climate Information System Helpdesks (CISH) to assist the extension actors (national, sub-national, private sector, NGOs etc…) to support climate adaptation strategies.

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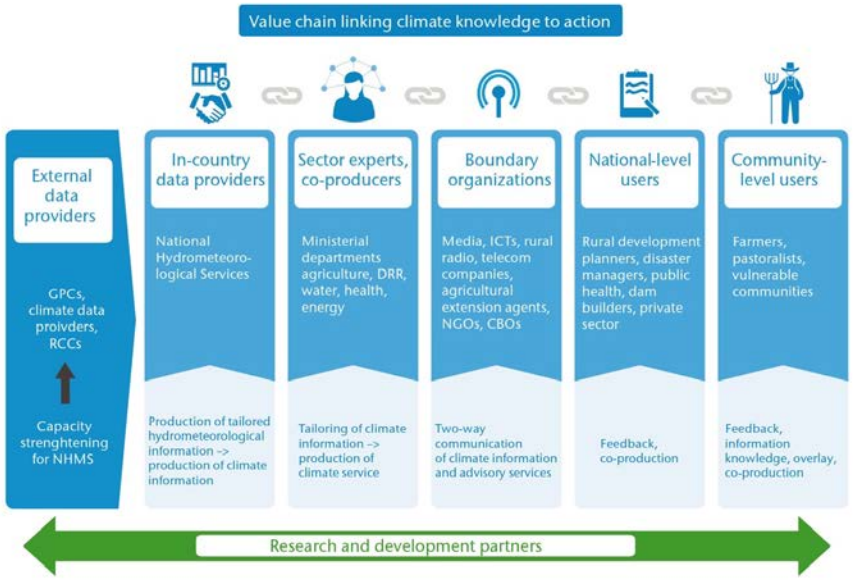

Figure 12. *National value chain for climate services*

Output 2.2: Implemented /improved local sectorial stakeholder networks to deliver and use of climate services.

Activities under output 2.2:

Activity 2.2.1: Conduct community level sectorial stakeholders mapping (water, energy, agriculture and disaster risk management), and capacity needs assessment on integration of weather, hydrology and climate information in extension programmes at sub-national level.

Activity 2.2.2: Co-development of training material and activities for field schools. Co-development of tailored material specifically for marginalized and vulnerable groups, women empowerment and indigenous people (where applicable).

Activity 2.2.3: Establishment of knowledge and experience sharing platform for climate adaptation strategies and pathways.

Activity 2.2.4: Capacity development activities and training of extension actors (training the trainers) in each pilot area to build capacity at all levels.

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Component 3: Empowerment of local communities to apply risk management and adaptation measures.

This component of the project is specifically and strongly focused on supporting adaptation activities in the local intervention areas, and every aspect of the implementation is a direct contribution to building climate resilience. It involves actions to reduce vulnerability, to apply

climate information for reducing exposure, and strengthen local institutions capacity while empowering local communities.

Outcome 3:

Many of the strategies and policies related to climate change adaptation, resilience and disaster risk reduction in Western South America and the target countries call for community based and bottom up adaptation actions that are locally appropriate in terms of the social, economic and environmental context. This component, led by NMHSs in close collaboration with relevant local institutions and country ministries of agriculture, environment, water and energy will support capacity building linked to implementation of locally adapted adaptation practices that enhance food, water security and hydropower generation. In depth consultation with communities will assist in linking traditional mechanisms for assessing and predicting climate variation with the packaging and dissemination of localized down-scaled climate services (climate forecasts, analyzed historical climate information, assessment of local risks and vulnerabilities). Communities will be supported to apply climate informed production and conservation practices through participatory training and experimentation on appropriate technology and adaptation options.

To consolidate the EWS, the project will support the implementation of the Common Alerting Protocol (CAP) standard for the automated communication of alerts in each NMHS. This process will be accompanied by a capacity building process targeted to local stakeholders, such as agricultural and energy associations, smallholder farmers and micro-hydropower operators. Depending on the local conditions and the previous observation gap analysis (component 1), voluntary local observation networks will be implemented in local intervention areas.

One of the main principles in the climate services value chain is the belief that different stakeholders and communities of practice operating at the local level have a tremendous amount of knowledge to contribute. This will advance their shared interests of reducing adverse impacts of climate-related risks while maximizing the socioeconomic benefits gained by receiving advance information of weather, water and climate parameters. Traditional knowledge and gender aspects will be assessed, along with capacity building activities on the access, interpretation and application of climate information and risk analysis. In addition the project will support participatory consultations and dialogues in order to establish strategic alliances and partnerships with local media (radios, TV), NGOs, private companies (ITC), telecommunication companies for SMS-based two-way communication, mobile device applications (apps), local offices of National institutions willing to the project implementation.

As final step, the project will support the preparation of local risk management and adaptation plans (considering voluntary adaptation responses) in line with the NDCs in water and agriculture, and with emphasis on climate extreme events through participatory processes in local intervention areas in the three countries.

Output 3.1: Local stakeholders manage risks arisen from climate variability and change in pilot intervention areas

The output will build on the premise that enhanced knowledge of past, present and future climate as well as availability, communication and use of both local and scientific climate and weather information is an integral component of community adaptation planning and enhancement of resilience of communities to weather variability and climate change. The community planning processes will be aligned to related national climate change policies and strategies and will be the basis on which community adaptation plans will be developed while taking into account the local context. The Output will also ensure the involvement of multiple

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stakeholders in climate change adaptation and resilience, providing a platform for identification of joint and coordinated responses and actions that build on the different strengths and knowledge of various organizations within and outside of the community and ensures ownership of the process by the climate affected people involving farmers, meteorologists, extension staff, community members, community based organizations, NGOs, local government and other local level support structures. The process will also ensure involvement of both men and women as well as the young and elderly who all have different levels of knowledge relating to weather and climate.

The discussion on use and application of both local level and scientific weather information particularly seasonal forecasts and longer term climate projections will aim to identify local level seasonal and longer term climate scenarios and the possible impacts and opportunities in terms of agro-pastoral livelihoods. Adaptation planning will be conducted on two time scales, the first being on a seasonal timescale to inform short term adaptation strategies (e.g. crop planting date, variety selection, reservoir management etc.,) based on the seasonal climate forecast, the second being on a longer term basis of 5-10 years informed by longer term climate projections.

Activities under output 3.1:

Activity 3.1.1: training of main agricultural associations, micro-power association on how to implement local EWS and mainstream climate information for risk management and adaptation at a community level. Initial community sensitization on climate change impacts.

Activity 3.1.2: Developing and launching a Gender Action Plan aligned with national policy and gender equity perspectives

Activity 3.1.3: Implementation of effective drought and flood community-based climate early warning systems in designated areas.

Activity 3.1.4: Training on the Common Alerting Protocol (CAP) standard for the automated communication of alerts.

Activity 3.1.5: Implementation/enhancement of local hydro-meteorological observation networks.

Activity 3.1.6: Establish mechanism of collecting data and sharing lessons learned and good practices for evaluation and system improvement

Output 3.2: Local climate risk management and adaptation plans with local authorities and the support of public and private institutions/stakeholders

Assessments of existing disaster, environmental and other development plans will be undertaken to identify gaps in integrating a disaster risk reduction and adaptation approach. The aim is to strengthen the risk-management focus of municipal and provincial land use plans, environmental plans, disaster management plans, sustainable economic development plans and policies of the participating countries to ensure that they properly capture climate change risks and propose effective adaptation measures. The project will also implement selected adaptation measures to demonstrate different approaches to reducing vulnerability and increasing local resilience to climate change risks. Broadly speaking, the adaptation measures will include: rain-water capture storage, enhancing distribution efficiency and water use monitoring, water saving techniques, introduction of efficient irrigation systems, soil and water conservation measures, enhanced land use techniques and use of more resilient crop varieties. Country-specific indicative adaptation measures were identified through community consultations and are detailed in Table 9.

Activities under output 3.2:

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Deleted: Activity 3.1.1: Identification and mapping of local partners and institutions to timely dissiminate climate information to local communities.¶

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Deleted: Implementation of a capacity building strategy for

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Deleted: Activity 3.1.3: Training workshops on the use of climate products to the main agricultural and energy associations, including training of trainers for smallholder farmers and micro-hydropower operators.

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Activity 3.2.1: Risk and vulnerability assessments at community level including traditional knowledge and gender aspects.

Activity 3.2.2: Participatory activities for local community stakeholders to provide feedback on the delivered climate information and develop risk analysis, combined with the traditional knowledge of local planning.

Activity 3.2.3: Establishment of partnerships with local media (radios, TV), NGOs, private companies (ITC), telecommunication companies for SMS-based, mobile device applications (apps) local offices of National institutions

Activity 3.2.4: Preparation of local risk management and adaptation plans (considering voluntary adaptation responses) in line with the NDCs in water and agriculture, and with emphasis on extreme climate events, through a participatory process in locally designated local communities.

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Component 4: Strengthening of regional cooperation among NMHSs from the Andean region.

The Andean region shares many common features among the covered countries this is why regional cooperation is essential to sharing of knowledge, expertise, and also good practices which can be extended to similar geographic, social, or cultural environments. To accomplish this regional approach and foster cooperation, it is critical to support the process of knowledge exchange, identify relevant regional experts who can train others and join the thematic expertise in groups that can be consolidated and evolve according to the emerging needs of each country. This regional cooperation should be promoted through a regional entity. Established as an international center for the study of the ENSO phenomenon, CIIFEN, based in Ecuador, has been closely working with the NMHS and other national institutions related with climate risk management and adaption during the last 15 years. Since 2015, the institutional relationship between CIIFEN and the NMHS from Western South American countries was formalized with the implementation of the WMO Regional Climate Centre for the WSA region. Despite this significant formal process, and the ongoing activities this institutional regional framework must be strengthened. The activities of Component 4 are designed to enhance the regional role of CIIFEN in supporting the NMHS of the region by regionalizing global climate products and tools, coordinating and implementing a sustained capacity building strategy, supporting the functioning of regional groups of experts and trainers and also seeking inter-regional partnerships and other alliances and articulation within or outside the region.

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Outcome 4: Strengthen regional cooperation mechanisms and upscale to Western South America Region

One of the CSIS enablers ensuring basic consistency of information across the regional and national scales, and from historical data to future climate change projections is the GFCS Climate Services Toolkit (CST). CST provides operational CSIS function to share new tools, procedures and instruction, information and methods, and thereby enable all CSIS providers to take advantage of research and development advances. CST facilitates the production, communication, and application of climate information products. CST enables more countries to develop their national products, and so encourage improved data sharing, and foster the interaction and shared learning between information providers through the development of a common set of skills. CST ensures the climate information and products developed for and provided to end-users is relevant, reliable, useable, consistent (through time and across regions) and of high quality. And finally, CST will reduce the need for expensive capacity building through availability of training resources and make training workshops more focused, tangible, and efficient in imparting the operational skills.

CIIFEN, will work with the NMHSs to improve the linkages across the Global-Regional-National information chain and optimize the use and application of what is available in the CST for the NMHS by developing a Regional CST. The CST will complement existent capabilities available at CIIFEN as WMO-RCC to further support the NMHSs participating in this project, and the implementation of climate services in other countries of the Andean region.

The project will consolidate the Andean technical groups of database developers, Sub-Seasonal to Seasonal (S2S) prediction and operational hydrology; and contribute to implement strategic regional alliances and partnerships for sustained capacity building. This will include close coordination with RA III WMO RTCs[80] to implement sustained climate services for water, energy and agriculture sectors, and the preparation of an online collection of best practices and lessons-learned on climate service implementation at a regional, national and local scale; and improvement of computational capabilities, interoperability and communication systems for regional climate services.

To consolidate the regional cooperation, the project will contribute with the implementation of joint coordinated activities with UN agencies such as FAO, UNESCO, UNISDR, regional intergovernmental organizations, such as the Secrateria General de la Comunidad Andina (SGCAN), and other networks working in the region on common matters. It is expected that based on improved partnerships the agreement for the further establishment of an ad-hoc panel of financial agencies for the sustainability and extension of adaptation efforts in other Andean nations will be reached.

The strengthened regional cooperation among NMHS and other partners will contribute to foster synergy in risk management and adaptation initiatives, and make them more complementary, cost-efficient and coordinated. This will reduce mutual interferences between projects, institutions and financial agencies, and consequently increase its impact on climate resilience.

Output 4.1 Implemented Climate Services Toolkit (CST) for the Andean region.

Activities under output 4.1:

Activity 4.1.1: Diagnostics of operational capabilities and needs of the NMHSs in the Andean region to provide sustainable climate services.

Activity 4.1.2: Strengthening of the regional platform to support the Climate services Toolkit, including new regional operational products:

- Generation of a regional Long-Range Forecast (LRF) from Global LRF products and verification (regional).
- Implementation of a regional platform to access global model outputs, including climatology.

Activity 4.1.3: Development of a regional training and capacity building plan in close coordination with RA III WMO RTCs to implement sustained climate services for water, energy, and agriculture sectors.

Activity 4.1.4: Development of an online collection of best practices and lessons-learned on the implementation of climate services at regional, national and local level.

Activity 4.1.5: Improvement of modern computer science, interoperability and communication systems for RCC-WSA members.

80 Regional Training Centers

Activity 4.1.6: Local assessment and demonstration of Social-Economic Benefits (SEB) of the services provided by NMHSs to the disaster risk reduction, water, agriculture and energy sectors.

Output 4.2: Consolidated Andean Technical groups of database developers, S2S prediction and operational hydrology.

Activities under output 4.2:

Activity 4.2.1: Regional workshops for coordination and training.
Activity 4.2.2: Improvement of the regional Andean database, S2S and interoperability system.
Activity 4.2.3: Implementation of innovative hydrometeorological prediction models based on satellite information.
Activity 4.2.4: Strengthening of operational hydrology, advanced techniques for hydrological monitoring and hydrometry.

Output 4.3: Strategic regional alliances and partnerships implemented for sustained capacity building.

Activities under output 4.3:

Activity 4.3.1: Implementation of joint coordinated activities with UN agencies such as FAO, UNESCO, UNISDR and regional intergovernmental organizations, such as the SGCAN.
Activity 4.3.2: Establishment of an ad-hoc panel of financial agencies for the sustainability and extension of adaptation efforts to other Andean nations.

B. *Describe how the project /programme would promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms.*

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Under component 1: Improvement of national and local operational weather, climate and hydrological services system.

Using and extending the Climate Services Information System (CSIS)

The project will apply and extend the ongoing principles, components and information of the CSIS.[81] For delivering climate information effectively it is imperative that appropriate operational institutional mechanisms are in place to generate, exchange and disseminate information nationally, regionally and globally. The Climate Services Information System (CSIS) is the principal GFCS mechanism that will routinely collate, store and process information about past, present and future climate. The CSIS will comprise a physical infrastructure of institutes, centres and computer capabilities that, together with professional human resources, will develop, generate and distribute a wide range of climate information products and services to inform complex decision-making processes across a wide range of climate-sensitive activities and enterprises. The WMO World Climate Services Programme will be the principal mechanism for implementing the CSIS, a substantial part of which already exists. The implementation strategy of the CSIS is based on a three-tiered structure of collaborating institutions (CSIS 'entities 1 ') that will ensure climate information and products are generated, exchanged and disseminated: a) Globally through a range of

81 Annex to the Implementation Plan of the Global Framework for Climate Services – Climate Services Information System Component. WMO, 2014.

advanced centres; b) Regionally through a network of entities with regional responsibilities (RCCs); c) Nationally and locally by National Meteorological and Hydrological Services (NMHSs) and, through national institutional arrangements, with partners. A set of initial, high priority minimum functions of CSIS include: (i) climate data rescue, management and mining; (ii) climate analysis and monitoring; (iii) climate prediction; and (iv) climate projection. These functions comprise processes of data retrieval, analysis and assessment, re-analysis, diagnostics, interpretation, assessment, attribution, generation and verification of predictions and projections and communication (including exchange/ dissemination of data and products) that will be carried out over a global-regional-national system of inter-linked producers and providers. Formalized structures and procedures governing CSIS entities and functions are essential for standardization, sustainability, reliability, and adherence to established policies and procedures. Knowing user requirements and understanding how users apply climate information will be essential for designing, disseminating and encouraging uptake of CSIS products and services. The CSIS will engage with the GFCS User Interface Platform (UIP) to achieve these objectives and will also work with the Observations and Monitoring (O&M) and Research, Modelling and Prediction (RM&P) pillars to obtain the inputs required for its operations. There are already a number of advanced centres providing global-scale CSIS products, although their operations will need to be further coordinated and standardized, especially regarding exchange of routine data and products so as to ensure compatibility across geographical and jurisdictional boundaries. Making regional implementation a first priority gives countries that need the most help something to work with quickly, while awaiting further specification and funding of longer-term national climate capacity development efforts. At regional level, Regional Climate Outlook Forums (RCOFs) are one effective mechanism for stimulating the development of such collaboration and consensus. Users of climate information can benefit from access to products reflecting collaborative expert assessment and consensus along with information derived from a variety of individual sources.

Enabling the cascading of climate information at different geographic scales

The project will innovate the ways of connectivity between the national, local and community level to ensure the cascading of climate information, building on existent partnerships, enabling new ones and empowering institutions, authorities, media, private and public stakeholders. This will contribute to increase the access, understanding, use and application of climate information, through the following outcomes:

- Improved use and access to weather and water data, remote sensing and model outputs, for use by both, intensive and extensive agriculture sectors, from those highly organized to small-scale agricultural associations.
- A wide portfolio of services to the energy sector, databases, forecasts and scenarios for medium and long term climatic variables, assessment, compliance with international standards of the hydro-meteorological networks, instrumentation calibration, training, research;
- Optimization of decision-making on water use based on resource monitoring, expected climate scenarios and impact-oriented forecasts. This will be particularly important to solve potential conflicts in water use between agriculture, energy and environment using multipurpose infrastructures, taking into account flood protection.

Capacity building activities for the NMHS

Capacity building activities for the NMHSs will be delivered based on materials already tested and made available by WMO in the framework of specific activities such as the Flood Forecasting Initiative, or the Integrated Drought Management Programme (IDMP). These training could also be embedded in wider WMO initiatives (e.g. corresponding to the work

plan of the WMO Commissions for Climatology and Hydrology), and therefore provide an in-kind commitment from WMO in the development of training materials and the logistical organization of the training workshops. Countries would benefit from this training and at the same time contribute in-kind by having their NMHSs staff attending the workshops or assisting on the local logistical arrangements for holding the workshops. These trainings will strengthen NMHS capacities in generating and delivering climate information and prediction products for climate services by developing skills required to access forecasts and reforecast data from Global Producing Centres for Long-Range Forecasts (GPCLRF).

Figure 13. WMO Global Producing Centres for Long-Range Forecasts

GPCLRF is an integral part of the WMO Global Data-Processing and Forecasting System (GDPFS) underpinning the generation of climate information products by the NMHSs. The GPCLRFs follow a strict designation process according to which the Centres adhere to well defined standards to ensure consistency and usability of output. These standards include a fixed forecast production cycle, a standard set of forecast products and the WMO defined verification standards. Currently there are 13 WMO designated GPCLRFs, from which NMHSs can take advantage, especially from CPETC in Brazil (Figure 13).

Trainings will also focus on products from WMO Regional Climate Centres (RCC-WSA for the Andean region) and two Lead Centres: The Lead Centre for Long-Range Forecast Multi-Model Ensemble prediction (LC-LRFMME) and the Lead Centre for Standard Verification System for Long Range Forecasts (LC- SVSLRF). RCCs have been established to deliver regionally, high-resolution data and products including long-range forecasts that support regional and national climate activities and climate services. Regional Climate Centres are operated as Centres of Excellence that strengthen capacity of WMO Members in a given region to deliver the best climate services to national users.

LC-LRFMME is jointly managed by the Korean Meteorological Agency and NOAA's National Centre for Environmental Prediction in the USA. Its functions include: collection of long-range forecast data from all GPCs each month; maintaining a central portal from which forecast

users can access the GPC output in standard digital and graphical formats; developing and providing multi-model forecast products with improved skill and promoting research into techniques for combining predictions from different models.

LC-SVSLRF is jointly managed by the Australian Bureau of Meteorology and the Meteorological Service of Canada. The key role of the LC-SVSLRF is to collate and display GPC hind-cast verification diagnostics in standard formats that allow easy comparison between models. The Lead Centre provides access to: verification datasets; verifying software; documentation of the system; broad technical support; and, access to the final verification data as well as graphing and display of results.

Under component 2: Implementation of national and local inter-institutional/ sectorial stakeholders networks.

Fostering the inter-institutional and sectorial coordination

NMHSs are increasingly coordinating with other national and local authorities, private institutions and NGOs to deliver weather/climate advisories and warnings for extreme events. Those alliances will provide a basis for climate information co-production among them. The project will develop capacity building activities and foster joint and coordinated work among national institutions which could improve the holistic approach to the climate resilience, by connecting the related economic sectors linked with water resources: agriculture, and energy production. This coordination should lead to a better governance and coordination to optimize financial resources and enhance the sectorial risk management and adaptation plans.

Under component 3: Engagement and empowerment of local communities to co-design local risk management and adaptation plans and projects.

Innovation on capacities building

The project will combine virtual platforms with sustained capacity building processes by engaging local institutions, NGOs, or other stakeholders. They will include typical training workshop but combining traditional /ancestral knowledge with the formal one. This will be done through participatory, gender inclusive, activities with strong involvement of local actors from different economic sectors, and private and public institutions.

Under component 4: Strengthening of regional cooperation among NMHSs from the Andean region.

The regional approach

The regional approach is one of the key elements within the GFCS. The innovative side and added value of the regional cooperation is based in the following principles (1) improve capabilities within national institutions through regional collective action, (2) share knowledge and experiences on national specific benefits, (3) contribute to the reduction of disparities among countries, (4) demonstrate that a regional climate service can be enhanced as a result of improving national components and vice-versa, and (5) agree upon regional coordination mechanisms[82].

82 Martinez, R. (2011). Building sustainable regional climate information systems. Climate Research, 47(1/2), 41-45. Retrieved from http://www.jstor.org/stable/24872339

Colombia, Chile and Peru, and other Andean countries, share regional climate characteristics. However, their social, cultural and economic characteristics could be different with a wide variety of good practices, learning and innovative solutions, which could strengthen to all involved national and local institutions if they are shared within a regional cooperation mechanism.

The regional approach proposed in this project in mostly based in a long cooperation history among Western South American NMHSs[83] and CIIFEN which since 2015 is a WMO RCC. Previous experiences, good practices and lessons learnt provides a suitable regional platform to complement national and local actions to foster risk management and long-term adaptation.

From an operational perspective, a regional approach allows identifying common needs supported by an operational system for climate services involving CIIFEN as WMO RCC, and global climate centers as well as NMHSs. The forecast system worldwide is based on operational global and regional numerical weather prediction models, fed by data and observations exchanged internationally by NMHSs, and regional and global centers. The regional approach seeks for the deployment of a CST, which facilitates access by NMHSs to relevant climate data, products and tools from CIIFEN and WMO global centers with which NMHSs can create value-added products. CST deployment will be accompanied by hands-on support from CIIFEN and third-party NMHSs with advanced climate services capabilities, through "twinning" arrangements. The resulting operational system will support climate services delivery in selected local communities affected by climate variability and change. The value chain will set an example supported by CIIFEN for the larger region (Bolivia, Ecuador, and Venezuela).

Since 1997 WMO has supported the routine generation of regional seasonal climate outlooks in most regions of the world. The principal mechanism for this is the Regional Climate Outlook Forum (RCOF). An RCOF is a platform that brings together national, regional and international climate experts and user representatives from countries in a region to provide consensus-based climate predictions with input from NMHSs, regional institutions, WMO Regional Climate Centres (RCCs), Global Producing Centres for Long Range Forecasts (GPCLRFs) and other climate prediction centres. Through interaction with sectoral users, extension agencies and policymakers, RCOFs also assess the likely implications of the outlooks on the most pertinent socio-economic sectors in a given region, and explore the ways in which use can be made of them. In the Western South America, the RCOF involves six NMHSs on a monthly and uninterrupted cooperation since 2003 to provide regionally integrated climate outlooks. This integration mechanism will be used to strengthen south-south cooperation where countries contribute with experts to enhance the capacities of their peers in other NMHSs. RCC-WSA members are the directors of the NMHSs who signed the following regional strategic actions:

1. Strengthening capacities for climate data management.
2. Capacity building for seasonal prediction.
3. Strengthening tailored climate services to priority sectors.
4. Positioning and visibility of NMHSs as permanent and official entities in the respective countries
5. Resource mobilization and technical cooperation for the RCC-WSA operation.

83 Martinez, R. & Mascarenhas, A. (2009). Climate risk management in western South America: implementing a successful information system - WMO Bulletin, 2009 - researchgate.net

This project aligns with this regional strategy. It will strengthen the operational exchange of data and products between global, regional and national meteorological institutions, and between NMHSs and climate affected stakeholders, to increase the capacity for developing, delivering and using tailored products for risk management and adaptation (figure 14).

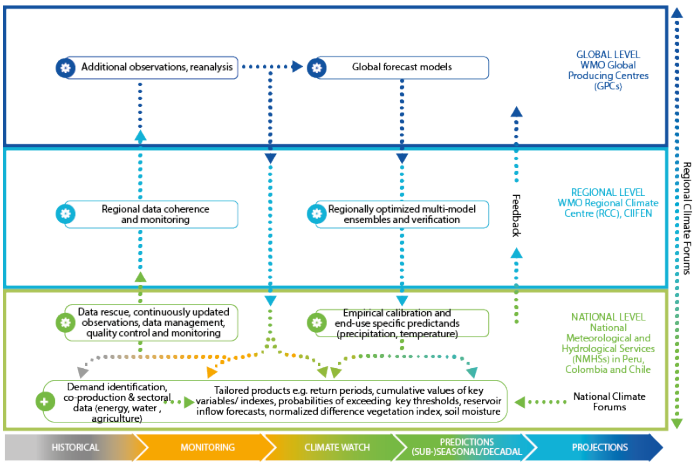

Figure 14. WMO Climate Operational framework at Global, Regional and National level

C. *Describe how the project / programme would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project / programme would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.*

The project will ensure consistency with the Environmental and Social Policy of the Adaptation Fund and its principles. All the activities will be developed in line with:

- Local, national and regional policies and programmes
- National laws and global instruments related to environment and natural resources management, plant and animal genetic resources
- Standards, policies and laws for the responsible governance of land (Sistema Nacional de Planeamiento Estrategico in Peru, Plan Nacional de Desarollo "Todo por un Nuevo Pais" Ley 152 in Colombia, Tercer Plan de Accion Nacional de Gobierno Abierto de Chile)
- Fair and impartial allocation of benefits to all relevant stakeholders, without discrimination, and access to benefits to women as well as men and marginalized groups
- Promotion of support to the most vulnerable group to become more resilient to climate change including women, elderly, indigenous people and children
- Promotion of 50% participation of women in project activities and 50% of project direct beneficiaries to be women, while also targeting specific project activities at women or women groups (for example training activities)
- Core labour standards as stated in the 1998 ILO Declaration of Fundamental Principle and rights at work

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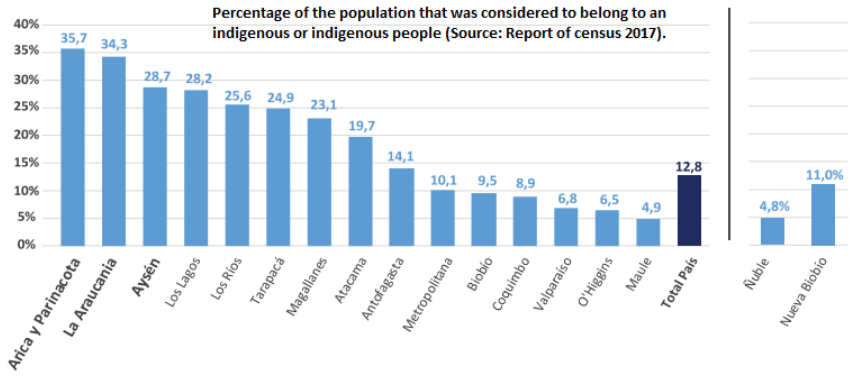
- Support of appropriate and no-invasive species of crops and livestock varieties
- Use of climate smart approach to maximize on and take advantage of opportunities within identified adaptation and resilience options that reduce carbon emissions and improve efficiency use of natural resources

Indigenous communities in the pilot areas (like Quechua, Aymaras, Yanaconas) will be involved in the design and implementation of the project according to the principle of no discrimination to marginalized and vulnerable groups as well as the UN Declaration on the rights of Indigenous Peoples (UNDRIP). According to the latest census, the pilot areas have a low percentage of indigenous populations and those are supporting their households with agriculture and farming in the rural areas. The aim of the project is to improve their agricultural practices, reducing risks and increasing productivity thus raising substantially their well-being.

In Chile 12.8% of people consider themselves belonging to an indigenous or native people. The following figure shows the percentage of the population that was considered to belong to an indigenous or native people, by region. The regions of Valparaíso, Metropolitana, O'Higgins and Maule are under the national percentage.



The definition of "indigenous peoples" in Peru has cultural/historical connotations. In the pilot areas of intervention, the population will be addressed as Andean/rural communities or organized populations vulnerable to the impacts of extreme hydrometeorological events; likewise, a large part of the areas of intervention have an incidence of total poverty between 40 and 60% according to the Peruvian National Institute of Statistics (INEI, 2015).

The project does not involve conversion of natural habitats to other uses and will in fact through some activities perhaps improve and restore degraded lands and watersheds, improve soil fertility, reduce erosion and carbon emission. In addition WMO incorporate social and environmental risk screening into the identification phase of all projects, conduct social and environmental impact assessments for all medium or high risk projects, ensures disclosure of project activities and their potential risks with affected communities, engages in a process of free, prior and informed consent (FPIC) with relevant stakeholders and target communities and ensures consultation with communities at all phases in the project cycle to minimise environmental and social risks.

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Preliminary consultations that took place in July 2018 in the few municipalities of the pilot areas (see Annex 1) provide evidence that the participation to meetings and surveys included the local agricultural associations, mainly the farmers of indigenous populations, who are the direct beneficiaries of the project. Especially for the actions included in component 2 and 3, the needs of local/indigenous communities will form the base for designing tailored adaptation strategies. The project's products will be widely disseminated locally through the Regional Ministerial Secretariats of Agriculture in order to make the information available to farmers and the advisors that support them through the promotion programs of territorial units at the communal level and area in each region. This is expected to reach the largest number of users and beneficiaries in the territory. More detailed profiles of the vulnerable groups residing in the target locations will be provided at the proposal stage.

The project as a principle will apply participatory approach at the community and municipal level relaying on the active engagement of multiple actors. In accordance with the Adaptation Fund Gender Policy, the project will assure gender equity and women's empowerment. In the framework of ENANDES, a baseline will be established to identify the participation of women and men in resource management and in the access to and use of climate information for decision-making. Participation quotas will be established for women in the interface workshops, using participatory techniques and providing facilities for their participation. The participation of women's groups in leadership will also be promoted through participatory teamwork, seeking to support the associativity of vulnerable rural communities. The typology of farmers organized into productive activities and value chains (identification of roles in the production process) associated with information and communication needs will be identified. Such intervention will define a framework of a Gender Action Plan in the project's areas of implementation, aligned with national policies on equity and the gender perspective, and the experience of the CLIMANDES project in Andean areas.

Similar WMO projects implemented in Africa and Asia have been classified as having no adverse environmental or social impacts. Moreover WMO has also been accredited as implementing entity by the Green Climate Fund for category C projects. This means the project potentially falls within the Category C rating of the Environmental and Social Policy of the Adaptation Fund. However, any potential negative impacts as a result of this project are believed to be small in scale, limited to the project area, reversible and can be either avoided, minimised or addressed through the use of recognized good environmental and social management practices.

Investments in climate risk reduction and preventive adaptation measures based on authoritative climate information spanning the historical recurrence and the future new trends result in economic benefits for local communities and the whole nation given the potential avoided costs associated with lack of preparedness. CIIFEN as part of the activities of the regional project, PRASDES[84], conducted in 2014, a Social and Economic Benefits Study in Puno-Peru, which was presented in the COP-20. The study demonstrated that the benefit of the Peruvian Government investment in the regional office of SENAMHI in Puno, was easily doubled only for the avoided losses associated with weather and climate adverse events. The potential of the financial return only by increasing the number of climate information users, is 4 times the current investment without considering the economic impact of social benefits. The experience of CLIMANDES Project in Peru on the estimation of the socioeconomic benefits (SEB) of climate services will be shared with the Project. The SEB constitutes a necessary building block for public policy-making. This helps mobilizing the required financial and personal resources to operate and maintain climate services, and to invest them

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84 Regional Programme to Strengthen Weather, Water, Climate Services and Development in the Andean Region. http://www.prasdes-ciifen.org/

strategically to enhance such services and make adaptation decisions based on prevention strategies.

The effective end-user climate services through capacity building, communication and awareness will guide resource allocation at community, municipality and national level. By engaging local government authorities and community members in identifying climate information needs linked to monitoring, forecasts and alerts, the project will lay the foundation for environment-related behavioural patterns and attitudes of future generations. The exhaustive description of benefits is summarized in table 6.

Table 6. *Social, economic and environmental benefits per country*

Country	Economic benefits	Social benefits	Environmental benefits
Chile	Reduced losses and damages associated with hydro-meteorological and climate extreme events. Increased competitiveness based on climate-smart production (agriculture, energy). Increased economical growing associated with increased climate resilience.	Improved capacities at national and local level to cope with adverse weather and climate events which mean less impact in the livelihoods of most vulnerable families. Improved quality of life associated with reduced vulnerability and increased safety in communities and their properties. Reduced possibilities of abrupt cuts jobs or negative effects in communities' livelihoods. Improved employment stability in rural climate-sensitive areas.	Improvement and better practice on use of agriculture fertilizers reducing the amount of applications. Improved practices for water resources. Efficient use of hydroelectric power and clean energy.
Colombia	Reduction of production cost through agricultural planning, crop, soil and water management, sowing programming, phytosanitary management, among others. Efficiency in the generation of climate information products, focus on expressed needs of final users.	Reduction of climate extreme events that impacts food production and water availability. Livelihood improvement for non-connected communities and population to the national electrical net through the use of renewable energies. The Project will provide	Land use planning improved with environmental aspects, such as: water resources management, renewable energy, disaster risk management, conservation and exploitation of biotic and edaphic resources. Reduction of issues that increases climate change impacts and disaster risk factors.

	Clean energy projects based on information of water availability at the intervention area. Improvement of the local economy through energy saving consumption by reducing the operation and production cost.	key information for system design and technological solutions applied to lighting, communications, refrigeration, water pumping, air heating, drying of agricultural products, air conditioning, among other applications.	Improvement of the natural resources management.
Peru	Through timely access to hydro-meteorological warning and/or weather forecasting information for planning purposes, preventive risk management actions and adaptation measures will be developed that will contribute to reducing impacts and damage to crops, livestock, energy infrastructure (production, transmission, distribution, etc.), as well as optimal water resource management. Avoided damages are avoided costs in emergency response, rehabilitation costs, costs of restoring operational capacity of risk and/or energy infrastructures,	The populations are more aware of the changes in climate and climate variability and have more information on response mechanisms, which will strengthen the participation of the population (the most vulnerable communities that include women in decision-making related to agricultural production and risk management) and organized society in the development of a culture of prevention and commitment to disaster risk management.	Reduced damage and losses to populations, livelihoods, and also ecosystems that are part of the production systems of rural populations. The negative effects of extreme events are managed through adaptation measures that aim to maintain and conserve ecosystems and their ecosystem services (agro-biodiversity, water-regulating water services for the provision of water for irrigation and/or sustainable energy generation), as well as to mitigate their negative impacts.

D. *Describe or provide an analysis of the cost-effectiveness of the proposed project / programme and explain how the regional approach would support cost-effectiveness.*

The project has been designed to be implemented over the basis of what is available and is working with or without limitations. The cost-effectiveness of the improvement of national and local operational weather, climate and hydrological services system (component 1) will be reflected in the south-south cooperation which is being facilitated by CIIFEN as WMO RCC. This means to reduce asymmetries between countries with the local expertise of the most advanced institutions, sharing knowledge through regional or national workshops. The cost-effectiveness of the regional approach also is reflected in the knowledge, experience and

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Apurimac: 70% Quechua, ¶
Huallaga : 66% Quechua¶
Rimac river: Quechua¶
¶
Colombia: ¶
Chimilas, coconuco, Kichwa, Yanaconas, ¶
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Chile: no pueblos¶

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good practices from past regional projects implemented by CIIFEN with the NMHS of the Andean region where national and local interventions were conducted, such as the project funded by the IDB: *"Implementing a regional information system to support climate risk management in the Andean region"*[85].

Regarding the implementation of national and local inter-institutional/sectorial stakeholders as well as the engagement and empowerment of local communities (components 2 and 3), the regional approach improves the cost-effectiveness, avoiding significant investments in new structures at local level because the existent networks are going to be strengthened. Past experiences of CIIFEN in regional projects, will be used to implement community-based EWS (PRASDES, 2016)[86] http://www.prasdes-ciifen.org/ or multi-institutional local networks to increase climate resilience (Cuencas Climáticamente Resilientes, 2015-2019) http://www.cuencasresilientes-ciifen.org/

The impact and cost-effectiveness will be reflected in enhanced on-going collection, updating and processing of data at regional level, delivering reanalysis and forecast model outputs to countries, providing technical assistance in model downscaling outputs and developing tailored products for country-level decision support systems.

E. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist. If applicable, please refer to relevant regional plans and strategies where they exist.

The Project will be consistent with the national sustainable development strategies, National Plans and others. The relation between the National and subnational plans with the local intervention areas is indicated in Table 7.

Table 7. *Relationship between these documents and their relations with the local intervention areas*

Country	National/Subnational Plans	Relationship between these documents and their relations with the local intervention areas
Chile	▪ Climate Change National Action Plan (PANCC-2017-2022), ▪ Climate Change Adaptation Plan ▪ Agriculture Sectorial Plan, ▪ Energy Agenda, ▪ National Plan to fight desertification, ▪ National Strategy of Water Resources, ▪ National Strategic	PANCC-2017-2022: climate change impacts have projected significant reduction of monthly average flows in the regions of Coquimbo and Los Lagos (intervention zone in Quillota), and an elevation of the isotherm 0 °C, which brings as a consequence, the reduction of water reserves in the headwaters of the snow melting and rainwater basins, increasing the risk of disasters during extreme rainfall events and high temperatures, consequently floods and alluviums may be generated. In the agroforestry sector, with less water availability for irrigation in the central zone, a migration of crops towards the south is anticipated, generating changes in production and also in the net income, with negative effects, especially for rain-fed farmers and cattle ranchers, at the coastal, internal and transversal valleys.

85 http://www.ciifen.org/index.php?option=com_content&view=article&id=1885&Itemid=513&lang=es

86 http://www.ciifen.org/index.php?option=com_content&view=article&id=1885&Itemid=513&lang=es

	Plan for Disaster Risk Reduction and NDC.	The energy sector will be affected on temporality and availability of basin flows affecting current hydroelectric generation and reducing the capacity of response in front of increasing demand of energy. The agroforestry sectorial plan includes climate change effects on soil, production, annual and permanent crops (fruit tress), forest and pastures. The plan concludes that there will be low availability of water for irrigation, where droughts, frosts and precipitation are the main risks for the sector. The project proposal for agriculture is aimed to increase farmer's resilience capacity to cope climate change by improving climate products and services for decision making on risk management process. The energy agenda contains an action plan to build and execute a long-term energy policy with social, technical and political validation. Considering that the energy sector is strategic and fundamental for the functioning of society. This document has 7 axes focus on an accomplishment of energetic efficiency as national policy, hydroelectric sustainability and massive educational campaigns which are related to the components 1, 2 and 3 of the project. The National Action Plan heads against dry and desertification in Chile (PANCD-Chile) looking for strengthening population life quality and communities directed to reduce negative impacts allowing to achieve economic and social development through the strengthening of knowledge of the causes and impacts of these phenomena and the development of sustainable production systems. The main objective of the project is to support the rain-fed agricultural activities of the most vulnerable communities. The National Strategic Plan for Disaster Risk Management is the instrument to reach what is established on the current national DRM policy. The project aims to strengthen early warning systems and the development of scientific capabilities on identification process for risk scenarios.
Colombia	▪ National Development Plan 2010-2014 ▪ National Climate Change Adaptation Plan, ▪ Green Growth envelope strategy	**Agriculture and rural development:** Promotion of comprehensive preventive risk management schemes, to cope climate variability, prices and the exchange rate. It covers the three work zones. Land use planning to take advantage of the productive potential of soil, environmental aspects and access to markets.

	and Law 1715 of 2014, which encourages the diversification of energy supply with other non-conventional renewable sources (wind, biomass, among others), and Nationally Determined Contribution (NDC) to the Paris Agreement. ▪ The National Plan of Disaster Risk reduction.	**Environmental management for sustainable development:** Strengthening of water resources management: development of hydrological, meteorological and oceanographic networks, water quality monitoring and evaluation systems, guidelines for watershed management, among others. Implementation of the National Climate Change Policy, creating the National Climate Change System, and incorporate the climate change variables into the policy instruments. Institutional strengthening: define priorities of the national environmental policy, deepen the quality of environmental information, and implement monitoring and evaluation schemes. **Disaster risk management for safe communities:** Strengthening knowledge of local risk conditions; articulate this knowledge with planning instruments; prioritize public policies in front of adverse events and management of frequently disasters.
Peru	▪ National Strategy to Fight Desertification (2016-2030), ▪ National Plan on Disaster Management (PLANAGERD), 2014-2021, ▪ National Strategy on Water Resources, ▪ National Adaptation Plan for Agricultural Sector (PLANGRACC) 2012-2021, ▪ The Predicted and Determined Contribution at national level-NDC	The PLANAGERD is an instrument for resilient and safe communities for SINAGERD. The diagnostic reveals that 4 of 5 main hazards have hydro-meteorological origin (80%) related to low temperatures, heavy precipitations, drought and El Niño phenomena. ENANDES Project supports the strategic objectives: 1. Strengthening the local level knowledge of disaster risk including the climate change scenarios, extreme events and adaptation actions plan 2. Reduction of the risk level of population livelihood with a territorial approach, promoting that local governments include risk management and emphasis on adaptation actions in the agriculture and water sectors 3.- Strengthening the participation of organized society and population on the intervention areas, for a culture of prevention and commitment to DRM. The national Strategy for Drought and Desertification seeks for an information system for drought monitoring indicators, impacts and related actions and projects on current and potential affected zones. The project will contribute to the implementation of the policy and strategy of Fight against Desertification and Mitigation of drought in the country, through the National Action and Awareness Program aimed at state

		authorities and public opinion, as well as carrying out activities framed in the specific objectives 2 and 6. The PLANGRACC is a management instrument that provides strategies and political proposals for risk and vulnerabilities reduction by reducing climate change negative effects on agricultural sector. As is considers the climate risk management as a priority for agricultural development, the sector is already including climate change adaptation measures to increase resilience The project will contribute on the following strategic lines: 1.-Research, technology and information for the DRM and CCA through hydro-agrometeorological information affecting the agricultural sector, in the intervention areas of the project. 3.-Prevention and reduction of climatic risks, 5.-Improvement of local capacities in DRM and CCA. The National Determined Contribution NDC presents the per capita emission total level with 0.3% of global GHG, which is related to change of soil uses and forestry (USCUSS). According to CMNUCC, Peru has been qualified as particularly vulnerable. The ENANDES project supports the enabler's conditions of major part of NDC for thematic areas of agriculture and water. Consequently, the identified climate change adaptation measures on NDC – GTM as part of international commitments are binding for the agricultural and energy sectors.

F. *Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.*

The preliminary screen done by WMO for environmental and social risks reveals no existent adverse harms. The project potentially falls within the Category C rating of the Environmental and Social Policy of the Adaptation Fund.
The preliminary screening has involved checking for the following factors among others:

- That the project will not have a negative effect on water availability and quality in the target areas;
- That the project will not result in the displacement of any people in the project target areas;
- That the project will not negatively affect the tenure rights of individuals, communities or others;
- That the project will not have any negative impact on the biodiversity and genetic resources of the target communities;

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- That the project will not encroach into or affect protected areas and critical habitats;
- That the project will foster gender equality and promote equitable access to resources and services; and
- That the project will be sensitive to the culture of the people in the target areas.

The ENANDES project has been found to meet all of these requirements all of which will be continually monitored throughout project implementation to ensure that no negative social or environmental affects emerge as a result of the project.

In addition, along with being aligned with the sub-national, national and regional plans, policies and strategies of the target countries as described in Section II E, as well as being in compliance with the Environmental and Social Policy of the Adaptation Fund as elaborated in Section II C and above, the project implementation team will also ensure that all relevant national technical standards, laws and byelaws for construction and infrastructure are adhered to where such developments are required as part of the project. To support this, all project activities will be implemented in close collaboration with the National Meteorological and Hydrological Services (NMHS's) and the relevant Ministries of Agriculture, Livestock, Environment and Energy, together with the National Water Authorities, so as to ensure compliance with the relevant standards and technical guidelines in each of the target countries (see Part III A).

The project will work with NMHSs which complies with all WMO technical standards for the data management and services delivery. The actions to be developed in the context of the project are closely related with the improvement of the access, understanding, use and application of climate information for risk management and adaptation in different geographic scales and focused on three priority sectors: agriculture, energy and water resources. The project will not implement actions that require interventions in land use or building. It is mostly focused on technical institutional strengthening, capacity building, stakeholders and users consultations. The national consultation processes and the local intervention will be performed according to the Environmental and Social Policy of the Adaptation Fund.

Other national laws on environmental and social assessment in each of the countries will be followed during the project design and implementation to ensure compliance and to complement with the ESP of Adaptation Fund. The following list of laws and regulations cover most of the fields that are included into the ENANDES project: environment protection and impact assessment, sustainable development, water resources management, risk and crisis management, public participation, labour, regional and local responsibilities.

Peru:
Ley General del Ambiente – Ley 28611
Ley Marco del Sistema Nacional de Gestion Ambiental – Ley 2845
Ley de Recursos Hidricos – Ley 29338
Plan Nacional de Gestion de Riesgo de Desastre 2014-2021
Ley del sistema nacional de evaluacion de Impactos Ambientales – Ley 27446

Chile:
Bases generales del medioambiente, Ley 19300, 1994-art.10
Ley General de Servicios Electrico – Ley 20257

Colombia:
Plan Nacional de Desarollo – Ley 1753
Uso eficiente y ahorro del agua – Ley 373
Ley Organica de ordenamiento territorial – Ley 1454

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Sistema Nacional Ambiental – Ley 99
Aguas no Maritimas – Decreto 1541

A project grievance mechanism will be introduced in all target communities, so as to ensure that there is a mechanism for stakeholders to communicate and get feedback on any problems regarding project implementation including problems related to environmental and social standards.

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***G.** Describe if there is duplication of project / programme with other funding sources, if any.*

The project will not duplicate efforts of other initiatives or funding sources. Instead the project will promote synergies with on-going and planned initiatives and will seek engagement with the NIEs in Chile (AGCI) and Peru (PROFONAPE), regional/national institutions, and organizations like FAO. There are no regional projects that address common climate related phenomenon and apply similar approaches. Specifically, lessons will be drawn from the sample initiatives in each country.

The ongoing projects in the region are listed in Table 8.

Deleted: The project will work with NMHSs which complies with all WMO technical standards for the data management and services delivery. The actions to be developed in the context of the project are closely related with the improvement of the access, understanding, use and application of climate information for risk management and adaptation in different geographic scales and focused on three priority sectors: agriculture, energy and water resources. The project will not implement actions that require interventions in land use or building. It is mostly focused on technical institutional strengthening, capacity building, stakeholders and users consultations. The national consultation processes and the local intervention will be performed according to the Environmental and Social Policy of the Adaptation Fund.¶

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***Table 8.** Projects ongoing in the Andean region and their potential synergies*

Project title/web	Description	Potential synergies
Northwest South America Flash Flood Guidance System (NWSAFFGS)[87] To be implemented in three years (2018-2020) by IDEAM, INAMHI, SENAMHI and US NOAA National Weather Service, the Hydrologic Research Center (HRC), San Diego, USA as scientific partners. Funded by USAID/OFDA.	It will be implemented in two phases: phase one will include standard flash flood guidance system with landslide module and weather Radar data ingestion; phase two will include FFG advanced modules - Riverine Routing and Urban Flash Flood Early Warning System for selected River Basins and cities in the participating countries. Extensive training would be provided to the forecasters from the participating NMHSs to allow forecasters to be able to use its products effectively in daily	Complementary with Component 1: 1.2.1. Implementation of integrated hydro-meteorological prediction system integrating hydraulic modeling and flood mapping in selected basins. 1.2.2. Implementation of experimental/operational hybrid models for Seasonal to subseasonal (S2S) prediction including skill assessment and operational verification.

87 NWSAFFG is the regional component for the north-western part of South America of the Flash Flood Guidance System (FFGS) developed by the WMO Commission for Hydrology (CHy) jointly with the WMO Commission for Basic Systems (CBS) and in collaboration with the US National Weather Service, the US Hydrologic Research Center (HRC) and USAID/OFDA, to provide operational forecasters and disaster management agencies with real-time informational guidance products pertaining to the threat of small-scale flash flooding.

Project title/web	Description	Potential synergies
	operations.	
Climate Resilient Basins: Chinchina, Colombia and Mantaro, Peru Implementation period: 2015-2019 (four years) Implemented by CIIFEN; key partners: IDEAM, Corpocaldas and Vivo Cuenca in Colombia; and SENAMHI, Peruvian Ministry of Environment (MINAM), Regional Governments of Junin and Ayacucho, and Junin Regional Directorate of Agriculture in Peru. Project funded by USAID. www.cuencasresilientes-ciifen.org/	The objective of the project is to increase resilience and reduce vulnerability to climate change in the basins of Chinchiná (Colombia) and Mantaro (Peru), through the strengthening of knowledge used as basis for decision-making for local policies and strategies for adaptation to climate change.	Project´s activities are complementary with components 3.1 Strengthened capacities of local stakeholders and communities to access, use and apply climate information for risk management and adaptation. 3.2 Co-designed local climate risk management and adaptation plans with local authorities and the support of public and private institutions/stakeholders.
Strengthening of national systems and regional monitoring and risk management of drought and floods in a context of climate change and desertification in the Andean countries. Project funded by EUROCLIMA +. Project will start the last quarter of 2018.	The main objective of the project is the strengthening of national information systems for the integral management of droughts in the countries of western South America.	The project is complementary with component 1 and 4. There are complementary actions with strengthening of NMHS and improvement of regional cooperation mechanisms to enhance information services for sectoral management

H. *If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.*

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A learning and knowledge management component to capture and disseminate lessons learned will be provided by CIIFEN. The following mechanisms will be available for the project:

- In each Project Component, there will be a capacity building strategy which will be implemented by CIIFEN and composed of several actions: training of trainers, development of training resources for future national training efforts, and reference materials and guides so that people can be sure to apply what they have learned, and so that new people after the project can learn to perform their jobs in the same way.
- An adequate and complementary coordination will be established with the WMO Regional training Center hosted by Peru.
- An E-learning platform for specific contents related with Components 1, 2 and 3. The target audience will be the technicians from NMHSs, sectorial users and local

authorities. Good paractices and existing training platforms developed under CLIMANDES project willl be considered and enhanced.

- Training to local trainers approach which is complemented with a complete training toolkit to extend capacity building activities by selected community leaders, tecnhicians at local Governments.
- Discussion forum on good practices, learning and innovation as part of the National/Local Sectoral climate meetings in each country to be implemented during the project.
- Quarterly bulletins and annual technical publications.
- Regional forums for knowledge and experiences exchange which could be organized back to back from Regional climate Outlook Forum.
- Regular webinars in different topics coordinated by CIIFEN for technicians of technical institutions from participant countries.
- National/local webinars coordinated by NMHS or partner institutions in each country.

As a complement, the WMO climate services information system (CSIS) will comprise a set of tools, including an online web interface and sharing platform to facilitate access and networking. Lessons learnt from knowledge management in other projects in the region like CLIMANDES (https://public.wmo.int/en/projects/climandes) phase I and II, PRASDES (http://www.prasdes-ciifen.org/), or Cuencas Climáticamente Resilientes (http://www.cuencasresilientes-ciifen.org/) will facilitate the dissimination of best practices.

I. Describe the consultative process, including the list of stakeholders consulted, undertaken during project / programme preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

This proposal was developed by national institutions, CIIFEN and WMO following a series of national consultations in Colombia, Chile and Peru. CIIFEN has wide experience to engage different audiences which include authorities, local stakeholders, and small communities. The following regional activities emerged after consultations: Regional Climate Information to strengthen risk management in the agriculture sector (2007-2009)[88]. Regional information to support public policies on climate change and biodiversity in the Andean countries (2011-2013)[89].; Regional Andean Programme to enhance weather, climate water services and development-PRASDES (2013-2016).[90]

Colombia, Peru and Chile have conducted national consultations on Climate Services requirements with target stakeholders as documented here below:

Colombia: The Climate Services for Resilient Development (CSRD) Partnership already conducted a stakeholders meeting in Bogota in 2015, the output white paper on “Options for Climate Services Investments in Colombia “ was published in early 2016. The official launch of the National Framework of Climate Services held in 1-3 November 2017 provided the basis for the development of a National Plan for implementing Climate Services. Prior to that event, meetings with sectors representatives of agriculture, energy, disaster risk reduction and water took place in September-October 2017.[91]

[88] https://www.researchgate.net/publication/255754566_Technical_Guide_IADB_Final
[89] http://geoportal.ciifen.org/es/
[90] http://prasdes-ciifen.org/
[91] http://www.wmo.int/pages/prog/wcp/meetings/presentations/Bogota3010-0311-2017/Report_SeasonalForecast_Bogota_2017_final.pdf)

Peru: During the National Forums on Climate Perspectives in Peru, the users and different stakeholders have ben consulted about the information gaps, priority needs with valuable information from small farmers, sectors representatives and authorities. (2014-2016).[92] SENAMHI has conducted workshops to identify needs and demands for climate services (2016)[93]; a Workshop: Mapping of actors of the agricultural sector for climate services (2017)[94] and Dialogue roundtables on potential socio-economic benefits of climate services (2017)[95]

Chile: Several workshops were organized by DMC during July 2017with the aim to meet users and learn about their climate information demand[96]. The participant entities were: Dirección Meteorológica de Chile (DMC), Subdepartamento de Información, Monitoreo y Prevención (IMP), Ministerio de Agricultura (MINAGRI), Dirección General de Aguas (DGA), Ministerio de Energía (MEN), de la Unidad de Gestión de Riesgos y Emergencias Energéticas and Ministerio de Medio Ambiente (MMA).

During the process of construction of this Concept Note, consultations were designed in order to explore in the communities among men and women the following aspects:

- Requirements of climate information (specific products, frequency and resolution) from local stakeholders and representatives of agriculture, water and energy sectors, to improve their plans for risk management and adaptation.
- Identification of the current barriers (access, awareness, understanding, local capacities, ownership, lack of articulation and coordination) to implement local climate risk management and make better informed decisions in the agriculture, water and energy sectors.
- The perception of local stakeholders about the potential impact in their lives of improved climate services

During July, 2018, local consultations were conducted in: Quillota (Chile), Espinal, Riosucio and Popayan (Colombia), Matucana and Lima (Peru). The findings of these consultation meetings are summarized in Table 9 and complementary information are included in Annex 1 (In Spanish).

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Table 9: Summary of the country-consultation events

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National consultation processes
Colombia- Community activities at Riosucio (Caldas), 10 July 2018, Espinal (Tolima), 13 July 2018 and Popayan (Cauca), 12 July 2018
Participants: ASOHOFRUCOL – Assocation of fruits and vegetables producers – 30 participants

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[92] http://www.senamhi.gob.pe/?p=prensa&n=492 ; http://www.senamhi.gob.pe/?p=prensa&n=16 http://www.senamhi.gob.pe/?p=prensa&n=59; http://www.senamhi.gob.pe/?p=prensa&n=194

[93] http://www.senamhi.gob.pe/climandes/index.php/noticias/detalle/senamhi-desarrolla-taller-de-necesidades-y-demandas-de-servicios-climaticos-para-autoridades http://www.senamhi.gob.pe/climandes/index.php/noticias/detalle/conociendo-las-necesidades-de-los-agricultores-en-cusco

[94] http://www.senamhi.gob.pe/climandes/index.php/noticias/detalle/cusco-senamhi-present-mapeo-de-actores-del-sector-agropecuario-para-los-servicios-climticos

[95] http://www.senamhi.gob.pe/climandes/index.php/noticias/detalle/senamhi-instala-mesa-de-dilogo-sobre-beneficios-socioeconmicos-potenciales-de-los-servicios-climt

[96] http://164.77.222.61/climatologia/

FEDEARROZ – Assocation of Small scale rice producers – 20 participants
Community Water managers and Indigenous associations representatives- 40 participants

Main Outcomes:

- IDEAM needs to strength stakeholders participation at Climate Services development and delivery and to develop institutional agreements.
- Climate information needed to be translated into actionable information by integration of community cultural practices.
- Detailed advice tailored for each crop needs to be provided in terms of recommended adaptation practices.
- Climate information is provided at national/regional scale. It has to be downscaled at local level.
- IDEAM official information is not easy to understand nor having easy access. Communication channels need to be improved, as for instance, simple and clear messages including use of SMS, and developping rural radio broadcasts.
- Rice management needs detailed information on rainfall, moisture, evapotranspiration at local level and it is closely related with water resources management.
- Strategic planning on crop varieties and field selection need adequate climate information. Climate prediction and rainfall monitoring is highly demanded for water reservoirs and irrigation schedules planning
- IDEAM and partners needs to develop guidance graphic schemes including adaptation practices.
- Capacity building and training of local users is higly demanded.
- The role of local institutions at the project need to be clarified, They need guidance on adaptation practices. . Local stakeholders are not fully aware of territorial planning tools. Support of local water use planning and management based on adaptation practices and territorial is needed.

Chile – Community activities. Quillota (Central Chile), 5 July 2018 – about 30 participants

Participants:

Ministry of Agriculture – Regional Office Quillota, Valparaiso region and their services: Servicio Agrícola y Ganadero (SAG); Corporación Nacional Forestal (CONAF); Instituto de Investigaciones Agropecuarias (INIA); Instituto de Desarrollo Agropecuario (INDAP); Sección de Emergencias y Riesgos Agrícolas (SEGRA).
Farmers associations. Water managers Aconcagua River

Main Outcomes:

- Snowfall information is needed for water and irrigation schedules planning
- Heat waves, high evapotranspiration events, strong winds and forest fire risk informations are requested.
- Climate information has to be build upon geo-referenced information, GIS and internet tools.
- Ground water levels fluctuations and soil moisture are requested for greenhouse crops. In general, agricultural sectors request high technical demands.
- A good climate reference information based on historical data including averages, extremes and events of previous years is requested. Drought indicators are demanded.
- E-mails are preferred broadcasting tools
- Each crop demands specific and tailored climate information and crop advisories.
- Broadcasting tools are acceptable but need to improve quantity and quality of delivered products. Improvements on social media, TV and radio bulletins are demanded.
- A more friendly Web page is requested.

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- More capacity building and training is also requested
Peru – Parties consulted – Community activities – Matucana (Lima Department) 98 participants for Agriculture and Water (71 % men, 29 % women), 11 July 2018
Participants: Ministry of Agriculture and Irrigation – AGRORURAL- Lima Directorate Ministry of Environment CENEPRED – National Centre for Risk Disaster Prevention and Reduction INDECI – National Civil Protection ANA – National Water Management Authority Regional and Community leaders from Matucana and other cities.
Peru – Sectorial activities – Energy – Lima, 13 July 2018
Participants: Ministry of Energy and Mining Ministry of Environment
Main Outcomes - Climate information flows and contents is still insufficient, TV and radion bulletins need to be more frequent and more contents are needed. Widescale use of SMS is recommended. - Frost risk, livestock management and pest development are areas that require better climate and weather information. - Adaptation measures have been promoted by other projects but there is a need to better link with ENANDES. An effective drought and flood early warning system is requested including local management plans. Information should be ellaborated to provided guidance materials, accionable resources and monitoring tools - Internet is not fully developped. - SENAMHI is not identified as a reference institution delivering climate information. A communication and action plan are needed. More inter-institutional work is needed at community level to optimize information use, including local authorities role at the project, and local authorities. - The renewable energy sector needs rainfall, wind, evaporation, water flows observations and forecasts at different time scales. There is a request for wind and solar resources national updated maps. - Communication improvements on contents, formats and language for climate information are requested by users at all levels. - An integrated information system for climate and water is requested.

J. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

The justification for funding requested is described by comparing the current situation and the impacts due to the implementation of the project. It is detailed in the Table 10.

Table 10. *Justification of funding requested based on impact due to the proposed project*

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Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
1.1 Updated national data management systems, archives, and integrated regional, hydrological and meteorological databases.	**Chile** -The DMC provides warnings and early alerts for high impact events at national and local level. For the agricultural sector, there are bulletins for frosts, heat waves and heavy precipitation. -Daily bulletins of agro-climatic risks and seasonal forecast. -Monthly bulletin of drought index, heat waves, climate indicators. **Colombia** -A diversity of process such as data integration, storage, verification, control and quality assurance, generation of outputs, tables, graphs, maps and texts are performed through the data management project. - Analysis and manual capture of rain gauge belts, thermograph and anemocinemograph has been developed for more than 1'000,000 graphs. - In close coordination with universities, there is a process of construction and application of software for digitization and analysis of output graphs and also the development of a methodology for the homogenization and complementation of daily meteorological data. -The DHIME is implementing several instruments for verification, control and quality assurance of meteorological data and climate information. - IDEAM through the World Telecommunications System of WMO shares meteorological data in METAR, SYNOP, BUFR, TEMP and PILOT. **Peru** -Related to the variables of extreme temperatures, precipitations and levels: 85% of database have been transcribed; 40% digitized; 50% has quality control in conventional and automatic stations; and 15% of data has been homogenized. -There is a 70% of the platform for interoperability (infrastructure), where:	**Chile** -Design and implementation of an IT platform (Climate Services Portal), planned to disseminate the products and services generated by the DMC and other related institutions. -Hydrological and meteorological models adjusted to the needs of final users. **-**Implementation of new climate services for other productive sectors. **Colombia** -It is expected to have data quality with timely availability and free access for final users. -Improvement of climate products and services through availability and the development of applied studies of climate and meteorology. **Peru** -Maintain the level of data interoperability and services. -100% of transcribed database, digitized data, quality control and 50% of homogenized data of conventional stations. -To implement an Integrated Data bases and metadata management system which includes a systematic module of data quality control.

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
	100% of data with the first level of quality control are interoperable and 0% of climate information/products was produced.	
1.2 Improved weather, climate and hydrological predictions and projections by establishing an optimized cascading system involving the regionalizatio n of the global forecast products.	**Chile** -The DMC applies numerical modeling with WRF in various configurations, supporting the research work, such as long-term climate simulations and specific meteorological simulations, in collaboration with national entities (INIA, Ministry of the Environment, Universities, among others). **Colombia** -Model for hydrological forecasting (3 days) integrates data from real time stations, satellite hydro-estimator inputs and forecast of precipitation in the articulated FEWS (Flood Early Warning System) platform. -FEWS is also applied to generate hydrological alerts in watersheds with no hydrological models or level stations. -IDEAM is using the Climate Predictability Tool (CPT) of IRI. Currently there are obtained outputs based on 598 precipitation stations and about 180 temperature stations. **Peru** SENAMHI has medium infrastructure capacities and personnel for integrated meteorological, climate and hydrological forecasts in the intervention area of the project. There are some limitations in the following areas: -The meteorological and hydrological forecast systems are not explicitly integrated. SENAMHI has models for daily forecast through the RS-Minerva Platform. -The regionalization of climate forecasts is made, however it is important to integrate with the hydrological forecasts. -Operational sub-seasonal forecast products are not available. -There are conceptual models for forecasting extreme events, but the associated operational forecasting procedures are not documented.	**Chile** ¨-Improvement of computing capacity (HCP) and numerical modeling, with high speed process for spatial and temporal resolution. **Colombia** -Operational products based on seasonal predictions -There will be time-series data equal or longer than thirty years. **Peru** -Integrated meteorological, climate and hydrological forecast system, according to the needs of end users and articulated to the decision-making processes for the intervention areas. -Validated operational model for flood forecast to support the decision-making of key stakeholders at local level. -Improved seasonal and sub-seasonal forecast. -Updated climate change senarios for adaptation plan

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
	-Climate Change senarios at national level not gridded	
1.3. Sustained delivery of weather and climate-related advisories to support decision-making for national and local water, agriculture and energy stakeholders	**Chile** -The DMC provides warnings and early alerts for high impact events at national and local level. For the agricultural sector, there are bulletins for frosts, heat waves and heavy precipitation. -Daily bulletins of agro-climatic risks and seasonal forecast. -Monthly bulletin of drought index, heat waves, climate indicators. **Colombia** - As part of the strategy of raising requirements, the sectors have been included as active participants in the identification of information, products and services that respond to their needs and activities specific to agricultural activity, for the first phase of the process. - The National Technical Agroclimatic roundtable and the 7 regional agroclimatic subgroups are initiatives in which information, advice and recommendations on crop management are periodically delivered to support the decision making of stakeholders in the sector. **Peru** -SENAMHI provides information at different time scales, organizes workshops on climate perspectives, integrates information for short, medium and long-term planning, develops products and services for different sectorial users. -SSCC has been consolidated in the DRM at the inter-institutional level (CENEPRED, INDECI); however, in the project area the SSCC has not already been operationally consolidated in some priority areas such as energy, agriculture and waterincluding the climate risk management *	**Chile** -operational tailored weather and climate related services widely used in the decision-making processes in water, agriculture and energy sectors. **Colombia** - As it has been a consensus and a participative information gathering, the subsequent phase consists of jointly designing future products or adjusting existing ones to cover the needs of the sector identified in this phase of requirements. - As for the implementation of a platform, once the action plan has been drawn up, it is considered a priority. **Peru** -Implementation of climate services for agriculture and water sector, which was identified in the NDC document as the information priorities for local capacities.
	Chile	**Chile**

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
	-The information is disseminated through mass media: newspapers, radio and TV. -At regional level, there are Agro-climatic Information Centers (CRIA), whose function is to disseminate information and train final user, in close coordination with agricultural organizations. -The DMC develops extension and training workshops for users, to establish feedback mechanisms.	-Improve the dissemination of bulletins using social networks, infographics, radio stations and local newspapers. -Implement workshops and technical tables with final users to train on the understanding and use of climate information.
1.4 End-to-end services through customization of climate information, communication and user´s feedback system.	**Colombia** -The main information chain links the national and regional Agroclimatic Technical Tables, through the dissemination of climate information. -The monthly climate-health bulletin is prepared with the institutions of the national health system. **-**A guide document called "PICSA" has been developed (Implementation of Participatory Integrated Climate Services for Agriculture) and was already proved and implemented in the department of Cauca. **Peru** -There are chains of information for the DRM at the Rimac river basin. -There are general protocols for delivery and dissemination process of hydrological and climate information.	**Colombia** -Climate prediction bulletins for all sectors, users and decision makers. -Agroclimatic bulletin for the regions at national level, by crop in the agricultural sector and by species in fishing sector. -Climate-Health bulletin for 5 natural regions of Colombia, on the probable development of respiratory diseases, zoonoses, vector-borne diseases and critical diarrheal diseases. -Institutionalize a protocol for the dissemination of information from the regional agricultural tables. -The MAPA of AGROSAVIA and TeSac of CIAT projects have components for the strengthening of local capacities for an information transfer process related to adaptation and risk reduction at the community level. **Peru** -There will be chains of information for DRM for all areas of intervention including for climate change projections. -There will be communication and feedback protocols considering a better articulation of actors and processes in order to improve the access and use of hydroclimatic information by different users (officials, private sector, urban population, rural population, etc.).
	Chile -There is a gathering data process to initiate	**Chile** -Implementation of the National

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
2.1 Implemented contributions for the establishment/consolidation of National Frameworks for Climate Services in each country.	the evaluation of the baseline according to the implementation of the National Framework for Climate Services (NFCS-Chile). -It is planned to advance on the key actors mapping by 2019 for the implementation of the national framework, with emphasis on the needs of intermediate and final users. **Colombia** The IDEAM launched the National Framework for Climate Services, but the elaboration of the Action Plan is currently on preparation. **Peru** **-**The National Meteorological Service has been strengthened from the CLIMANDES project in order to provide climate information services, as well as improving interaction with final users. This is an advance in the process of institutionalizing a regulatory framework for climate services at the national level.	Framework of Climate Services. **Colombia** The NFCS in Colombia is fully consolidated covering the local areas of intervention in this project. **Peru** -Initialize a process for the preparation of the National Framework of Climate Services with priority to the agricultural, water and energy sectors.
2.2 Implemented /improved local sectorial stakeholder´s networks to support co-design, deliver and use of climate services	**Chile** At local level, DMC works with the local Secretariat of the Ministry of Agriculture, which facilitates contact and dissemination mechanisms with agricultural technical key actors, such as the Agricultural and Livestock Service (SAG), Agricultural Research Institute (INIA) and Agricultural Development (INDAP). **Colombia** Currently there are incipient and limited local networks to co-design, disseminate and use climate information. They are mostly focused on agriculture. **Peru** -The risk management group works operationally at national and regional level. -Local networks are still limited to support a	**Chile** Implement a network of direct and permanent contacts with small and medium farmers and associations, as well as water monitoring boards. **Colombia** Local sectorial stakeholder´s networks will be consolidated in the intervention areas and they will be able to effectively co-design, deliver and maximize the use of climate information. **Peru** **-**There is a network of interest groups in water agriculture and energy articulated and implemented at the

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
	major interaction at national and regional level.	intervention areas, including actions to cope climate change-related hazards. -Strengthening of the deconcentrated processes of SENAMHI with management tools in order to implement the Interface Platform with local users.
3.1 Strengthened capacities of local stakeholders and communities to access, use and apply climate information for risk management and adaptation.	**Chile** -Climate and meteorological information is used in local agricultural development plans lead by the Ministry of Agriculture, Institute of Agricultural Research (INIA) of La Cruz and the Pontifical Catholic University of Valparaíso with headquarters in Quillota province. -Agriculture adaptation plans are related to seasonal forecast (1 to 3 months) applied to prevent the negative impacts of climate extreme events associated to climate change. **Colombia** -The 2010-2011 La Niña event allowed switching from conventional to automatic stations, with real-time data from 639 hydrometeorological stations and 680 conventional stations reporting daily. -Google Public Alerts is the platform used by IDEAM to disseminate emergency messages, such as evacuation alerts in case of hurricanes. **Peru** -There are disaster risk management plans at regional and national level. -The national water resources plan, national strategy and policy for water resources include adaptation and climate risk reduction actions. -Adaptation measures in agriculture and water have been identified, which also include the goals and indicators of intervention at 2021, 2025 and 2030 within the framework of Peru's commitments to the UNFCCC.	**Chile**-Dissemination and efficient use of meteorological and climate information (current and new) applied on forestry and agricultural sector of the pilot area. -Development of new 5-day forecasts from numerical models and sub-seasonal forecasts (10-30 days), for disaster risk management.-New climate model runs (outputs) in order to update regional scenarios of climate change as key information for the definition of more resilient crops at the intervention area. **Colombia** Dissemination of official alerts by performing a Google and Google Maps search. **Peru** -Small and medium farmers use meteorological and hydrological information and early alert system, such as adaptation process at local level. -Local and regional governments use hydrological information for investment projects; develop strategies and agricultural production development plans within the framework of the NDC implementation process. -Hydropower operators use hydrological information in vulnerable watersheds to develop mechanisms

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
		and risk reduction strategies within the framework of the NDC on water sector.
3.2 Co-designed local climate risk management and adaptation plans with local authorities and the support of public and private institutions/stakeholders.	**Chile** -There is a close coordination between the secretariat of Agriculture and other agricultural services of the Valparaíso region based in Quillota province, in order to provide meteorological and climate information for local farmers. In addition, in joint coordination with the CMD/DMC, early warning information is disseminated for frosts, heat waves, intense precipitation and strong winds. -Agro-meteorological and climate tendencies seminars for decision makers and farmers have been developed in the zone. **Colombia** -According to the conceptual bases of the IPCC Evaluation Report 5, a multi-sectorial analysis was conducted at national, departmental and municipal levels for six dimensions of human development (food security, water resources, biodiversity and ecosystem services, health, human habitat and infrastructure). **-**The vulnerability analysis presents the information about the glacier reduction in Colombia, as well as flood maps due to sea level rise at the Atlantic and Pacific coastal regions for 2011-2040, 2041-2070 and 2071-2100. **Peru** The Huallaga region has climate information for climate risk reduction.	**Chile** -Implementation of new networks for information dissemination and communication between the government authorities and farmers. -Agricultural risk management plan should work efficiently through the different channels of information between the authority and the end users. -Implementation of a safe communication network by using current communication systems between authorities and final user. -The creation of a participatory agrometeorological group that contributes to decision-making process of farmers. **Colombia** -The updating process for vulnerability information and risk assessment due to climate change in the 1122 municipalities of Colombia. -Development of seasonal forecast in a better space-temporary resolution. **Peru** -The three pilot areas have climate risk management and adaptation plans or protocols. -The evaluation of climate risks and climate change using the integration of traditional, technical and scientific knowledge is led by local populations at the community level. -Local, regional and national key actors work articulated for the dissemination of climate information

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
		related to data, alerts, forecast, among others for the implementation of adaptation measures to cope negative impacts of climate change. -Regional and local authorities promote and develop projects with adaptation measures for climate change in agriculture and water sectors through management instruments. -The energy sector updates the risk management tools including climate change issues according to climate scenarios of water resources and energy sector.
4.1 Regional Climate Services Toolkit (CST).	**Chile:** There are initiatives to consolidate climate services. DMC is in charge of providing climate information for sectoral users. Since the last years important improvements have been made in this matter. Other initiatives from the academia side contributed enhancing climate services. Private sector is also an active actor supporting maintenance of information services specific for sectors as agro exports and water resources. **Colombia:** IDEAM is officially in charge of providing climate services, although there are private initiatives also. There is a strong linkage with academia as a source of qualified scientists. The country established a NFCS. IDEAM coordinates regular meetings to inform seasonal forecast to users from agriculture, hydropower and health sectors. **Peru:** SENAMHI is in charge of provide climate services. Regional offices lead provision of specialized products to users. CLIMADES project conducted by SENAMHI has developed several climate services in the intervention areas. Academia and private sector has a limited role in the climate services chain.	It's expected to have enhanced and operative linkages among NHMSs and users from food security, energy and water resources, to generate and disseminate end-to-end and local demand-driven weather, climate and hydrological services. The project aims to Improve data management, prediction systems, tailored information, and services delivery of climate information through the implementation of regional implementation of the Climate Services Toolkit. The expected impact is to have an extended number of users that access, apply and make decisions based on improved climate services delivered by NMHSs.
4.2 Consolidated Andean technical groups of databases	-There is a group of database developers from Colombia and Peru who created a system for real-time data exchange from selected stations, the group is no longer operational active. -The group of seasonal forecast is active in	Through the regional climate outlook forum which involves six NMHSs of western South America on a monthly and uninterrupted cooperation since 2003 to provide regionally integrated climate forecasts, the work of regional groups will be strengthened for south-

Expected Outputs	Base line (current status)	Impact due to the proposed programme (with the support of Adaptation Fund)
developers, (S2S[97]) prediction and operational hydrology.	Chile, Colombia and Peru, since they are part of climate outlook bulletin coordinated by CIIFEN. Activities of the groups need to be strengthened.	south cooperation where countries contribute with experts to enhance the capacities of their peers in other NMHSs. Bolivia, Ecuador and Venezuela will be included as well
4.3 Implemented strategic regional alliances and partnerships for sustained capacity building.	There are regional activities coordinated by CIIFEN, recently enhanced by the establishment of the WMO's Regional Climate Center for west of South America, who facilitate regional coordination among NMHS of Chile, Colombia and Peru. Activities may further have extended to other countries of western South America.	The project will combine virtual platforms with sustained capacity building processes by engaging local institutions, NGOs, or other stakeholders. They will include typical training workshop but combining traditional /ancestral knowledge with the formal one. This will be done through participatory activities with strong involvement of local actors from different economic sectors; private and public institutions, but focused in the co-design of risk management and adaptation plans The regional approach of the project, seeks to facilitate access by NMHSs to relevant climate data, products and tools from CIIFEN and WMO global centers with which NMHSs can create value-added products. The value chain will set an example supported by CIIFEN for the larger region (Bolivia, Ecuador, and Venezuela).

K. *Describe how the sustainability of the project / programme outcomes has been taken into account when designing the project / programme*.

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The participating NMHSs are standing entities within their national governments. The project sustainability will be garanteed by DMC, IDEAM and SENAMHI in their roles of government agencies supported by public funding with officially mandated duties. In Peru, policies for adaptation to climate change in agriculture are spearheaded by the Ministry of Agriculture and Irrigation (MINAGRI) in coordination with the Ministry of Environment (MINAM) and with the support of the Regional Governments (GOREs). The National Service of Meteorology and Hydrology of Peru (SENAMHI) provides climate and environmental data. Similar arrangements are in place in Colombia and Chile.

For the outcomes of component 1:
The component has been designed to support the improvement of several operational capacities within IDEAM, SENAMHI and DMC which involves technical staff and technological tools. This will be accompanied by a comprehensive capacity building strategy which will ensure the continuous knowledge transference within the national institutions, produce and update relevant training material, e-learning tools with the adequate support

[97] Seasonal to sub-seasonal

and follow up from the RCC-WSA and the WMO RTC for the Andean region which is based in Peru. All the technological tools for data bases management, prediction and services delivery will be developed in open source code in order to reduce the risks of discontinuity for lack of funding to purchase licenses. The whole component will also improve the visibility and awareness of NMHS in local areas contributing to increase their relevance for local and national authorities.

For the outcomes of component 2:
The component has been designed to build institutional and multi-stakeholders network to support climate services information chain. The construction of the framework itself, is conceived to sustain the climate information provision in a continuous way. This implies to identify gaps, user needs by sector, stakeholders, institutions to be further engaged, reach formal agreements, and join them to a whole coordinated structure to be connected with the NMHS for the dissemination, use and application of climate information. The sustainability of the framework will be based on the perceived social and economical benefits of the new information services to trigger further support from public institutions, local governments, private companies and the community in general.

For the outcomes of component 3:
The component has been designed to build capacities at very local level involving also the private sector. Through a participatory process of dialogue and discussion, the project will promote the ownership of local communities and private stakeholders to improve their current risk management and adapatation actions. The sustainability is build through the further materialization of both capacity building and participatory co-design in formal plans for risk management and adaptation endorsed by the community and supported by public and private actors. Since all this planification instruments are long term based, they become the basis for the sustainability which is key for long term adaption.

For the outcomes of component 4:
The regional component has been designed to ensure the sustainability of the other components 1, 2 and 3 by articulating the national efforts with the international initiatives and other projects running in the region. CIIFEN will facilitate the synergy with other projects, UN efforts and global and regional opportunities to ensure further contributions build on what has been done in each country. This will contribute to increase the possibility to ensure new funding from national governments or international sources with interest in the Andean region. In the operational aspect, as RCC-WSA, the project will consolidate several regional group of experts from the NMHS which can provide technical assistance and training to other technicians in the region and conduct training to trainers to ensure the knowledge source will keep available in a long term basis and sustain the implemented tools, methodologies, systems and networks in each country and expand them to other countries of the Andean region.

L. *Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.*

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According to the initial screening/identification of potential adverse impacts and risks against the Adaptation Fund Environmental and Social Principles (see Table 10), the project anticipates a categorization C with low to no adverse environmental and social risks. Any potential negative impacts as a result of this project are believed to be small in scale, limited to the project area, reversible and can be either avoided, minimised or addressed through the use of recognized good environmental and social management practices.

Comparable WMO projects implemented in Africa and Asia have been classified as having no adverse environmental or social impacts. Moreover WMO has been accredited by the Green Climate Fund as implementing entity for category C projects. This means the project potentially falls within the Category C rating of the Environmental and Social Policy of the Adaptation Fund too.

A thorough Social and Environmental Safeguards screening procedure is planned to be conducted during the proposal development stage to update and complete the risks and safeguards information in Table 11.

Table 11. *Environmental and social impacts and risks*

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	The project will work to strengthen capacities of NMHS; inter-institutional coordination and sectorial networking at national and local level involving authorities in all the levels. All these actions will be developed in according to National Plans in force in the three countries. Therefore, all the actions implemented under this project are within the institutional frameworks and comply with national law in all the participant countries.	Risk: Low Potential Impact: Low
Access and Equity	The project will provide impartial and equitable access to project benefits. As one of the planned activities a local vulnerability and risk assessment will be conducted in local intervention areas. This will include the social, economic, environmental and governance dimensions. The findings of these studies will guide the prioritization of actions specially related with capacity building and more effort at community level to assure access and equity in all the activities.	Risk: Low Potential Impact: Low
Marginalized and Vulnerable Groups	The project will provide impartial and equitable access to project benefits. As one of the planned activities a local vulnerability and risk assessment will be conducted in local intervention areas. This will include the social, economic, environmental and governance dimensions. The findings of these studies will guide the prioritization of actions specially related with capacity building and more effort at community level to assure access and equity in all the activities.	Risk: Low Potential Impact: Moderate The project will ensure that the adaptation measures are gender sensitive and that at the local level that they do not limit the participation of women and the disabled as beneficiaries.

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Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Human Rights	The proposed activities are not or will not be against any of the established international human rights. Moreover, the proposed programme will promote the basic human rights of access to weather, climate water information to better risk management of associated in agriculture, food security, water resources and energy. The project will make sure to provide equal opportunity to all individuals to share their views, perceptions and needs in developing better climate adaptation measures	Risk: Low Potential Impact: Low
Gender Equity and Women's Empowerment	The proposed project will improve the gender equity and women empowerment through the WMO developed tool: Training Manual for mainstreaming gender in End to End Early Warning system for Floods and integrated Flood Management through a participatory design approach. This will help in increasing the participation of women, girls and other vulnerable groups in Flood and Drought management activities as well as decision making processes. Specific activities will be designed for targeting women only and building on past experience in previous project like CLIMANDES in Peru.	Risk: Low Potential Impact: Moderate The project will conduct gender assessment to determine gender differentiated needs, capabilities, roles and knowledge resources. The project will also conduct perception survey to measure differences in perceptions on climate and disaster risks among genders
Core Labour Rights	The project will be implemented and managed in compliance with the participating countries labour laws which adhere to the ILO core labour standards. Local communities will be involved in capacity building and participatory activities but will not be exposed to any risk of accidents. The project will not undertake any significant work that would utilize manual labour.	Risk: Low Potential Impact: Low
Indigenous Peoples	The project will consider the inclusion of indigenous peoples in the different local networks and participatory activities as part of local risk management and adaptation plans. The traditional knowledge of indigenous people to cope with extreme events or mitigate adverse impacts will be considered and integrated to local plans.	Risk: Low Potential Impact: Moderate The indigenous population in the region will be consulted and involved during the design and implementation of the project activities as part of the communities in the local intervention areas.

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Deleted: The proposed project is targeting¶ some localities where men occupy the majority of the leadership positions. Women participation in local plans, disaster preparedness and decision making is often limited due to cultural and social norms. There is therefore a risk that women will not benefit equitably from the proposed adaptation measures and capacity-development interventions.¶

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Deleted: No individual will be hired without pay and the payment will be according to the countries labour legislation/laws. Children's labour will be forbidden and it will not be accepted from other programme partner agencies.¶

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Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Involuntary Resettlement	The project will work with communities in their locations, and will, in any way, avoid involuntary resettlement of communities.	Risk: Low Potential Impact: Low
Protection of Natural Habitats	There is no potential direct risks to the protection of ecosystems and its natural habitats and biological diversity through the project activities. For adaptation plans, the conservation agricultural practices promoted by the project will bring about additional benefits related to the conservation of biological diversity.	Risk: Low Potential Impact: Low
Conservation of Biological Diversity	The conservation agricultural practices promoted by the project will bring about additional benefits related to the conservation of biological diversity.	Risk: Low Potential Impact: Low
Climate Change	By providing accurate and relevant climate and weather information to the targeted communities the programme will improve adaptive capacity to climate change in the targeted areas, and at the national level through the development of climate products to inform planning processes at the national and regional level.	Risk: Low Potential Impact: Low
Pollution Prevention and Resource Efficiency	The project activities are not expected to result in water, air and soil pollution.	Risk: Low Potential Impact: Low
Public Health	The project activities unlikely have negative effect on public health. On the contrary, it will contribute to prevent the population from natural disasters, to reduce the application of fertilizer with related runoff and pollution issues, improve income for getting access to health facilities, etc.	Risk: Low Potential Impact: Low
Physical and Cultural Heritage	The project unlikely have any activity related to affecting physical and cultural heritages.	Risk: Low Potential Impact: Low
Lands and Soil Conservation	The project will promote the conservation of soil and land resources, especially through the selection of ecosystem-based solutions with environmental-friendly approaches.	Risk: Low Potential Impact: Low

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Deleted: The project will address the current limitations in the participant countries to ensure the adequate production and delivery of relevant climate information by NMHSs to a complex multi-institutional framework, sectorial stakeholders, subnational and local authorities to action risk management at national, subnational, local and community level and support ongoing local climate change adaptation plans and actions and increase resilience.¶

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PART III: IMPLEMENTATION ARRANGEMENTS

A. *Describe the arrangements for project / programme management at the regional and national level, including coordination arrangements within countries and among them. Describe how the potential to partner with national institutions, and when possible, national implementing entities (NIEs), has been considered, and included in the management arrangements.*

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The project will be implemented by WMO in partnership with CIIFEN, the WMO Regional Climate Center hosted in Guayaquil (Ecuador) and the National Meteorological and Hydrological Services (NHMSs) of Chile, Peru and Colombia as Executing Entities. NMHSs are the main national authorities responsible for providing weather and climate warnings, advisories and services, and are playing a major role in developing partnerships for the project implementation by taking the lead on national consultations and climate information co-production.

CIIFEN is expected to lead the project implementation of the regional "common" activities as well as to provide support to IDEAM, SENAMHI and DMC given the institution long experience in project implementation with regional institutions like the Inter-American Development Bank, World Bank, Latin America Development Bank, European Commission, Ministry of Foreign Affairs of Finland, the Adaptation Fund through the World Food Programme for Ecuador, specific projects/consultancies with GIZ, UNDP, FAO, UNISDR, IUCN, OAS and ACTO.

At regional level, the project will be executed by CIIFEN supervised by WMO Regional Office for America (ROA). The project will be executed by a Project Management Team (PMT) to be hosted in CIIFEN and in the NMHSs. The PMT will be composed by an overall Project Manager, three part-time national officers, WMO specialists to provide technical support to activities and a Project Coordinator at ROA. Regular meetings of the PMT will be chaired by the Director of ROA with the support of WMO staff in Geneva as required.

In one hand, PMT will ensure the good execution of the various components of the project and coordination between the different national and local entities. On the other hand, the PMT will centralize data, compile reports and analyse the financial and technical contributions while ensuring that the project's logical framework, objectives and expected results are achieved.

Institutional coordination at regional and international level will be led by WMO, including communication, promotion and cooperation. Based on a consolidated partnership with WMO, FAO has been invited to participate for developing synergies with its "Integrating Agriculture on NAP" project proposal in preparation. The project will also contribute to the implementation of Global Framework for Water Scarcity in Colombia, Chile, Peru and the Andean Region.

At the national level: The project will be implemented by national executing entities, the NMHSs, who will develop agreements with their respective National Implementing Entities to ensure coordination and long-term sustainability of project achievements.
The identified country level project partners are:

- Colombia: National Hydrometeorological Institute IDEAM, Ministry of Agriculture and Rural Development (MADR), Agriculture and Livestock Institute (ICA), Agriculture and Livestock Research Institute (CORPOICA), , Rural Agricultural Planning Unit (UPRA), Tropical Agriculture Research Centre (CIAT), Energy National Operation Centre (CNO), Energy Market Experts (XM), Mine and Energy Planning Unit (UPME), Irrigation Management National Unit (UNGRD) and several private agricultural associations as FEDEARROZ, FENALCE.
- Chile: National Meteorological Service (DMC), Water General Directorate (DGA), Ministry of Agriculture (MINAGRI), Ministry of Environment (MMA) and Information, Monitoring and Prevention Unit at Ministry of Energy (MEN),
- Peru: National Hydrometeorological Service (SENAMHI), Ministry of Environment (MINAM), National Centre for Estimation, Prevention and Risk Disaster Reduction (CENEPRED), , Ministry of Agriculture and Irrigation (MINAGRI), Ministry of Energy and Mining (MEM) , National Institute of Civil Defense (INDECI), National Water Authority (ANA).

At national level, the National Framework of Climate Services will represent the platform for enhanced institutional cooperation. A National Coordination Project Team, chair by a representative from the NMHS, with participation of the relevant participant institutions and one observer from NIE will be established. Main role of this Team would be to implement the national and community activities components.

A Steering Committee (SC) composed by the Western South America Regional Climate Centre Board (6 Andean countries NMHS plus CIIFEN), NIEs from Colombia, Peru and Chile, WMO, FAO, MeteoSwiss, CIAT, IRI and others will provide to the project guidance and recommendations on the implemented activities in the past year and will endorse proposed next year action plan.

B. Describe the measures for financial and project / programme risk management.

Financial and programme risks measures will be assessed as an on-going process throughout the design and implementation of the programme. The potential risks identified are described in Table 12:

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Table 12. Potential risks identified and mitigation measures

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Type of risk and how it affects the project	**Risk impact on the project goal** (low, medium, high)	**Probability of occurrence** (low, medium, high)	**Mitigation measure(s)**

Type of risk and how it affects the project	Risk impact on the project goal (low, medium, high)	Probability of occurrence (low, medium, high)	Mitigation measure(s)
Acceptance of the programme Even though detailed needs assessments have been conducted since 2017, the support of the stakeholders can differ in the three countries. This results in differential levels of acceptance and slowdown of the inception phase of the programme.	Medium	Medium	- During the preparation phase of the project, all relevant stakeholders (government, agencies, departments and communities) will be/are clearly identified, so that they fully share the vision and goal of the project and are aware of their contribution to the programme, hence fostering ownership over the process. - MoU and Agreements will be signed with the participating stakeholders. - Roles and responsibilities of the implementing agencies and executing agencies will be defined in the initial stages of the project so that all the activities are completed in a coordinated way.
Physical risks Administrative barriers hinder sharing of social and topographic data. This result in difficulties to implement components 1 and 3.	Medium	Medium	The executing and implementing entities will ensure from the National Coordination Team that the required data and information are shared.
Technical/quality risks Component 1 and 4 of the programme are can be too technical and could be difficult to be adapted to specific area or countries. Low commitment and interest from stakeholders.	Medium	Low	The project activities will be monitored by experts of WMO Development of strategic partnerships with NMHS leaders in science and technique with experience in South America will be seek. Meetings with local decision-makers and participants from community to understand the expectations and suggestions from the participants under Component 3 would provide feedback and guidance for technical improvements. The feedbacks and

Type of risk and how it affects the project	Risk impact on the project goal (low, medium, high)	Probability of occurrence (low, medium, high)	Mitigation measure(s)
			suggestions from the participants will be integrated.
Restructuring of government officials Restructuring in the government work structure may cause possible shifts of responsible persons at local and national levels to a different location. Delays and lack of support.	Low	Medium	Alternative persons from the departments will be involved in most of the activities so that implementation of project activities will not be hampered at any time.
Financial/resources risks Inadequacy of the financial management system: procurement system, financial availability, monitoring, reporting and auditing system, etc. Availability of programme resources	Low	Low	During implementation, project and financial monitoring/reviews will be conducted to ensure efficient management of project resources.
Human resources/capacity risks Lack of skills or human resources availability Inadequacy of existing versus required experience and skills could result in slowing down the programme activities	Medium	Low	- The project benefits from the deployment of professionals/staffs by the implementing and executing agencies who are selected by a panel of experts. Their Terms of Reference are developed based on the programme needs and in collaboration with the hosting institutions. - Projects in the region and the WMO Regional Training Centre in Peru will provide additional support for training and capacity building. - National support is obtained at the level of the governmental agencies to ensure sufficient human resources
Documentation/Reporting risks Lack of available tools and templates for developing reports and progress report. Delays of reporting by the partners Delays in the reporting process and financial access to funding	Low	Medium	Appropriate tools/templates and reporting structures and procedures will be put in place by WMO to ensure proper documentation and reporting so that donor agencies and steering committee receive timely reports.

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Techniques and technology developed are not accepted by all groups of the communities.¶
Decreases the gender equality compliances ...

C. *Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.*

During the preparation of the Full Project Proposal, all relevant issues related to environmental and social risks will be identified. The UNDP Social and Environmental Safeguards Procedure (SESP) will be completed along with all related requirements under the Adaptation Fund and recommendations made for appropriate action for the project implementation stage.

D. *Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan*.

Monitoring and Evaluation (M&E) measure the overall progress and impact of the project activities through Key Performance Indicators (KPI). They will be monitored regularly to identify the achievements or insufficiencies, therefore supporting the development of additional strategies to achieve the targets. M&E tool will be made available for project activities, as well as project management.

Monitoring and evaluation arrangements for the programme activities
A monitoring and evaluation system will be developed to support the PMT team in designing, implementing and adjusting the project activities. The overall (short, medium and long term) impact of the planned activities will also be assessed using the resources, methodologies or tools etc.

The M&E arrangements will be structured and organized at various level of project institutional set-up such as:

- **Local level:** for the local executing partners and other stakeholders
- **National level:** for the NMHS of Colombia, Peru and Chile.
- **Regional level:** for the regional technical support or consultation that will be regularly carrying out the monitoring and mid-term and terminal evaluations.

Monitoring and evaluation arrangement for Programme Management
The Programme Management Team (PMT) will be made available with monitoring and evaluation tools of project activities and resources. The PMT under the implementing agencies will ensure that the executing agencies have adequate resources and capacity to measure and monitor results at the local, national and transboundary level. The quarterly monitoring and annual evaluation reports of the executing agencies along with the financial statements and resource management will be submitted to the implementing agencies and further to the Adaptation Fund Secretariat for the review.

E. *Include a results framework for the project / programme proposal, including milestones, targets and indicators.*

Table 13. Results framework for the project

Objectives	Components related activities	Overall baseline situation	Key performance indicator	Target to be achieved	Methods of verification
Increase technical	**Component 1:** Observations gap	Climate data bases and data	Number of databases integrated	Climate and water datasets of the three	Detailed reports from NMHS's

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capacity of NMHSs provide demand-driven weather, climate and hydrological services.	analysis, integrations of databases, improved seasonal and sub-seasonal prediction and tailored products for water, agriculture, and energy. Capacity building in the NMHS.	management are not integrated		NMHSs and stakeholders are improved, are interlinked and managed according with QC standards.	and institutions about databases performances
		Weather, climate and hydrological forecasts cascading from Global centres are not fully operational	Number of new operational weather and climate products, generated from the global producing centers are reaching end users	Global forecasts on weather and climate are downscaled.	External WMO expert assessment.
		Forecasts and climate products are not tailored to users needs and climate service providers are not trained to integrate users needs	Number of new tailored products for EWS and risk management provided per sectors..	Tailored forecasts and products are provided for EWS for flood and drought.	Monitoring on deliverables and evaluation reports.
		NMHS are not delivering products and services as stakeholders required in terms of accuracy, timeliness and reliability	Number of direct users accessing and integrating the information on their decision making process	Minimum 40% increase in satisfaction rates among direct and indirect beneficiaries with climate advisory services prior to the last extreme weather event.	User survey
Enhance stakeholder networks to produce sector specific climate services for disaster risk management, long-term adaptation and, water, food, and energy security.	**Component 2:** Assessments of stakeholders needs, development of climate information system helpdesk CISH. Road map for NFCS. Institutional coordination, and capacity building to institutional and sectorial stakeholders	National Framework of Climate Services are still on early stages in Colombia, Peru and Chile	Number of NFCS work plans approved at national level	The three countries have developed national frameworks for climate services (NFCS) and their implementation plans are on-going	National NFCS and WMO Global Framework of Climate Services (GFCS) documentation
		Sectorial and local networks have been set but they need to improve.	Number of inter institutional working groups for drought and floods management are established at the pilot communities as well as for adaptation plans.	Community managers are using drought and floods warnings among other relevant climate and weather information for adaptation strategies.	Monitoring and evaluation done at local communities. .
		Effective co-production of	Number of co-production	National and local stakeholders engaged in co-production of climate	User feedback surveys

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		climate services need to be broadened to more communities and regions.	processes started	services	
Empower communities to use the information to develop risk management and adaptation plans. Strengthened regional cooperation for mutual technical assistance among NMHSs, alignment with other complementary initiatives in the Andean region, and foster capacity building on data management, climate prediction, and tailored sectorial information that can be expanded to other countries such as Bolivia, Ecuador and Venezuela.	**Component 3:** Develop local risk assessments and implement local EWSs, local networks and partnerships including media and ICT companies. Capacity building to communities users.	Climate and weather information provided by NMHSs is not tailored for communities needs.	Number of EWS for droughts and floods are established	60% of the target population and its productive activities are more climate resilient	Reports from local authorities
		Poor knowledge of communities in understanding and using climate and weather information for EW and adaptation	Number of community adaptation plans that integrate climate and weather information	At least two adaptation and risk management plans are co-developed for each country and each sector.	Feedback from community stakeholders (local)
		Climate and weather information is not easily accessible by local users	Number of end users accessing warnings advisories	Access to climate information by sectorial users is improved on each of the pilot areas.	Sectorial reports
	Components 4: Strengthen regional cooperation, data sharing and development of platforms for training and best practices compilation. Strengthen regional groups for climate and hydrological forecast and database development. Support NMHS to implement SEBs, risk assessments,	Regional Climate monitoring tools and data sharing are not fully functional	Number of Climate Services Toolkit implemented according a regional standard	Climate Service Toolkits are implemented in all Andean countries on most relevant agricultural, water management and energy sub-sectors achieved.	Western South America Regional Climate Centre technical reports
		There is a weak regional cooperation in databases, numerical weather prediction and climate forecasts and operational hydrology	Number of technical regional working groups delivering regional guides and advices on technical aspects like databases, NWS, Seasonal Forecasts and operational hydrology.	Regional platform for technical aspects	WMO Regional Association for South America Technical Reports

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	and local communities' engagement.	No regional sectorial approach on agriculture, water management and energy	Number of adaptation plans that have been modified or adopted lessons learnt or tools/information provided by the project , including other Andean countries. SEB results	SEB results highlighted for future projects	Country adaptation and risk management plans documentation abd SEB evaluation .
		Weak coordination in the region is a limiting factor for the local exploitation of the full value chain from data to information.	Number of regional coordination activities	Guidelines on Regional Climate Change adaptation Strategies	UNFCCC NAPAs

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F. *Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund*

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Project Objective(s)[105]	**Project Objective Indicator(s)**	**Fund Outcome**	**Fund Outcome Indicator**	**Grant Amount (USD)**
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**

Deleted: During the preparation of the Full Project Proposal, all relevant issues related to environmental and social risks will be identified. The UNDP Social and Environmental Safeguards Procedure (SESP) will be completed along with all related requirements under the Adaptation Fund and recommendations made for appropriate action for the project implementation stage.

[105] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

G. Include a detailed budget with budget notes, broken down by country as applicable, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

Projects costs are split over the main four components according the following criteria:

- Improvement of national and local operational weather, climate and hydrological services system: 26,3% (1,800,000 USD)
- Implementation of national and local inter-institutional/ sectorial stakeholders networks: 13.1% (900,000 USD)
- Engagement and empowerment of local communities to co-design local risk management and adaptation plans and projects: 26.3% (1,800,000 USD)
- Strengthening of regional cooperation among NMHSs from the Andean region: 24.8% (1,700,000 USD)
- Execution cost including monitoring and evaluation will take 8.5% (650.000 USD).

Table 14. Detailed budget per component

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Project Components	Expected Outputs	Countries / Regional Institutions
Component 1 - Improvement of national and local operational weather, climate and hydrological services system.	a) Updated national data management systems, archives, and integrated regional hydrological and meteorological databases. b) Improved weather, climate and hydrological predictions and projections by establishing an optimized cascading system involving the regionalization of the global forecast products. c) Sustained delivery of weather and climate- related advisories to support decision making for national and local water, agriculture and energy stakeholders. d) End-to-end service through customization of climate information, communication and user´s feedback system.	270.000 USD (90.000 per country) 30,000 WMO 270.000 USD (90.000 per country) 80.000 USD WMO regional approach 600.000 USD (200.000 per country) 100.000 USD WMO regional approach 420.000 USD (140.000 per country) 30.000 USD WMO technical support
Component 2. Implementation of national and local inter-institutional/ sectorial	a) Implemented contributions for the establishment and consolidation of National Frameworks for Climate Services in each country.	285.000 USD (95.000 per country) 15.000 USD WMO

stakeholders networks.	b) Implemented/improved sectorial local multi-stakeholder networks s to support co-design and co-production of tailored climate services.	540.000 USD (180.000 per country) 60.000 USD WMO
Component 3 . Engagement and empowerment of local communities to co-design local risk management and adaptation plans and projects.	a) Strengthened capacities of local stakeholders and communities to access, use and apply climate information for risk management and adaptation. Co-designed local climate risk management and adaptation plans with local authorities and the support of public and private institutions/stakeholders.	810.000 USD (270.000 per country) 90.0000 USD WMO regional 900.000 USD (300.000 per country)
Component 4. Strengthening of regional cooperation among NMHSs from the Andean region.	a) Implemented Regional Climate Services Toolkit (CST). b) Consolidated Andean Technical groups of data bases developers, S2S[106] prediction and operational hydrology. c) Implemented Strategic regional alliances and partnerships for sustained capacity building.	500.000 USD (CIIFEN and WMO) 600.000 USD (CIIFEN and WMO) 150.000 USD (CIIFEN) 450.000 USD (150.000 per country)

H. *Include a disbursement schedule with time-bound milestones*.

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The disbursement schedule for each outputs of the components proposed in the ENANDES project proposal will be developed and presented in the final programme proposal.

PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[107] *Provide the name and position of the government official and indicate date of endorsement for each country participating in the proposed project / programme. Add more lines as necessary. The endorsement letters should be attached as an annex to the project/programme proposal. Please attach the endorsement letters with this template; add as many participating governments if a regional project/programme:*

[106] Seasonal to Subseasonal

[6.] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Gladys Santis, Adaptation Officer, Ministry of Environment, Chile	Date*: 31st July 2018*
David Felipe Olarte Amaya, Acting Chief International Affairs Office, Ministry of Environmental and Social Development, Colombia	Date*: 01st August 2018*
Rosa Morales Saravia, Head of the General Directorate of Climate Change and Desertification, Ministry of Environment, Peru	Date*: 02nd August 2018*