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IMPLEMENTATION COMPLETION AND RESULTS REPORT
(TF-91712)

ON A

GRANT

IN THE AMOUNT OF US$7.94 MILLION

TO THE

GENERAL SECRETARIAT OF THE ANDEAN COMMUNITY (SGCAN)

FOR AN

ADAPTATION TO THE IMPACT OF RAPID GLACIER RETREAT IN THE TROPICAL ANDES PROJECT

September 22, 2014

Environment and Natural Resources Global Practice
Bolivia, Ecuador, Peru and Venezuela Country Management Unit
Latin America and the Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective September 22, 2014)

Currency Unit = Bolivian Boliviano (BOB)
United States Dollar (Ecuador)
Peruvian Nuevo Sol (PEN)

BOB$ 1.00 = 0.14 US$
US$ 1.00 = 6.91 BOB$

PEN$ 1.00 = 0.35 US$
US$ 1.00 = 2.87 PEN$

FISCAL YEAR
July 1 - June 30

ABBREVIATIONS AND ACRONYMS

AGRORURAL	Productive Rural Agrarian Development Program (Programa de Desarrollo Productivo Agrario Rural)
ALOS	Advanced Land Observing Satellite
CAS	Country Assistance Strategy
CC	Climate Change
CPS	Country Partnership Strategy
EMAAP-Q	Former name to the current EPMAPS water utility
EPMAPS	Quito Water Supply and Sanitation Utility (Empresa Pública Metropolitana de Agua Potable y Saneamiento)
EPSAS	La Paz and El Alto Water Supply and Sanitation Utility (Empresa Pública Social de Agua y Saneamiento)
FONAG	Fondo para la protección del Agua, Quito
GEF	Global Environmental Facility
GEO	Global Environment Objective
GFDRR	Global Facility for Disaster Reduction and Recovery
ICR	Implementation Completion and Results Report
IDEAM	Instituto de Hidrología, Meteorología y Estudios Ambientales, Colombia
IHH	Instituto de Hidráulica e Hidrología, Bolivia
INAMHI	Instituto Nacional de Meteorología e Hidrología, Ecuador
IRD	Institut de Recherche pour le Développement, France
ISN	Interim Strategy Note
JICA	Japan International Cooperation Agency
MRI	Meteorological Research Institute of Japan
MTR	Mid Term Review
NGO	Non-Governmental Organization
NTS	National Technical Specialist

O&M	Operation and Maintenance
PAD	Project Appraisal Document
PHRD	Policy and Human Resources Development Grant
PIU	Project Implementing Unit
PPCR	Pilot Program for Climate Resilience
PRAA	Adaptation to the Impact of Rapid Glacier Retreat in the Tropical Andes Project (Proyecto Regional Andino de Adaptación)
PRONAMACHS	(Now AGRORURAL) Proyecto nacional de manejo de cuencas hidrográficas y conservación de suelos
SCCF	Special Climate Change Fund
SEDAM	Municipal Water Supply and Sewerage Service, Huancayo, Peru
SENAMHI	Servicio Nacional de Meteorología e Hidrología, Bolivia
SENAMHI	Servicio Nacional de Meteorología e Hidrología, Peru
SGCAN	Secretaría General de la Comunidad Andina
ToRs	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
WB	The World Bank

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PLURINATIONAL STATE OF BOLIVIA, REPUBLIC OF ECUADOR AND REPUBLIC OF PERU
Adaptation to the Impact of Rapid Glacier Retreat in the Tropical Andes Project

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I N S E R T

D A T A S H E E T

H E R E

AFTER APPROVAL BY COUNTRY DIRECTOR

AN UPDATED DATA SHEET SHOULD BE INSERTED

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1. Project Context, Global Environment Objectives and Design

1. This Implementation Completion and Results Report (ICR) describes the results of the Adaptation to the Impact of Rapid Glacier Retreat in the Tropical Andes Project, GEF Grant funded through the Special Climate Change Fund (SCCF), and approved by the Board on May 27, 2008. The recipient was the General Secretariat of the Andean Community (SGCAN) on behalf of the Plurinational State of Bolivia, the Republic of Ecuador and the Republic of Peru. The US$7.49 million Grant became effective on July 8, 2008 and the closing date was September 30, 2012. The amount was later increased to US$7.94 million and the closing date extended until March 31, 2014.

2. Besides the GEF funds, the Project included activities financed with resources from a PHRD (Japan Policy and Human Resources Development) Grant in the amount of US$0.86M, which included the Republic of Colombia as an additional beneficiary; and a GFDRR (Global Facility for Disaster Reduction and Recovery) Grant of US$0.247M, specifically for activities in Bolivia.

1.1 Context at Appraisal

Country and sector issues

3. At appraisal, climate change (CC) represented a serious global challenge to ecosystem stability and human well-being, with evidence indicating that it would be more pronounced in high-elevation mountain ranges. Thus heavily populated high-elevation areas, such as the tropical Andes, were experiencing, and would likely continue to experience, dramatic changes in climate, compromising the scarce water resources upon which those populations and critical ecosystems depended. In particular, global warming had been linked to the accelerated retreat of tropical glaciers and to an increase in the weather variability and weather extremes affecting the Andean ecosystems.

4. Field observations and records proved that the pace of glacier retreat had accelerated over recent decades, coinciding with an overall warming of the Andean troposphere. Tropical glaciers in the Andes (those located between Bolivia and Venezuela) experienced a 6% area loss between 1970 and 1991, and an additional 10% between 1991 and 2000.1

5. In the Andes, runoff from glaciated basins is an important element of the regional water budget, it regulates flows and is essential to the integrity of mountain ecosystems (many Andean valleys are seasonally dry, and depend on glacier runoff to maintain extensive mountain biomes). Natural glacier melt ensures year-round water flows for agriculture, potable water, hydropower, and the stability of critical ecosystems. Their accelerated retreat would thus have long lasting implications for economic activities, imposing a threat that could jeopardize the sustainability of water use patterns and ultimately the viability of related economies and ecosystems, with potential wider impacts on the entire Andes region.[2] Those prospects required the identification and planning of adaptation measures to strengthen the resilience of local ecosystems and economies.

[1] Tropical glaciers in the Andes covered an area of over 2,940 km2 in 1970 but declined to 2,758 km2 in 1991 and to 2,493 km2 by 2000. In Peru alone, glaciers covered an area of 2,041 km2 in 1970 but had declined nearly 22 percent to 1,595 km2 by 1997.

[2] Glacier retreat places a burden on water resources in their area of influence. For example, the retreat of Tuni Condoriri glacier threats water supply for La Paz and El Alto, where 21% of Bolivia's population lives. This is shared by other Andean cities (e.g., Quito, Cuzco, Bogota). Fluctuations in hydrological cycles would impact already stressed ecosystems and reduce the biodiversity and productivity of highland agricultural lands because of unreliable water supply. The adaptive limitations of less-developed areas would likely increase the disparity in food production and food security in rural highlands. Because much of the lowland basins depend on tributary streams coming from the Andes, impacts would also be felt downstream.

6. Understanding vulnerabilities to the impact of climate change and developing adaptive capacity was important for Andean countries. Relevant initiatives in this direction were already ongoing, such as the development of strategies and plans at national level. At regional level, SGCAN had a mandate to develop the Andean Environmental Agenda, and act as a platform to promote country integration around common environmental challenges. There were, however, very few experiences of specific on-the-ground investments that would demonstrate a viable way to do this.

Rationale for Bank involvement

7. The World Bank's engagement in this regional Project was timely and justified by the increasing role the institution was taking on CC issues. By the time of appraisal, the WB's portfolio on CC in the Latin America and Caribbean region was growing, with an accumulated body of experience including mitigation and adaptation projects[3], and different carbon funds totaling about US$1.6 billion. The WB was also supporting low-carbon economic growth strategies, a large agenda on forestry and avoided deforestation, and linking knowledge and information to decision-making on climate issues. As later explained, the Project supported specific national priorities, and was well aligned with the Bank's own objectives to fight poverty and promote sustainability, especially in areas that had traditionally received little attention, such as high mountains.

Contribution to higher level objectives

8. The Project was directly contributing to relevant issues highlighted in Peru's Country Partnership Strategy (CPS FY07-FY11), Ecuador's Country Assistance Strategy (CAS 2003-2007), and Bolivia's Interim Strategy Note. The Project contributed to Peru's CPS on protection and conservation of strategic ecosystems, while activities in Ecuador and Bolivia contributed to understanding and reducing water resources' vulnerability to changing environmental conditions.

9. Moreover, the Project was designed following the guidance provided by the United Nations Framework Convention on CC (UNFCCC), supporting adaptation activities to address adverse climate change impacts and complementing traditional government interventions in water resources management, including the impacts of warmer temperatures and glacial melt into planning processes. Project activities were country driven, cost effective, and integrated into national priorities as expressed in the participating countries' National Communications to the UNFCCC.

10. Lastly, the Project was pioneering the implementation of on-the-ground adaptation activities to compensate for the loss of glacier services, raising awareness about the consequences of climate change in the region, and increasing stewardship of global common goods such as glaciers, *paramo*[4] ecosystems and water resources more broadly.

1.2 Original Global Environment Objectives (GEO) and Key Indicators

11. The Project's GEO was **to contribute to strengthening the resilience of local ecosystems and economies to the impacts of glacier retreat in the Tropical Andes, through the implementation of specific pilot adaptation activities that illustrate the costs and benefits of adaptation**. The specific objectives of the Project, in support of this broad objective, were: a) the effective integration of the implications of glacier retreat into the regional and local planning in glacierized basins; b) the inclusion of glacier retreat impacts in local, sector development projects; and c) generation of data on glacier dynamics.

[3] The regional "Mainstreaming Adaptation to Climate Change Adaptation (MACC)" and "Strategic Pilot on Adaptation to Climate Change (SPACC)" projects in the Caribbean, and the Colombia Integrated National Adaptation Project (INAP), all GEF-funded.

[4] *Paramos* are ecosystems placed in the northern Andes of South America and adjacent southern Central America, above the continuous forest line, yet below the permanent snowline. They play important water regulation functions.

12. Key GEO performance indicators were: (i) Availability of local, regional, and country-level plans integrating the implications of glacier retreat; (ii) Pilot projects generate useful lessons and information on costs and benefits of adaptation options that are incorporated into broader public and private investments in the water, agriculture and power sectors; (iii) A sustainable glacier observation and monitoring network, operated and maintained by local meteorological and hydrology agencies produces relevant, reliable, and valid records on a continuous basis on hydrology and climate for selected glacier basins; each country allocates adequate budgets for operations after the end of Project; and (iv) Increase in the national and local awareness of the impacts of rapid tropical glacier retreat as measured through mentions in written media of mass circulation.

1.3 Revised GEO and Key Indicators, and reasons/justification

13. Both the GEO and the specific Project objectives, as described on Section 1.2, were not modified. However, three of the four key outcome indicators were adjusted after the Project's Mid Term Review (MTR). This adjustment was necessary in order to fix inaccuracies, mainly: (i) one indicator accounted for the approval of climate change plans, whereas the Project could not ensure their final approval but rather their preparation and submission to be considered for approval; (ii) another indicator measured the extent to which information generated by the Project was actually included into wider public and private investments. This indicator was not properly crafted, as these processes happen on the medium term and a Project cannot directly commit to influencing those. It was adjusted to indicate that the Project would provide the lessons and information, which would then be delivered to relevant decision makers seeking to influence wider investments; and (iii) a third indicator was focused on an output (i.e. the operation and maintenance of a monitoring network), thus not capturing the essence of the outcome, which was to strengthen the capacity to monitor glacier retreat.

14. Finally, and as a result of the Project restructuring that followed the MTR (Sections 1.6 and 1.7) a new, regional component was added, and it became necessary to include a new key outcome indicator to capture the achievements of this component. All the above changes did not negatively impact the GEO and allowed for a better delivery of outcomes in a sustained way.

1.4 Main Beneficiaries

15. **Populations in and around the influence area of glacierized basins**. Most relevant, direct beneficiaries were high-mountain communities highly vulnerable to climate change impacts, in most cases living in poverty. These communities were to benefit from the development of management tools and the implementation of pilot measures on agriculture, livestock, irrigation, water supply and others. Also large settlements, such as La Paz and El Alto in Bolivia, Quito in Ecuador, or Huancayo in Peru benefitted indirectly, through improved management of the upstream water resources upon which they depend.

16. **Critical Ecosystems**, such as paramos, high-Andean wetlands and native grasslands, through improved management and conservation.

17. **Participating countries**, which strengthened their technical capacity (monitoring, research, knowledge); tested different adaptation activities and the use of methodologies to engage local communities in the adaptation process; generated relevant plans and strategies to influence investments; and increased the resilience and efficient use of scarce water resources.

18. **Andean region**, which benefited from a strengthened high-mountain monitoring system, the effective integration of the implications of glacier retreat into regional planning, a more comprehensive and informed Andean environmental agenda, and more cohesive group of practitioners working on water resources management in mountain areas.

19. **Water utility companies** (EMAAP-Q (currently EPMAPS) in Ecuador, EPSAS in Bolivia, SEDAM in Huancayo), which were able to make better-informed decisions on water management (e.g., learn about options to conserve watersheds, water demand management, improved monitoring systems, options to replace loss of water regulation).

20. **Other strategic partners** including CARE, IRD ("Institut de Recherche pour le Développement"), AGRORURAL (formerly PRONAMACHS), FONAG, and local governments (all of which co-financed the Project), which benefited because the Project complemented their own activities with additional resources, creating synergies and providing the basis for future work.

21. **Meteorological, water resources management and scientific communities,** through strengthened capacity (e.g., increased availability of meteorological and hydrological monitoring, glacier dynamic modeling) and increased opportunities for knowledge exchange among countries.

1.5 Original Components

22. The Project had 4 components (details in Annex 10). **Component 1** focused on the design of key selected adaptation measures. It was based on an assessment of climate change impacts in the selected basins, using the results of the Earth Simulator model in Japan as reference. The component also included dissemination and outreach activities.

23. Specific adaptation investments were included under **component 2**, and were carried out in sectors and communities highly vulnerable to glacier retreat (see Annex 2 for a detailed description). Two pilot activities were contemplated in Ecuador: one would support EPMAPS (Quito's water utility company) to strengthen the resilience of the water supply system, while the second would implement community level activities in Papallacta to promote integrated watershed management for the Antisana microcatchments. In Bolivia, one pilot supported EPSAS (La Paz and El Alto water utility) to promote integrated watershed management in the Tuni Condoriri basin (especially water conservation and supply); a second pilot focused on agriculture and irrigation in the Bolivian plateau and high valleys; and the third pilot focused on mainstreaming adaptive river defense systems along the La Paz river. In Peru, the first pilot investment aimed at improving water use practices in the agricultural and livestock sectors at the Mantaro and Urubamba basins' headwaters (Junin and Cusco regions, respectively); the second focused on developing and implementing an agricultural production plan in Shullcas and Santa Teresa (Junin and Cusco regions, respectively) to compensate for water availability reduction; and the third pilot aimed at implementing an integrated watershed management plan in Huancayo (Junin region).

24. **Component 3** provided for scientific and monitoring activities, and included three key sub-components: (i) The design and set-up of a glacier and high mountain monitoring stations network; (ii) The acquisition and use of ALOS satellite images to monitor glacier dynamics; and (iii) A Peru-specific activity on the estimation of glacier retreat and its economic implications, and the analysis and monitoring of mountain wetlands (paramos) to determine their role on carbon and water cycles.

25. **Component 4** financed Project management through the establishment of a dedicated Project Implementing Unit (PIU).

1.6 Revised Components

26. As a result of the MTR (September 2010), the implementing agency submitted a restructuring request to the Bank on June 21, 2011. The restructuring, approved at Country Director level, was carried out in order to improve the Project description and ensure full delivery of its objectives. It introduced two main changes to the components. First, with the objective to boost the regional dimension of the Project (the Tropical Andes is a regional hotspot), a new regional component was created, focused on joint activities that promoted South-South exchange and cooperation. It also supported SGCAN on its mandate to facilitate regional integration on relevant environmental topics. Second, original components were reorganized as follows: Component 1 was reorganized to focus solely on scientific research and knowledge creation, moving design activities to component 2, and the outreach activities to component 5; The restructured component 2 reflected the interrelated nature of design and implementation of adaptation measures. It also clustered some of its sub-components differently, and, for example, instead of having three pilot activities in Peru, it was reorganized into two pilot projects, which in substance included the same activities but in a more integrated, geographically-focused fashion; An illustrative table of the reorganized components is provided in Annex 11.

1.7 Other significant changes

27. Some additional changes were included as part of the restructuring process (see Annex12), namely the adjustment in the specific description and scope of some pilot adaptation measures, which had not been fully defined during the Project design phase and needed a realignment in order to make them more relevant and likely to succeed. In addition, and to provide space for the changes to have an effect and the new regional component to achieve its goals, the closing date was deferred in two occasions from the original September 30, 2012 to the final March 31, 2014. More specifically:

28. Pilot adaptation measures adjustments: descriptions for Bolivia, Ecuador and Peru were updated, reflecting the progress made during implementation in the identification, prioritization and design of activities, and reducing the uncertainties created by non-specific language used in the Project Appraisal Document (PAD). Pilot activities in Peru were re-organized by geographical location, thus strengthening an integrated watershed vision. In Ecuador, adjustments were made to concentrate efforts around the development of vulnerability assessments and knowledge activities for an existing water supply system for Quito, rather than supporting the construction of a new supply Project (initially pre-identified in the "Mindo Bajo" area), which had become unviable for reasons outside Project's control. The second pilot in Ecuador remained unchanged. Pilots in Bolivia also remained largely unchanged, and the restructuring was limited to providing further details, given that original descriptions were prepared at a conceptual level only. None of the modifications changed the objectives of the pilot adaptation measures or the scope of the Project.

29. Other changes: The results framework was modified to better craft the key outcome indicators, establishing a clear link between objectives and outcomes, and also at intermediate level to establish a better link between outputs and outcomes. Grant proceeds were reallocated among components and the financing plan was updated.

2. Key Factors Affecting Implementation and Outcomes

30. This Project was a regional effort, involving three sovereign national governments, one supra-national organization (SGCAN) and a high number of local partners and actors. This institutional

complexity translated into delays and inefficiencies, especially during the first two years of the Project, and required intense Bank engagement and supervision. Significant examples of this are illustrated in subsequent sections.

2.1 Project Preparation, Design and Quality at Entry

31. The Project design was conceptually sound, and contemplated all required pieces to ensure its outcome. It included a robust flow of activities, from scientific research to monitoring to implementation to policy, and provided incentives at national level for actors to get involved. The design managed to bring different stakeholders to the same table, placing glacier retreat and adaptation to climate change in mountain areas at the center of the discussion. Lessons from other Bank projects were identified during preparation, and further reflected to some extent in the design (e.g., adaptation measures generating benefits for all stakeholders, comprehensive participatory approach, and governance structure). Some relevant shortcomings, however, were:

32. Although the PAD provided solid justification for a regional Project, the design gave prevalence to in-country activities (thus the need to include a regional component during Project restructuring).

33. The Bank design team failed to properly assess the complexity of some proposed pilots, (e.g. the Project's planned support to larger water supply works which never materialized in Ecuador), and to identify viable alternatives. Also, the design did not define a simplified operational structure, with clearly spelled-out mechanisms and functions. The Project included many diverse activities and stakeholders, thus requiring significant coordination efforts that were not foreseen. The design failed to consider mechanisms allowing for direct use of funds by key partners, which would have expedited the use of funds, simplified the procurement plan, and reduced SGCAN's exposure to activities for which it lacked direct expertise.

34. Although significant efforts were carried out to empower a regional institution with the adequate competencies to execute the Project, the design team failed to recognize SGCAN's limitations as an effective implementation agency. SGCAN had the mandate and experience to implement environmental projects, but mainly related to the generation of knowledge products. The scope of activities under the Project, in many cases, fell outside this area of expertise, especially when civil works in remote communities were involved, causing delays and forcing the Bank supervision team to increase their support efforts.

2.2 Implementation

35. Project implementation went through two phases. During the first one, progress was slow, mainly due to administrative and operational issues. The second phase, after restructuring, saw a speed-up in disbursements and execution, and the final achievement of objectives.

36. A significant initial difficulty was that, although SGCAN had signed cooperation agreements with participating countries, these needed to be ratified by the "Andean Council" (Foreign Affairs Ministers of the Andean Community of Nations). SGCAN had failed to identify this requirement, also due to the non-fully defined Andean body of regulations. This hurdle required strong political engagement and convening power from the Bank and participating countries, which finally resulted into the Andean Decision 727 (December 2009). Until then, the Project had not been able to disburse in Bolivia. Moreover, SGCAN did not provide sufficient technical support and guidance, rarely participated on missions, and did not sign Aide Memoirs. Their operational procedures were cumbersome and in some cases not even fully defined. Although the Bank team identified these issues earlier on, the remedies put in place at the time proved to be insufficient. During the MTR, a

collective effort crystalized into a fast-track procedure included into the Operations Manual. Processes sped up thereafter, with SGCAN improving its performance. Given the initial slow implementation pace and lack of robust technical leadership by SGCAN, the Bank team strengthened its supervision efforts, and brought additional country-based staff (in Bolivia and Ecuador). This decision brought clear benefits, as country-based staff were able to directly engage at national level, supporting the PIU and Environmental Ministries and providing targeted guidance.

37. Changes in key PIU staff impacted its performance: the procurement specialist left in January 2011, taking 10 months to identify a competent replacement, and in July 2011 the regional coordinator was appointed as Peru's Minister of Environment. Despite significant impacts, the Project did not stop, due to a greater national engagement, increased National Technical Specialists' (NTS) performance (including a new, proactive NTS in Bolivia) and an even greater Bank assistance.

38. Another challenge was that several investments were poorly identified/assessed during Project design (especially those related to larger water supply works with the water utility companies of Bolivia and Ecuador), and they were either not a priority, or were not ready for financing (e.g., due to technical difficulties, lack of financial closure, unforeseen land tenure issues). The Project restructuring addressed the situation and, instead of focusing on specific infrastructure, it selected more strategic activities which could inform and have a longer-lasting influence on sectoral investments, delivering long-term gains, and therefore contributing to the longer goal of climate change adaptation.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

39. M&E Design. The results framework was prepared so that output indicators were linked to outcome indicators, in order to better assess Project progress and impact. It is challenging to measure resilience increases in absolute terms, and therefore most indicators were qualitative in nature, their progress measured through descriptive text. The M&E system could have been designed to gather more quantitative information, however, it would have turned the framework bulky and non-operational. Additionally, most measurable indicators (e.g. increased natural flows after reforestation, or increased agriculture productivity after irrigation schemes are finalized), would have implied dedicated monitoring stations and equipment, with additional costs and challenges.

40. M&E Implementation. The implementation was reported through semiannual reports. After changes in key staff, the reporting method changed, mainly due to lack of enough human resources, and most of the information was gathered by NTSs in preparation of missions. The detailed aide memoirs signed after missions reflected this information and described the implementation of the M&E. The MTR undertaken by the Bank proved to be a key exercise, crucial in determining the specific needed changes to improve Project performance. The M&E was the basis upon which a number of reports were prepared (an end-of-project report, country-based systematizations, detailed component 2 systematization, and others). Moreover, a rather complete and aggregate final Project review was included at the closing supervision mission's signed Aide Memoir.

41. M&E utilization. The Project complexity implied that many steps needed to be taken before activities could actually be implemented and outputs achieved. This was not reflected in the first M&E, as it focused mainly on outputs. After restructuring, the adjusted framework improved the description and follow-up of the causal steps to achieve outcomes, and was frequently used by the different Project stakeholders to report on progress and identify weaknesses, and informed decision making, as discussed in section 3.

2.4 Safeguard and Fiduciary Compliance

42. Safeguards. This Project was categorized as B, with minor environmental impacts arising from on the ground investments. Safeguard policies triggered were Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Pest Management (OP 4.09), Forests (OP/BP 4.36), and Indigenous Peoples (OP/BP 4.10). The Project complied with all safeguard policies, and no mayor impacts or issues of material compliance occurred.

43. At appraisal, an environmental and social management framework was developed. This framework was generic and focused on the positive impacts promoted by the Project, whilst providing limited guidance on actual implementation. During the MTR it was identified that some aspects, mainly related to proper documentation of processes and plans, had to be better prepared and registered by SGCAN. The framework was updated and turned into an easy tool, dedicated training was offered to the NTSs, and closer Bank guidance and supervision was also provided.

44. The updated environmental framework provided clarity for the preparation of simplified environmental impact assessments, mitigation activities and monitoring for small water and sanitation works. It included a sample pest management plan, sample terms of reference for the preparation of a forestry plan, and procedures to adequately address and document the requirements of the Indigenous Peoples safeguard among others.

45. From a social point of view, Project implementation was highly participatory and supportive of rural farming communities. Pilot activities had no social adverse impacts, and positively helped enhance the resilience of the involved communities to changes in water runoff and glacier retreat.

46. Financial Management (FM). The Project provided reasonable assurance that Grant proceeds were used by the SGCAN for the intended purposes, keeping adequate FM arrangements in terms of budgeting, accounting, internal controls, funds flow, financial reporting and auditing. The SGCAN submitted periodically the withdrawal application of funds and disbursed 99.31% of the Project funds. Some coordination among participating countries for requesting, approving and processing payments implied some challenges for timely Project implementation. During the last FM supervision, the FM team advised to rate Project's FM performance as Satisfactory, as SGCAN kept qualified staff to manage the Project and adequate internal controls during implementation. In addition, SGCAN was able to provide timely and reliable information required to manage and monitor implementation. The SGCAN also submitted the final audit reports and auditors issued unqualified opinion on the Project's financial statements.

47. Procurement. Procurement performance at Project closing date was rated Satisfactory. Close supervision and extensive Bank support were needed to improve the overall procurement capacity of the PIU within SGCAN and of the participating entities in each country (especially Bolivia and Ecuador). Initial shortcomings in terms of contract management and low participation in bidding processes – largely related to lack of experience with Bank procedures – were identified and addressed in each country. By closing of the Project, the PIU had demonstrated adequate capacity for compliance with Bank procurement standards and procedures.

2.5 Post-completion Operation/Next Phase

48. The participating countries' Governments have internalized plenty of the results and products. Many Project-financed activities have already been incorporated under own routine responsibilities, and will count on continued financing (e.g. EPSAS's replication of water efficiency in La Paz, Ecuador's Ministry of Environment replication of adaptation efforts in Papallacta and FONAG's continuous operation of the water resources monitoring system, or Peru's work on *paramo*

monitoring in Piura). The long term operation and maintenance (O&M) of monitoring equipment purchased by the Project was ensured by country-specific agreements. Regarding investments, the Project made significant efforts to ensure appropriate O&M: in Bolivia the Project helped create and formalize irrigation committees and operation manuals in both municipalities where irrigation works where built, and consolidate a basin committee that is currently leading the implementation of an integrated management plan (CARE provided on the ground support, and will continue to work in the area for several years, providing a sound environment for a smooth transition). In Ecuador, the Project created a water user's association, who took over the management of the investment. Irrigation and water users committees were strengthened in Peru as well.

49. Regarding the continuous funding of climate change adaptation activities more broadly, participating countries have continued to succeed in securing external financing, and there are a number of initiatives to expand initiatives spearheaded by the Project (with the Japan International Cooperation Agency (JICA), CARE, Swiss Development Cooperation and others). The Bank is also supporting additional efforts, such as the Pilot Program on Climate Resilience in Bolivia, the Sierra Irrigation Project, the Water Resources Management Modernization Project and the Program for the modernization of SENAMHI for Climate Change Adaptation Project in Peru. More significantly, and given the level of Project success, the three participating countries plus Colombia have requested a new operation, and the Bank, through GEF's Special Climate Change Fund, has secured additional finances. The new operation was being prepared at the time of writing this ICR.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

50. At the time of design, the Project was directly contributing to relevant issues highlighted in Peru's CPS FY07-FY11, Ecuador's CAS 2003-2007, and Bolivia's ISN. At the time of writing this ICR, the Project's GEO and outcomes are still relevant and contribute to Peru's CPS FY12-16 third main pillar "sustainable growth and productivity" (Results Area 3.3 specifically mentions the Government and Bank's collaboration to address CC impacts); to the Ecuador ISN (pillar number one "Sustainable and Inclusive Growth"); and the Bolivia CPS FY12-15 (Results Area 2, specifically devoted to CC and Disaster Risk Management and significantly mentions glacier retreat as an important development threat). Moreover, the Project was designed to capture the priorities of GEF4-5, and is still fully responsive to the global priorities underlined by the current GEF6.

51. This Project had the vision of tackling an issue that was only incipient during the preparation phase, and which has become crucial for the region. Currently, participating countries have all just issued national CC plans, strategies, and national adaptation action plans. These national instruments address glacier melting as a priority. Therefore, the objectives and achievements of the Project, as conceived over six years ago, are still relevant and consistent with all beneficiary countries' development priorities. As specific examples, the Project objective of adapting to impacts of glacier retreat is more relevant than ever in Peru, a country where the most populated city (Lima, over 8 million people), important infrastructure and touristic attractions are located on an arid coast which receives most if its potable water from mountain runoff. Adaptation is fundamental for Peru's government, as reflected by the fact that Lima will host the UNFCCC's 20th Conference of the Parties in December 2014 (during which mountain ecosystems and glacier retreat will have specific, dedicated events). Ecuador created in 2009 the CC Sub-Secretariat, and in 2010, the Inter-institutional Committee on CC, to coordinate and enhance the implementation of CC policy. Significantly, the National Climate Change Strategy was launched in 2012, constitutes the official political instrument that tackles CC issues nationwide, and is the basis under which the

National CC Plan will be developed. Adaptation to CC in Bolivia in general, and glacier melt in particular, are important challenges that the country is currently tackling. In 2012 the Mother Earth law was passed, which positioned CC at the forefront of the policy dialogue. The law provides the context and institutionalization to articulate the national adaptation and mitigation mechanisms.

52. More specifically, the Project tackled issues that are fundamental for adequate country development. It provided support to address Bolivia's La Paz and El Alto pressing potable water demands, Ecuador's needs to strengthen water supply systems for Quito through protection of upstream basins, and Peru's efforts to improve water management for irrigation in priority basins.

3.2 Achievement of Global Environmental Objectives

53. The achievement of the GEO is rated **Satisfactory**.

54. Project objectives were achieved, all outputs were completed satisfactorily, and they all added up to achieving the GEO. The resilience of local ecosystems and economies in the selected areas were strengthened, through the implementation of specific pilot adaptation activities. The Project managed to illustrate the costs of selected adaptation measures, although the monetary benefits accrued will have to be estimated as more data becomes available.

55. The first specific outcome was to generate CC and glacier retreat scenarios in order to contribute to the definition of local/regional governments' adaptation strategies. All results in this front can directly be attributed to specific Project outputs. The three participating countries, through the Project, generated CC scenarios using the Earth Simulator from the Meteorological Research Institute in Japan; obtained and used ALOS satellite images to better describe historic glacier retreat; prepared integrated watershed management plans, vulnerability analyses of critical sectors, and developed information and monitoring systems. These outputs were translated into strategies and planning instruments that go beyond initial expectations, and have long term significance. It would not have been possible to mainstream glacier retreat and other CC impacts into those instruments without Project's outputs. Some selected examples (full results matrix in Annex 3) are: **(i) Ecuador:** Preparation of the local government of Papallacta's development and zoning plan, with Project resources and using the information generated under component 1. The Ministry of Environment is using this experience to promote the inclusion nationwide of CC in local development and zoning plans; Preparation of the National CC Strategy and the National CC Plan using Project information; Increased protection of key relevant ecosystems (*paramo*, Andean forests, grasslands and wetlands) through reduction of anthropogenic pressures and better management of natural areas, through the implementation of specific zoning, fire prevention plans, sustainable cattle and tourism practices. These practices also contributed to diversifying the local economy, increasing its resilience to climate shocks. **(ii) Bolivia:** Preparation of integrated management plans with CC and water resources considerations in selected basins. These plans were prepared with CARE's leadership and laid the grounds for the subsequent irrigation investments. The irrigation infrastructure and agricultural development in the area contributed to strengthen the local economy's resilience. The Choquacota plan, the first one of its kind in the country, was selected as example on how to include CC into the country's incipient basin plans. Integrated management in both locations and improved agriculture practices also reduced pressures on an already strained environment; The glacier inventory prepared by the Project was used as input to influence three relevant plans: Master Plan for Water and Sewage for La Paz and El Alto, Multipurpose Irrigation and Water Plan for the municipalities of Batallas, Pucarani and El Alto, and five-year investment plan of the water utility for La Paz and El Alto, EPSAS; **(iii) Peru**: The CC scenarios for 2030 and 2100 for the Mantaro and Urubamba basins were directly used to inform the

regional CC strategies in Junin and Cusco respectively; An entire fragile ecosystem along the Shullcas microbasin was strengthened, with specific reforestation activities, delimitation of protection zones, infiltration trenches and other measures.

56. The second outcome was related to the design and implementation of pilot investments. These have all been completed and have been able to generate lessons that have been incorporated into national planning, programs and investments. The number of outputs achieved and their contribution to the wider GEO, has also gone beyond expectations. As selected examples: **(i) In Ecuador,** the different adaptation activities in Papallacta (cattle management, *paramo* management, community development using demonstration agriculture plots) have yielded such positive results that they have become the basis upon which the Ministry of Environment is building a larger adaptation program in the same area. Also, the Project has contributed to the formulation of strategies and investment activities of the water utility company through the development of the Adaptive Management Plan for the Pita-Puengasi water supply system; **(ii) In Bolivia,** the pilot activity to improve water distribution efficiency and reduce unaccounted for water in El Alto yielded very positive results, and similar activities are being replicated by EPSAS in other districts (three more to date). The implementation of pilot adaptation community activities informed micro-basin integrated management plans. As example, the Batallas (Khullu Cachi) plan identifies 8 investments that include climate change and glacier retreat considerations; **(iii) In Peru,** the Municipality of Santa Teresa has developed a project on food safety based on the agrobiodiversity and agroclimatology studies under the Project. Several local governments in Cusco are developing adaptation projects with own resources based on Project's experience. The *paramo* monitoring and conservation activities in Piura managed to preserve a critical ecosystem and biodiversity hotspot, ensuring longer term ecosystem services provided by it.

57. Activities implemented by the Project differ from more traditional livelihood, community agriculture and water supply projects, given that their design and implementation was based on CC research (e.g., selection of agricultural varieties based on the result of agro-climatological models, capacity building that underscore the link between efficiency and increased resilience, and others).

58. A third Project outcome was the strengthening of the national meteorological services' capacity to monitor glacier dynamics in Bolivia, Ecuador, Peru and Colombia. The Project acquired and installed eight high-mountain monitoring stations, currently under operation. In Ecuador, 15 additional hydro-meteorological stations were acquired, and are complementing the country's national network. ALOS satellite images were used to further understand glacier retreat and *paramo* dynamics. In this way, the Project has contributed extensively to strengthening national scientific institution's capacity to generate and analyze meteorological, hydrological and glaciology data.

59. A fourth outcome, included after restructuring, was related to the Project's contribution to strengthening the Andean region by supporting the implementation of the Andean Environmental Agenda. This Agenda specifically mentions glacier retreat as a regional threat, and encourages knowledge exchange and transfer of experiences. The Project contributed to increased regional integration at the scientific, decision makers, and beneficiaries' levels, creating spaces where knowledge, processes and experiences were exchanged (over 6 regional workshops were implemented). The Project also contributed to the publication of two important Andean region documents: The Andean Strategy for Integrated Water Resources Management, and the Andean Environmental Agenda, both led by SGCAN. Another significant Project output was the activity called AndesPlus, an effort to promote intensive cooperation of the participating countries to prepare a regional database and regional guidelines for adaptation projects in the region, together with top notch European institutions working on glacier retreat.

3.3 Efficiency

60. High mountain economies and ecosystems are commonly rated among the most vulnerable to climate change, and impacts are expected to affect Andean countries significantly. As highlighted by the recent IPCC's 5th Assessment Report, CC impacts from recent climate-related extremes, reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability. Numerous publications highlight the toll that climate change will impose in development. The benefits associated with increasing resilience to CC are thus significant.

61. There is an inherent difficulty in applying effectiveness criteria to adaptation activities, since most of the costs are incurred at the present time, whereas benefits will be accrued in the medium-to-far future. Some activities, such as the reforestation of a mountain slope, the implementation of infiltration trenches, or the protection of fragile high-mountain ecosystems, are challenging to assess from a cost effectiveness perspective. A first indication of Project's efficiency, however, is given by the positive results achieved, both in local ecosystems and economies and on strategies and plans, all obtained through an initiative with rather limited GEF resources (less than US$8M), to be distributed between three countries. This is especially relevant when compared to the tremendous losses that climate change could bring around to the region. The specific cost effectiveness of three key activities is discussed below. A broader perspective is given in Annex 4.

62. The Project invested resources in purchasing and installing hydro-meteorological equipment. It is well-known, and has been extensively documented in specialized literature, that investments in monitoring and improved weather forecasting are cost effective, because they yield significant benefits for long time periods, generating information useful at multi-sectoral level. Moreover, highly competitive procurement methods were used, thus ensuring best available prices.

63. In Bolivia, one of the most salient activities was the pilot project to improve water distribution efficiency, and reduce unaccounted for water of the La Paz and El Alto water utility, EPSAS. By purchasing selected pieces of equipment (approximately US$188,000 for the whole water distribution network), and by hiring a specialized firm (for US$181,000), the total investment yielded large reductions in water losses for District 4 in El Alto (from 39.6% overall losses down to 26.5%), with a total reduction of approximately 619 m3/year, equivalent to the water required for 18,697 new connections of similar characteristics within a year. EPSAS has already replicated this pilot in at least three districts, yielding 1.3 million m3/year savings, and has plans to expand to all.

64. In Peru, pilot projects in Shullcas included the modernization of irrigation systems, with three schemes that were upgraded with sprinkling irrigation and small water reservoirs. The total investment was around US$500,000, including supervision and capacity building. These schemes made 190 Ha of additional cultivation area available, and are benefiting 347 families. The Project also invested in the lining of an open canal. These canal lining investments are amongst the most cost-effective measures in agriculture development. The costs of the canal lining amounted to around US$235,000, including supervision and capacity building. This relatively low investment allowed for 144 Ha to be incorporated under intensive agriculture practices, benefitting 179 families and allowing them to have two harvests per year. Investments were complemented with community development and capacity building on climate change for farmers, provided by CARE, and these are activities well known for their cost-effectiveness and long term impact.

3.4 Justification of Overall Outcome Rating

65. Rating: **Satisfactory**

66. Climate change was and continues to be a major threat to the sustainable development of the Andean region, and countries need to continue enhancing their capacity (scientific knowledge base, institutional strengthening, development of sound policies, and regional coordination) and reduce their vulnerabilities to climate change impacts. The Project contributed extensively to those goals, achieving significant outcomes and successfully fulfilling its intermediary outputs. The Project contributed substantially at different levels, some of which unprecedented: (i) strengthened the high-mountain monitoring network, installing some of the highest altitude stations in the region and in the world; (ii) implemented on-the-ground climate change adaptation activities, which, to the authors' knowledge, are amongst the first of its kind in the world; (iii) made significant contributions to public policy, strategies and planning, at local, regional and national level; and (iv) increased the relevance and urgency of climate change adaptation widely, and high mountain adaptation specifically, as reflected by its impact on mass media and on national agendas.

67. All the above was achieved within a complex environment, involving three participating countries (plus Colombia for selected activities through its Institute of Hydrology, Meteorology and Environmental Studies IDEAM), a regional implementing agency and numerous strategic partners. This gives an indication about the Project's efficiency, since significant outcomes at local (activities done with municipalities), national (activities lead by the Ministries of Environment), regional (Andean community strengthening and sharing of experiences) and even international (through a South-South exchange) level were completed with relatively low funding.

68. The participating countries have moreover shared their experiences in several fora, and have successfully used the Project to leverage additional resources, with plenty of ongoing replication and scale-up initiatives (see Section 4).

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

69. There were no explicit poverty or gender related objectives at the time of Project design, and therefore there was no data collection on net assets, income or consumption patterns before and after interventions. However most investments benefited and are expected to continue benefitting poor communities who traditionally inhabit in high mountain areas. The Project has managed to improve the economic, social and environmental resilience to climate change at the community level, and also managed to protect and strengthen the livelihoods of people and communities who depend on ecosystem goods and services. A key Project partner was CARE, organization that provided consistent and solid social development support. CARE has been constantly present in the Project's remote intervention areas, with dedicated staff devoted to social and community development, capacity building and strengthened institutions. More specifically:

(i) The irrigation activities in remote Bolivian communities benefitted 70 poor families in Palca and 85 in Batallas. These families now have an all-year, secure water supply for irrigation, and increased capacities to adapt their agricultural practices (mostly rain-fed, subsistence prior to the Project) to a changing climate. The collaboration with EPSAS managed to reduce water losses and directly benefit El Alto, a settlement inhabited by the urban poor that traditionally has water restrictions during dry seasons in Bolivia.

(ii) In Papallacta, Ecuador, a small water supply and sanitation system was built in the community of El Tambo, an impoverished settlement who had no source of piped running water, benefitting approximately 180 persons (32 households or equivalent). In the neighboring high-altitude communities, an integrated approach was followed to improve the local economy's conditions, with activities to safeguard *paramo* ecosystems on which many depend, improve cattle

management strategies, ecological tourism, reforestation and others. CARE supported several of these activities, which directly benefited around 900 inhabitants. The regional government of Quijos, to which Papallacta belongs, was involved in training, so that the lessons learned from these experiences also reached a broader population. More significantly, Papallacta was chosen as a priority because of its strategic importance in Quito's water supply. Therefore, activities to promote water conservation and efficient use are also indirectly strengthening the supply for the capital.

(iii) In Peru, the improved irrigation schemes and community development carried out in Shullcas benefitted around 580 rural families around the catchment, with intense social development support by CARE. Activities in Santa Teresa, Cusco, with strong leadership from the Municipality and CARE, provided direct support and assistance to the wider community, with several activities specifically targeted towards women.

70. Activities related to community agriculture, especially in Bolivia, had a gender angle, since women in high Bolivian communities are the only ones in charge of agriculture, whereas men are commonly working on the mines or in the city. Social development and capacity building led by CARE was thus primarily targeted towards women.

(b) Institutional Change/Strengthening

71. Within the Andean region, the Project has had a significant achievement in strengthening the ability to collect robust data, improve monitoring capacity, as well as data interpretation. Moreover, it served as demonstration on how to translate data into actionable investments. Long-term capacity is ensured through multiple interactions and agreements among partner institutions, and through the sheer number of professionals trained through numerous workshops, both regional and overseas.

72. The Project has contributed to empowering communities to collaborate and act together. Irrigation associations in Peru were strengthened, and newly created in Bolivia, where a basin committee model was reinforced. A new local water users association was created in Ecuador as a consequence of the pilot activity on water supply. There has been on-the-ground community-based adaptation, provided by CARE especially in Peru and Bolivia, with the aim of training trainers, identifying and empowering leaders to support own and neighbor communities.

73. The Project has been a platform on which a remarkable number of stakeholders have interacted: scientists with decision makers with water utility companies with NGOs with farmers and community members. As one scientist put it during the Project closing workshop, never before had they gone to the field and talked to farmers to hear about their needs.

74. The regional dimension of the Project promoted cross-fertilization. For example, Bolivia became a regional leader in satellite imagery, and provided support to the other participating countries in image processing; Peru made remarkable innovations in understanding future CC impacts on selected crops and hydrology, and transferred its knowledge to the other two countries; whereas Ecuador is arguably the world's first country to implement *paramo* restoration activities. This knowledge is strengthening the Ministry of Environment, and is being disseminated elsewhere.

(c) Other Unintended Outcomes and Impacts

75. The Project has received significant attention, with a number of mass media publications about it. This steered the interest of another glaciated region, the Himalayas. As a result, on January 2014, a delegation of government officials and practitioners from Afghanistan, China, India and Pakistan visited the Project in Ecuador to gain insights and ideas. Ecuadorian Government and institutions were proactive hosts, and participants remained positively impressed and mentioned their interest in replicating efforts in their countries.

76. The ALOS satellite images, initially envisioned for glacier retreat quantification, have found other uses, and in Bolivia there has been a PhD thesis on land-slides and disasters in the city of La Paz using the same images. One of Bolivia's pilot projects, financed by the Global Facility for Disaster Reduction and Recovery (GFDRR), addressed the construction of defensive structures throughout the banks of the La Paz river to protect crops and settlements from flash floods. The activity financed the construction of a physical simulation model of the river, the first of its kind in the country. The success of the model, built at the Institute of Hydraulics and Hydrology (IHH), and the amount of quality of information it provided, called the attention of the city of La Paz, who built similar models to inform the construction of other infrastructure.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

77. A final Project Stakeholder-wide workshop was held in Lima. It counted with presence of key authorities and decision makers from the participating countries, as well as the different institutions (the meteorological institutes, water utilities, local and municipal level governments, CARE and others), and direct Project beneficiaries During two days, the workshop unanimously and unequivocally praised the Project's achievements, relevance and importance, and underlined some of its most positive accomplishments, such as institutional coordination and its ability to connect all stakeholders. Another frequent observation was the right approach to strengthen the monitoring capacity and knowledge base first, and translate it into investments, which have served as an incentive to achieve Project goals. Annex 6 provides more detail.

4. Assessment of Risk to Development Outcome

78. Rating: **Moderate**

79. The Project's objective remains highly relevant, with relatively low risk to the development outcome given the importance of the topic and the level of institutional engagement.

80. Factors contributing to the success in reaching the development outcome are robust and have been mentioned before (knowledge strengthening, capacity generation, policy influence, actor involvement, deep social engagement). All these factors, in addition to the availability of increasing international adaptation-specific resources, provide the conditions for sustaining a positive path towards even stronger institutions and better informed decision.

81. Sustainability and scale-up of activities is also guaranteed through the leverage of additional funds and efforts to strengthen policies and foster resilient investments. In Bolivia, scientific activities will continue through initiatives such as JICA's "Proyecto Grande", while EPSAS will receive the support of the World Bank-financed Pilot Program for Climate Resilience, and the work undertaken with rural communities in Palca and Batallas will continue with support from the Swiss Development Agency and other CARE initiatives. In Peru, CARE together with AGRORURAL, and with the support of the World Bank's financed Sierra Irrigation Project, will continue activities with local communities in Shullcas to further strengthen Project investments. The implementation of two new projects with the support of the Swiss Government and the leadership of the Ministry of Environment will continue to strengthen the capacity around glacier retreat. Moreover, monitoring and scientific research will be supported through the World Bank-financed Program for the Modernization of SENAMHI for Climate Change Adaptation Project.

82. The role of CARE in the three countries must be underscored because of the capacity shown to raise resources aimed at achieving Project's objectives and sustaining these achievements. CARE more than duplicated the amount of resources committed to the Project reaching US$ 3.9 million,

part of which is currently being used to replicate some of the pilot investments, and to provide continuity to the capacity building activities.

83. Still, there are various factors that present challenges to the adaptation agenda. These include the usual shortcomings such as the general weak capacity at the local level, limited and competing availability of local resources, and the characteristic regional political turnover, which could potentially shift priorities. The pilot projects had the vocation to generate useful information for decision making and scale-up. Most of the activities have a well-designed M&E, and the challenge remains to maintain the arrangement over long periods of time (needed to obtain meaningful data).

84. The continuity and further strengthening of regional activities is more uncertain, because the SGCAN is currently re-examining its priorities, and indications point to the institution focusing on commerce promotion and Andean exchange, likely leaving environment outside its primary area of interest. However, support on regional integration will be given by a new GEF regional project on climate change adaptation and water, currently under preparation by the Bank. Thus the overall risk to development outcome is considered moderate.

5. Assessment of Bank and Borrower Performance

5.1 Bank

(a) Bank Performance in Ensuring Quality at Entry
85. Rating: **Moderately Unsatisfactory**

86. Bank Performance in Ensuring Quality at Entry is rated Moderately Unsatisfactory. The topic was incipient at the time of Project design, and the approach to address the issue at the regional level, considering country similarities both in challenges and in solutions, was innovative and daring. Moreover, the Bank seized the opportunity to mobilize a new source of funding (GEF's Special Climate Change Fund) to respond to a priority, and was arguably one of the first Projects worldwide to pursue real investments and activities related to glacier retreat, and to do so with a regional approach. At the time of design, plenty of the information needed to undertake these investments was still unknown, and the final achievement of objectives indicates that Project design contained the minimum basis upon which to build a successful intervention.. A considerable level of risk was thus taken, acknowledging that potential rewards were worth the effort.

87. However, and especially because the Project was challenging, the preparation and appraisal could have been more emphatic on the implementation arrangements, careful assessment of institutional capacities at regional and national level, or assessment of administrative requisites to make the Project actionable. A more careful appraisal of several proposed pilot interventions should have been carried out. The choice of SGCAN as implementing agency was risky and proved to play against the long-term objectives of the Project. Finally, the initial Project design did not specifically include regional activities.

(b) Quality of Supervision
88. Rating: **Satisfactory**

89. The Bank's supervision efforts should be analyzed before and after the MTR. Before, supervision was carried out in a general, detached way. Coordination and procedural difficulties were jeopardizing the Project, and hard decisions to better define or discard and identify alternatives for some of the anticipated pilot activities were delayed. Little progress was achieved, and this was also partly justified by certain lack of ownership and guidance from the participating countries.

90. A significant change came with a new Bank team, which was brought in to conduct the MTR. The MTR turned into an important milestone, since the review resulted in the formal restructuring of the Project. Thereafter, the Bank task team tightened its supervision efforts, organized many detailed field visits and frequent video and audio conferences, placing the participating countries at the center of the discussions. Moreover, Bank country-based staff was added to the supervision team to strengthen oversight and provide even further guidance to the PIU, SGCAN and Ministries of Environment. The procurement, financial management, disbursement, social and environmental safeguards, and legal Bank team members all had to engage directly with the client. This high level of attention and proactivity was maintained by the team throughout the Project life, ultimately turning into one of the main factors contributing to Project success.

(c) Justification of Rating for Overall Bank Performance

91. Rating: **Moderately Satisfactory**

92. Overall Bank Performance is rated Moderately Satisfactory, based on the ratings for Bank Performance for Ensuring Quality at Entry and Quality of Supervision.

93. There were several flaws on Project design, certainly related to its complexity and the inability to properly weigh national and regional weaknesses, and administrative requirements. However, a very proactive and engaged supervision team closely accompanied the Project; objectives were met, and significant contributions to climate change adaptation were achieved

5.2 Borrower

(a) Government Performance

94. Rating: **Moderately Satisfactory**

95. There is an inherent difficulty to describe the performance of three participating countries (Bolivia, Ecuador, Peru), throughout the life of the Project, into a single rating. However, as a whole, there have been periods –especially during the first years- of slow, reactive performance, with delays and discontinuities (often caused by high turnaround times of key Government staff), lack of ownership and leadership. These periods have been followed by others of intense and remarkable performance. The last years of the Project witnessed strong engagement and leadership from the Ministries of Environment, and are prove that, when motivated and engaged, the participating countries are regional references on climate change adaptation. During these last years, they stepped up to the challenges, devoted specific staff to coordinate and manage activities, and significantly contributed to achieving Project objectives. Participating countries have ultimately internalized Project's outputs and results, and are eager to continue learning from them and from each other.

(b) Implementing Agency or Agencies Performance

96. Rating: **Moderately Unsatisfactory**

97. The performance of SGCAN can be divided into two different types of contributions. From a fiduciary perspective (and especially financial management and procurement), SGCAN managed to provide, with PIU's support and own staff and resources, the needed environment to carry out processes in a positive way. The first years of Project implementation saw a somewhat cumbersome and slow administrative process, which resulted in significant delays. This was reviewed during the MTR, and SGCAN agreed to change some of its procedures, which allowed to speed up operations. Significantly, during a long period of time on which the externally-hired PIU staff changed, they managed to step up and prevent delays or discontinuities that would have resulted into failure.

98. From a technical perspective, however, SGCAN fell short of providing the technical leadership that was expected. Its country dialogue on environmental and climate change issues was fairly limited, and their engagement on Project supervision was reduced. Aside from some early occasions, SGCAN did not participate in supervision missions, did not provide guidance on the definition of activities, preparation of Terms of Reference, or engage on problem solving and dissemination of lessons. These issues have grounded reasons, since SGCAN was created to work on regional commercial and trading matters, and although it had experience implementing environmental projects, it had never before implemented works and investments on its member countries. Moreover, the ongoing re-evaluation of SGCAN's mission and core competencies seems to indicate that environment will likely be out of its main business.

(c) Justification of Rating for Overall Borrower Performance

99. Rating: **Moderately Satisfactory**

100. Overall Borrower Performance is rated Moderately Satisfactory, based on ratings for Government Performance and Implementing Agency Performance.

101. As previously explained, there have been some evident shortcomings, and several delays could have been avoided with the right level of oversight. However, certainly without sustained and high level Government commitment and support to the Project, none of the achievements would have been feasible. This is true especially during the second part of the Project, on which the three participating countries' Ministries of Environment stepped up and provided leadership and coherence. Moreover, they are currently committed and devoting own resources to the preparation of a new, regional project on climate change adaptation and water, through the GEF SCCF fund.

6. Lessons Learned

102. **Careful, early-planned partnerships with key stakeholders increases the viability and chances of Project success.** These arrangements need to be built around topics directly within partner's expertise and core business. The up-front close involvement of CARE as a key partner was crucial to facilitate all social engineering processes with rural communities, and ensuring that the Project had a strong local community-based adaptation pillar. CARE's ability to leverage resources also provided continuity beyond Project closing, sustainability and M&E strengthening.

103. **Climate change adaptation requires extensive bottom-up work and community development**. The combination of constant on-the-ground presence for community development, provided by CARE, together with infrastructure works as an incentive, conform a framework with more success chances than stand-alone investments or capacity building. An engaged and trained community, with improved basic infrastructure, becomes the best stewardship for fragile ecosystems that provide key environmental services. The use of a bottom-up approach facilitated the combination of the knowledge and experience of communities on coping strategies, with the rigorousness of science and technology, thus providing a sound base for the design of activities with a long term vision of increased resilience.

104. **The ability of countries to increase their climate change resilience is directly linked to their capacity to generate and analyze data to assess vulnerability**. Any adaptation project should be grounded on robust knowledge creation and capacity building. The Project initially focused on applying a specific, "donor driven" CC model to countries (Japan's Earth Simulator), instead of focusing in developing general capacities to use and interpret CC models more broadly. Whereas the former is good for getting hands-on experience and high resolution results from the best available climate model at the time, it has the risk of remaining as a one-off effort with no

continuity. A related lesson was learned when the Project strived to promote the development of modeling tools in selected basins: what participating countries needed mostly was not model developing, but data collection and database buildup. Absence of good data is typically the most important hurdle on these efforts. Strengthening of monitoring networks is thus key, and O&M mechanisms must be secured for the long run, with costs that short-lived projects cannot cover.

105. Several lessons to improve quality at entry that could inform regional projects have emerged:

106. **Different implementation arrangements should be considered and included in the legal agreements for flexibility.** The Project required the participation of a large number of stakeholders, some of them playing fundamental executing roles (e.g., CARE, AGRORURAL), and a thorough analysis of the possible options to engage them should have been carried out. Establishing subsidiary agreements, instead of, for example, including them as co-executors, might have been the most agile way to finalize preparation, but proved to be onerous in the long run.

107. **Clear operational procedures are essential to ensure an effective implementation of complex projects**. The Project had aggregated operational procedures, with uncertainty in steps, timing and responsibilities. It was designed from a technical perspective, but aligning the technical with the fiduciary (especially procurement and disbursement) should have been done better.

108. **Regional projects need more supervision budgets.** Although economies of scale were effectively reached (centralized procurement, financial management, disbursements), a regional project with three countries is costlier to supervise than a national one, and both SGCAN and the Bank should have had more resources.

109. **Two types of M&E arrangements should be designed and budgeted for as part of a pilot Project.** A clear distinction between a CC adaptation and a regular investment is the former's ability to generate data that informs the adaptation agenda. Notably, for this Project two different M&E schemes were needed: one to follow up on Project progress and results, and another to capture and evaluate long-term adaptation benefits. The Project was designed to implement the former but did not give enough consideration to the later. The MTR detected this and promoted some solutions, but it had to be done at no additional costs. As a result, long-term M&E arrangements were designed by the Project, but their continued implementation will depend on Government's capacity and availability of resources.

110. **The Project has contributed to the replication and scaling-up of adaptation activities.** These are suited to the specific local conditions, but have the potential to inform adaptation efforts in other geographical locations. Although it has taken considerable time to implement, the Project has accumulated a number of experiences and generated specific tools (e.g., models, methodologies, baselines), that are useful elsewhere. The contribution to the global community of practice on high mountain hydrology and glaciology is so relevant, and the level of interest and attention raised has been so significant, that, in retrospect, it would have been useful to allocate budget to translate key publications into English and improve communication during implementation. Nevertheless, adaptation is ultimately a local challenge, and the material generated by the Project would have to be adapted to specific circumstances, acknowledging the importance of local know-how.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

111. The recipient of this Project was the General Secretariat of the Andean Community (SGCAN) on behalf of the Plurinational State of Bolivia, the Republic of Ecuador and the Republic of Peru.

Moreover, the Republic of Colombia was a Project beneficiary for selected activities. A draft of this ICR was shared with all the institutions above, and feedback collected during a 4-week period[5]. A summary follows (additional details provided in Annex 7).

112. (i) The SGCAN expressed its full satisfaction with Project achievements and successes, underlining that, thanks to the Project, specific answers and solutions have been given to challenges to ecosystems and economies posed by glacier retreat in the Tropical Andes; (ii) Ecuador emphasized that the Project has been instrumental in implementing adaptation measures that compensate ecosystem service losses caused by rapid glacier retreat and ecosystem degradation, and call for continuous efforts by Project beneficiaries, local and national governments to ensure long term sustainability; (iii) Bolivia praised the Project and ICR, and noticed how, thanks to the Project, scientific information is currently being applied to decision making in the country; (iv) Peru stated that the ICR appropriately describes the technical, operational and financial aspects of the Project. They transmitted satisfaction with Project outcomes, and stress the role played by the Ministry as a convener of the different levels of government and other stakeholders. They also shared further Project lessons learned; (v) Colombia commended the document, and stressed out the remarkable achievements obtained through the Project, requesting the Bank team to reflect them more clearly. All comments and suggestions by were properly addressed in the ICR.

(b) Cofinanciers

N/A

(c) Other partners and stakeholders

113. The ICR was shared with CARE, institution that has partnered with the Project and financed several complementary activities with own resources. CARE provided additional details on Project achievements, especially in Peru, and stressed their contributions in technical and institutional aspects, taking community-based adaptation as departing point (additional details in Annex 8).

[5] The SGCAN prepared a number of documents (see Annex 9) in which lessons learned were reflected and systematized, whilst other documents captured and described the achievements of the Project, per component and per country. These reports were shared with participating countries and other stakeholders, and became a useful tool to inform decisions. A specific, consolidated report reflecting the whole Project was not prepared.

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD Million equivalent): original, updated (after MTR) and actual values by Project closing[7]

Components	Government			Other donors			NGOs (CARE) and others			GEF			Total		
	Original	Updated (MTR)	End of Project	Original	Updated (MTR)	End of Project	Original	Updated (MTR)	End of Project	Original	Updated (MTR)	End of Project	Original	Updated (MTR)	End of Project
Component 1: Detailed design of key selected adaptation measures[1]	**0.20**	**0.40**	**0.57**	**0.50**	**0.50**	**0.50**	**0.0**	**0.0**	**0.0**	**0.40**	**0.33**	**0.34**	**1.1**	**1.23**	**1.41**
Sub C1-1: Design of glacierized basin impacts maps	0.0	0.40	0.53	0.50	0.50	0.50	0.0	0.0	0.0	0.10	0.33	0.34	0.60	1.23	1.37
Sub C1-2: Detailed design of specific adaptation measures[2]	0.20	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.20	0.0	0.0	0.40	0.0	0.03
Sub C1-3: Public outreach and dissemination of information[3]	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.0	0.0	0.10	0.0	0.01
Component 2: [Design and] Implementation of pilot adaptation measures(4)	**10.97**	**6.59**	**4.97**	**7.69**	**12.98**	**12.98**	**0.95**	**1.84**	**3.88**	**5.94**	**5.8**	**5.79**	**25.55**	**27.23**	**27.8**
Component 3a: Monitoring of glacier retreat in the region	**0.22**	**0.35**	**0.32**	**1.63**	**1.39**	**1.39**	**0.0**	**0.0**	**0.0**	**0.45**	**0.35**	**0.32**	**2.30**	**2.09**	**2.03**
SC3a-1: Design and set-up of field stations to monitor tropical glaciers	0.11	0.21	0.18	1.14	0.94	0.93	0.0	0.0	0.0	0.0	0.0	0.0	1.25	1.15	1.11

SC3a-2: Use of high precision remote sensing to monitor tropical glacier	0.11	0.13	0.11	0.49	0.3	0.31	0.0	0.0	0.0	0.0	0.0	0.0	0.60	0.43	0.42
SC3a-3: Analysis and monitoring of the behavior of tropical glaciers and their associated mountain wetlands	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.45	0.35	0.32	0.45	0.35	0.33
SC3a-4: Capacity building and Economic Evaluation of rapid glacier retreat(5)	0.0	0.01	0.02	0.15	0.15	0.15	0.0	0.0	0.0	0.0	0.0	0.0	0.15	0.158	0.17
Component 3b-c: Development of scientific baseline for high mountain ecosystem(6)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.45**	**0.0**	**0.0**	**0.45**	**0.0**	**0.0**
Component 4: Project management	**2.75**	**0.56**	**0.71**	**0.07**	**0.20**	**0.20**	**0.25**	**0.0**	**0.0**	**0.70**	**0.70**	**0.69**	**3.77**	**1.46**	**1.60**
Component 5: Regional Activities	**0.0**	**0.03**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.75**	**0.74**	**0**	**0.78**	**0.74**
Total Project Cost	**14.14**	**7.93**	**6.57**	**9.89**	**15.07**	**15.07**	**1.20**	**1.84**	**3.88**	**7.94**	**7.94**	**7.89**	**33.17**	**32.78**	**33.6**

(1) Components were modified following the MTR.
(2) This sub-component was moved to component 2 of the project, and therefore the co-financing value under the updated column is "0". The actual co-financing was included under component 2.
(3) This sub-component was moved to component 5 of the project, and therefore the co-financing value under the new column is "0". The actual co-financing was included under component 5.
(4) As of the MTR, this component also included design, i.e., the activities from SC1-2.
(5) This activity was part of the original project (financed with CCIG resources) but had been omitted as part of the project description in the original legal documents, and was therefore added.
(6) This sub-component was moved to component 5 of the project, and therefore the co-financing value under the new column is "0". The actual co-financing was included under component 5.
(7) As reported by beneficiaries, CARE and Monthly Disbursement Summary (May 2014).

Changes in costs and sources of funding summarized in the table above are explained below:

Component 1: The updated cost of this component considered only the activities related to the development of climate change scenarios and glacier-fed basin impact maps and models, and associated studies. The total cost of this component was slightly higher than originally foreseen (US$ 1.23 compared to 1.1 million), and the difference had been covered by specialized governmental agencies. Given the relocation of the design (Sub-component 1.2) and dissemination (Sub-component 1.3) activities to Components 2 and 5, respectively, the total amount of GEF resources allocated to this Component was slightly less than original (US$ 0.33 million compared to 0.40 million), and the balance was reallocated to fund regional activities under the new Component 5.

Component 2: The Project cost for Component 2 to be covered by GEF resources was in line with the original financing plan (US$ 5.81 million compared to the original US$ 5.94 million). The overall expected co-financing contribution for Component 2 was also close to what was originally planned (US$ 21.41 compared to the original 19.61 million). At the time of restructuring, several of the co-financing resources foreseen in the initial financial package had materialized or were likely to be exceeded. These included: (i) the World Bank financed Peru Agricultural Research and Extension APL (US$ 6.26 million), (ii) CARE (US$ 1.8 million), and (iii) AGRORURAL[6] (US$3.1 million). Since its inception the Project had leveraged additional resources that had contributed to achieving the Project's global objective. These co-financing resources originate from: (i) in Peru, the World Bank financed Sierra Irrigation Project (US$ 2.75 million), and the World Bank financed Water Resources Management Modernization Project (US$ 2.24 million), and (ii) the Bolivia Pilot Program for Climate Resilience Phase 1 (US$ 1.5 million), a grant provided under the Strategic Climate Investment Funds. Finally, some co-financing resources that were foreseen originally did not fully materialize. This was the case of EPMAPS (Quito's water utility)[7] which was expected to contribute US$ 7 million for a new water supply system to Quito. Due to land tenure issues, however, EPMAPS had to abandon the foreseen new water supply system in Mindo Bajo; its revised expected co-financing, for planning and monitoring activities under pilot 1 in Ecuador, amounted to US$1.6 million. FAO's originally estimated contribution to the Project was US$1 million, but did not materialize during the life of the Project.

Component 3: Changes in the cost of Component 3 were minimal. The activities that were included under 3.3b and c were reallocated to Component 5 because of their regional nature and their cost was covered by an additional GEF Grant that was provided to the Project (P119725) and approved in early 2011. The only change in availability of co-financing resources with a minor impact on this Component corresponded to the lack of NOAA's participation, with a foreseen contribution of US$ 0.24 million, which was intended

[6] Previously called PRONAMACHS.
[7] Previously called EMAAP-Q.

to support the satellite collection and storage of data from the eight high-mountain monitoring stations, which was nevertheless already taking place in-country and financed in great part by government contributions.

Component 4: Costs for this Component were originally overestimated. The MTR estimated that Government counterparts funding amount to US$0.56 million (compared to US$ 2.75 million) based on disbursements so far, which had allowed for efficient execution of this Component (e.g., preparation for and participation in Steering Committee meetings, supervision missions, etc.).

Component 5: The reallocation of activities among components generate savings on GEF resources from the first three components, which were being used to finance half of the cost of Component 5. The other half corresponds to the reallocation of activities from Component 3 (Sub-component 3.3.b-c).

(b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (US$ million)	Restructured Estimate (US$ Million)	Actual/ End of Project	% of Restructured
Borrower	In-Kind	14.14	7.93	6.57	82.8%
UN Food and Agriculture Organization (FAO)		1.00	0.00	0.00	-
Global Environment Facility (GEF)	Grant	7.94	7.94	7.89	99.4%
JAPAN: Ministry of Finance - PHRD Grants	Grant (joint cofinancing)	0.86	0.86	0.85	98.5%
Bilateral Agencies (unidentified)*	Mix (joint and parallel cofinancing)	8.03	1.46*	1.46*	100%
Other complementary Projects**	Loans (parallel cofinancing)	0.0	12.75	12.75	100%
NGOs of Borrowing Country	Grant (joint cofinancing)	1.20	1.84	3.88	211%
TOTAL		**33.17**	**32.78**	**33.6**	

* MRI (500,000: in-kind), GFDRR (230,000: grant), IRD (600,000: in-kind), SGCAN (127,500: in-kind)
** Amounts as reported in the PAD of these projects

Original, Restructured and Final Financing Plan (US$M)

Source of Funds	Local			Foreign			Total		
	Original	Restructured	Final	Original	Restructured	Final	Original	Restructured	Final
Borrower/Recipient	**14.14**	**7.93**	**6.57**	**0.0**	**0.0**	**0.0**	**14.14**	**7.93**	**6.57**
GEF	**0.0**	**0.0**	**0.0**	**7.94**	**7.94**	**7.89**	**7.94**	**7.94**	**7.89**
Others	**1.2**	**1.84**	**3.86**	**9.89**	**15.07**	**15.06**	**11.09**	**16.91**	**18.92**
FAO	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0
CCIG - PHRD	0.0	0.0	0.0	0.86	0.86	0.85	0.86	0.86	0.85
Bilateral Agencies (MRI,GFDRR, IRD, NOAA) and SGCAN	0.0	0.0	0.0	1.77	1.46	1.46	1.77	1.46	1.46
Bank finance	0.0	0.0	0.0	6.26	12.75	12.75	6.26	12.75	12.75
CARE	1.2	1.84	3.88	0.0	0.0	0.0	1.2	1.84	3.88
Total	**15.34**	**9.77**	**10.45**	**17.83**	**23.01**	**22.95**	**33.17**	**32.78**	**33.6**

Annex 2: Adjustments in pilot project descriptions

Description as per Grant Agreement	Restructured description	Main characteristics of the pilots
Ecuador Pilot 1: Increasing water supply resilience for Quito and its metropolitan area through the implementation of the selected pilot climate change adaptation actions, including the incorporation of climate change issues in the planning and developing of a new drinking water supply project for the Quito metropolitan district, the development of new water sources from a complementary hydrological regime, adaptation measures aimed at conserving and managing basins that supply potable water to Quito and the implementation of a monitoring system to assess water availability and the evolution of the impacts associated with global warming.	The objective of this pilot project is to test sustainable approaches for adaptation against glacier retreat and climate change impacts through the implementation of specific measures at the Pita watershed. There will be a strengthened focus on monitoring and strategic planning of water resources, reduced or no civil works at all, and focus on existing infrastructure. Specific activities include: a detailed vulnerability analysis and an adaptive management plan for the Pita-Puengasí watershed, which includes policy recommendations and specific adaptation measures; adaptive management activities in the upper areas of the Pita watershed, through restoration, conservation and protection of key ecosystems; and full implementation of a monitoring system for the whole Guayllabamba catchment (of which the Pita micro-catchment is part) to evaluate availability of water resources and climate change related impacts; and purchase and installation of critical meteorological stations for improved monitoring of key meteorological conditions.	**Title**: Support of Integrated and Participatory Water Resources Management in the Micro-basin of River Pita with the objective to Increase the Water Supply for Quito. **Location**: Antisana, Ecuador **Scale of intervention**: Pita river micro basin **Direct beneficiaries**: EPMAPS, and Quito population.
Ecuador Pilot 2: Integrated Watershed Management Plan in the Antisana	Largely unchanged.	**Title**: Promote good practices for the use and conservation of natural resources (water, soil, etc.) in the microcatchments located around the Antisana volcano, especially in paramo areas. **Location**: Papallacta and El Tambo (Quijos Region), Ecuador **Scale of intervention**: Community level intervention in Papallacta and el Tambo **Direct beneficiaries**: local communities, and water association of Papallacta.
Bolivia Pilot 1: Integrated watershed management in the Tuni and Condoriri basins. Implementation of high priority	The pilot focuses on achieving increased resilience of the water supply system of La Paz and El Alto against glacier retreat and climate change. It will do so by tackling the pressing issue of inefficiencies in the water	**Title**: Design and Intervention of High Priority to Compensate for the Impacts of Glacier Retreat and Climate Change in

interventions in the Tuni and Condoriri basins as indicated in a watershed management strategy designed to improve water usage and to compensate for the impacts of glacier retreat on water availability, including the design and implementation of actions to cope with the loss of water regulation capabilities and reduction of water flow as a consequence of the rapid disappearance of glaciers and the analysis of increased basin storage, optimization of water diversion capabilities and the implementation of demand management options.	distribution system, which is fed by the Tuni and Condoriri basins, and others. A strategic analysis of unaccounted-for-water (UFW) in the local utility (EPSAS, Empresa Pública y Social de Agua y Saneamiento) will be conducted, together with a comprehensive strategy to systematically reduce inefficiencies. Critical equipment to improve EPSAS's capacity to diagnose the efficiency of the network, detect leakages, measure key flows and follow up on the actions taken to repair net failures will also be provided. Institutional strengthening and capacity building for both EPSAS and PNCC in water distribution efficiency will be a significant component of the pilot. The pilot will also contribute to support EPSAS's capability to improve their management of water resources in critical basins, and will provide a detailed analysis on the vulnerability of their systems to glacier retreat, as well as an optimization of the use of underground water, sustainable use of water wells and their storage capacity.	the Water Supply system of the cities of La Paz and el Alto. **Location**: La Paz and El Alto, Bolivia **Scale of intervention**: water distribution system of La Paz and El Alto. **Direct beneficiaries**: EPSAS, and La Paz and El Alto population.
Bolivia Pilot 2: Integrated Pilot Catchment Management Plan in the Bolivian Plateau and High Valleys. Development of integrated pilot catchment management plans in selected basins in the Bolivian Plateau and High Valleys and implementation of activities to adapt agriculture and livestock activities to the loss of water regulation and supply caused by glacier retreat.	This pilot is largely unchanged. Its objective is focused on adaptation and capacity building activities that contribute to an enhanced management of water resources and agriculture production. It is being implemented in Batallas and Palca, the two priority areas resulting from a participatory exercise conducted by the Municipal Government of Batallas, Municipal Government of Palca, PNCC and CARE as strategic partner. Integrated watershed management plans are being prepared for both areas. Pilot activities focused on increased resilience of agriculture and improved irrigation schemes at a demonstration level are being conducted. Community-level management plans will be developed, and beneficiaries will be trained in resilient agriculture and irrigation practices. The pilot project makes emphasis on capacity building and community and institutional strengthening to mainstream climate change concerns into local planning processes.	**Title**: Pilot Integrated Management Plan for micro-catchments affected by Glacier retreat in the Bolivia Plateau and High Valleys – Municipalities of Batallas and Palca. **Location**: Municipalities of Batallas and Palca, Bolivia **Scale of intervention**: micro-catchments of Khullu Cachi (Batallas) and Choquecota (Palca). **Direct beneficiaries**: local communities in Batallas and Palca.
Bolivia Pilot 3: Mainstreaming Adaptive River Defense for the Huayhuasi and El Palomar Settlements. Development of a social model and implementation of measures for disaster prevention and reduction of vulnerabilities to climate change impacts, including pilot activities to	This pilot project is largely unchanged. The whole pilot has a participatory approach, and key decision and prioritization has been done jointly with the communities of Huayhuasi and El Palomar. Initial intentions to build river defense structures were soon dropped due to the complexity of the risks in the area and the unknown river flux conditions affecting the project area. A more holistic approach was adopted through which a cutting edge methodology to physically model river flows during flood conditions was applied. The results given by the model shifted the national	**Title**: Participatory Adaptation for the Construction of River Defensives for the communities of Huayhuasi and El Palomar. **Location**: Rural communities of Huayhuasi and El Palomar , Bolivia **Scale of intervention**: Rio La Paz basin, section of Huahyhuasi community.

decrease risk and vulnerability to extreme events in the Huayhuasi and El Palomar rural communities in the La Paz river basin, with communal participation for the regulation and control of the La Paz river by means of adaptive best practices for disaster risk management.	paradigm of defensive design and construction, and results are being disseminated to the concerned audiences. A final design of improved defensive structures adopting the new knowledge generated by the model is also being completed as a case study that can be replicated in similar river regimes throughout the country and the region. A component of participatory risk identification and reduction has been included, and as a result, a community-agreed plan for risk management and risk reduction in the area will be produced.	**Direct beneficiaries**: local communities of Huayhuasi and El Palomar.
Peru Pilot 1: Implementation of a water management plan aimed at: (A) improving water use practices in the agricultural and livestock sectors; and (B) improving water storage infrastructure at selected basin's head waters to address negative effects caused by temporary increase in runoff.	Reorganization by geographical location instead of by topic. Peru Pilot 1: **Integrated water resource management in the sub-basin of the Shullcas river, Junin.** Pilot adaptation measures in the high, medium and low altitudes of the watershed to promote integrated water resources management and mainstreaming of glacier retreat concerns. Activities include conservation of natural grasslands in the higher areas of the watershed, reforestation in high and medium altitude areas to expand tree coverage and water retention capacity, and improved irrigation schemes and irrigation canals in the low altitude areas to promote efficient water usage practices. In the urban context, the pilot will promote efficient water consumption and strengthening of water management authorities in the area. These experiences will be direct inputs for the formulation of the Integrated water resource management plan for Shullcas. Peru Pilot 2: **Integrated water resources management in Santa Teresa sub-basins, Cusco.** Pilot adaptation measures to promote integrated water resources management and mainstreaming of CC and glacier retreat into planning. Activities are targeted on the strengthening of water management institutions at micro-catchment level, as well as implementation of demonstration pilot activities to improve water use efficiency for agriculture and human consumption. It also includes a component on disaster risk management with emphasis on glacier lake outbursts and river floods originated by glacier retreat. The pilot is carried out in partnership with CARE, who is also conducting activities for improved local governability and social responsibility to improve women and children life quality, food security and innovation in potable water use and sanitation management in Sta. Teresa.	**Title**: Integrated water resource management in the sub-basin of the Shullcas river, Junin. **Location**: Shullcas river sub-basn, region o of Junin. **Scale of intervention**: High, middle and low sections of the Shullcas sub-basin. **Direct beneficiaries**: local communities, water irrigation associations.
Peru Pilot 2: Design and implementation of an agricultural production plan for the diversification of agricultural production aimed at improving competitiveness and food security, reducing agricultural production losses, and implementing agricultural good practices adapted to the anticipated consequences of glacier retreat.		**Title**: Integrated water resource management in Santa Teresa sub-basin, Cusco. **Location**: Municipal district of Santa Teresa, Urubamba basin, Cusco Region. **Scale of intervention**: community level activities. **Direct beneficiaries**: Communities of the Santa Teresa Municipality.
Peru Pilot 3: Implementation of an integrated water management plan that incorporates reduction in glacier run-off contributions in Huancayo to improve the availability of water for human consumption by rationalizing the use of water and carrying out of research on alternative sources of water supply.		

Annex 3. Outcomes and Outputs by Component

Results Framework and Monitoring at end of Project

PROJECT OUTCOME INDICATORS					
Specific Objectives	**Original Outcome Indicators (PAD)**	**Outcome Indicators (post MTR)**	**Original Baseline**	**Target**	**March 2014**
1. The effective integration of the implications of glacier retreat into the regional and local planning in glacierized basins.	Availability of local-, regional-, and country-level plans integrating the implications of glacier retreat.	Information/data on climate change scenarios and glacier retreat contribute to the definition of local/regional governments' adaptation strategies to CC and/or integrated water resources management plans.	There are no climate change (CC) adaptation strategies or plans for the selected basins that incorporate the implications of CC or glacier retreat.	Development of at least one adaptation strategy/plan per country that incorporates the information generated by the project on the implications of CC and glacier retreat.	The Project supported the formulation and/or provided detailed information for plans, policies and management tools of different levels of government on climate change adaptation, beyond original expectation. • Ecuador: Scientific information on climate change informed the preparation of the development and zoning plan (PDOT) of the decentralized and autonomous Parroquial government of Papallacta. Based on this experience the Ministry of Environment is pushing forward the processes for the inclusion nationwide of the climate change variable in the local PDOTs. Five adaptation plans/strategies were prepared with information of the project setting the base for the implementation of adaptation activities. [8]Knowledge generated by the project also informed the National Strategy on Climate Change and the National Plan on Climate Change among others. • Bolivia: Integrated management plans with climate change and water resources management considerations were developed and informed by the project (Choquecota basin in Palca, and Khullucachi basin in Batallas). In addition, the glacier inventory for the Coordillera Real informed the preparation of three relevant plans

[8] Scientific studies have generated useful tools (e.g., climate studies, statistical analysis of the climate, impact maps, strengthening of the monitoring system of the high Guayllabamba basin, vulnerability analysis) to foster an adequate management of local development in the intervened zones, and to inform decision makers (e.g., EPMAPS). These have allowed for the preparation, and sometimes, implementation of investment adaptation activities. Within the framework of the project the following were elaborated: i) General adaptation strategy for pilot project 2 (prepared by the national technical expert of the project); ii) Adaptation management plan for the Pita Puengasi system (INTERCOOPERATION); iii) Adaptation management plan for the Antisana Ecological Reserve (INTERCOOPERATION); iv) Adaptation management plan for the Parroquial government of Papallacta focus of cattle management (ECOPAR); v) Adaptation management plan for degraded paramo zones (CONDESAN).

					related to the water sector: Master Plan for Water and Sewage for the cities of La Paz and El Alto; b) Multipurpose Irrigation and Water Plan for the municipalities of Batallas, Pucarani and El Alto; c) Quinquennial Plan of the water utility for La Paz and El Alto, EPSAS. • Peru: The project contributed to the development/update of management tools in both selected basins. The climate change scenarios for the years 2030 and 2100 for the Mantaro and Urubamba basins, informed the regional climate change strategies in Junin and Cusco respectively, as well as the water integrated management plan for Shullcas (this plan is to be adopted by the Management Committee of the Haytapallana Regional Conservation Area, created by the Junin regional government in 2009). The project also contributed with inputs (water balance) in the soon to be developed participative integrated water management plan for Sta. Teresa (to be developed by the a new project that focuses on risk management and will follow-up on many activities undertaken by the project). The project also contributed in the development of 16 community development plans in Santa Teresa. In these plans the community sets the priority investment activities that seek financing from the "Participatory Resources".
2. The inclusion of glacier retreat impacts in local, sector development projects.	Pilot projects generate useful lessons and information on costs and benefits of adaptation options that are incorporated into broader public and private investments in the water, agriculture and power sectors.	The design and implementation of pilots is able to generate lessons delivered to relevant institutions which could be incorporated into planning and implementation of public/private investment programs and projects.	There is no systematization of lessons learnt from what could be considered adaptation activities.	All adaptation investment activities implemented by the PRAA generate relevant information on adaptation which is collected and elaborated to be used as input in the planning and implementation of public/private investment programs and projects.	There are numerous examples where lessons learned with this project informed investments and planning tools which identify specific investment activities. • In Ecuador, activities identified in the development plans of the local governments of Pallapacta, Quijos, and Napo capture lessons from the pilot activities, opening a door for improvement and replication of adaptation activities. Further, the perception of the benefits of some adaptation activities implemented in Ecuador has been so positive and immediate (e.g., adaptive cattle management), that replication is already taking place, and it is expected that it will soon influence local and regional policy and investment decision and tools. Further, the activities in Papallacta Ecuador, have served as basis upon which the Environment Ministry is building a larger adaptation program in the area (several of activities prioritized by the community which could not receive finance from the project have received support from the Ministry). Also, the project has contributed to the formulation of strategies and investment activities of the water utility company through the development of the Adaptive Management Plan for the Pita-Puengasi water supply

					system. • In Bolivia, based on the positive results and lessons of the project to identify unaccounted for water in a pilot district in El Alto, similar activities are being replicated by EPSAS in other districts. Also, the final design of 2 investment projects, identified as immediate actions to ensure water supply in the medium term for La Paz and El Alto, have been developed by the project. These designs address the need of EPSAS in the medium-term to balance supply and demand of water. Adaptation community activities informed the micro-basin integrated management plans. As an example the plan of the Choquecota identifies 8 investment activities that include climate change considerations and glacier retreat. • In Peru, adaptation activities and scientific modeling have informed investment decisions. For instance the municipality of Santa Teresa, has developed a Project on food safety based on the results of the studies of agrobiodiversity and agroclimatology under the Project. Based on the experience in Sta. Teresa, the local governments of Echarate and Maranura in the province of La Convencion in Cusco are developing adaptation projects with their own resources.
3. Generation of data on glacier dynamics.	Sustainable glacier observation and monitoring, network operated and maintained by local meteorological and hydrology agencies (SENAMHI of Peru, INAMHI of Ecuador, and SENAMHI of Bolivia) produces relevant, reliable, and valid records on a continuous basis on hydrology and climate for selected glacier basins; each country allocates	Strengthened national meteorological services capacity to monitor glacier dynamic in Bolivia Ecuador and Peru.	Limited availability of high-mountain meteorological stations (only those administered by the IRD of France). Limited availability of satellite images/data.	Information on glacier behavior in the region is available and 8 high-mountain meteorological stations provide useful data for modeling, and for CC impact and glacier retreat studies in the selected basins. ALOS images have been processed.	The project has contributed to strengthening the capacity of national meteorological services to monitor glacier dynamics (e.g., INAMHI in Ecuador, SENAHMI in Peru, IHH and SENAMHI in Bolivia, and IDEAM in Colombia). The scientific knowledge generated by the project on glacier dynamics has been fed into the design and development of management instruments used by relevant institutions (e.g., Master Plan for water and sewage for La Paz and El Alto). Further, the opportunities provided by the project for regional exchange, have helped to strengthen the capacity of these institutions, identify protocols for information sharing, and has also allowed for the identification of the strengths of the scientific community among the different countries, thus opening an opportunity for knowledge transfer within the region (e.g., it is notable the work of climate change scenarios done by SENAHMI in Peru, the work on glacier dynamics in Bolivia by the IHH which includes the creation of a very precise national glacier inventory, high mountain water bodies and moorlands, and the inclusion of climate change modules in the monitoring system of the high

	adequate budgets for operations after the end of the project.				Guayllabamba basin in Ecuador). In addition, meteorological services have been strengthened with monitoring equipment. The project acquired 8 high-mountain meteorological stations which are installed, operational, and producing useful information. Moreover, in Ecuador, 15 additional hydrometeorological stations were also acquired, and in Colombia, an additional high mountain monitoring network was set up. ALOS satellite images have been received and processed for Bolivia, Ecuador, Colombia and Peru. In the case of Bolivia they have been key in the development of an updated national glacier inventory.
There is no specific objective linked to this indicator.	Increase in the national and local awareness of the impacts of rapid tropical glacier retreat as measured through mentions in written media of mass circulation.	Unchanged.	0	At least 8 press articles in the local written media.	The number of mentions in media of mass circulation, about the impacts of rapid glacier retreat in general, and of the project in particular, has been large, and virtually impossible to keep track of. There have been rigorous scientific publications, reports, mass media on local, regional and national newspapers, radios, blogs etc. There have even been publications on internationally recognized media such as the Spanish El Pais. The increase of the rapid glacier retreat awareness has been remarkable: Peru is proposing a mountain pavilion for COP20. A large delegation of South Asia officials came to visit the project, and country institutions presented the relevance and priority of working on high mountain hydrology and glaciology. Several articles about PRAA have been published in Ecuador local media, and various TV reports have been broadcasted. Some online media coverage in Ecuador include: Ecuavisa: http://www.ecuavisa.com/articulo/noticias/nacional/52358-proyecto-preservar-antisana-referente-mundial; Ministerio del Ambiente: http://www.ambiente.gob.ec/paises-de-la-cuenca-del-indo-pretenden-replicar-un-proyecto-similar-al-de-ecuador/; http://www.ambiente.gob.ec/author/ambiente/; El Telegrafo: http://www.telegrafo.com.ec/sociedad/item/delegacion-asiatica-visitara-zona-del-volcan-antisana.html; El Ciudadano: http://www.worldbank.org/en/news/press-release/2014/01/24/banco-mundial-afganistan-china-india-y-pakistan-visitan-ecuador-para-intercambiar-conocimiento-sobre-monitoreo-de-glaciares-y-cambio-climatico; Prensa Latina: http://www.prensa-

					latina.cu/index.php?option=com_content&task=view&idioma=1&id=2318251&Itemid=1; Blog del agua: http://blogdelagua.com/noticias/ecuador-es-pionero-en-cuidado-de-glaciares. In Bolivia, more than 10 reports in local media and a TV documentary. In Peru, glacier retreat infographic in El Trome newspaper on June 2013: http://issuu.com/praa/docs/informe_escolar); Report of the PRAA Project on the Andean News official agency: http://www.andina.com.pe/Espanol/especiales/style2/video.aspx?proceso=232&ID=126. Others: El Pais newspaper (online video): http://internacional.elpais.com/internacional/2014/03/05/actualidad/1394030154_385015.html. Mexico Planeta Azul: http://www.planetaazul.com.mx/site/2014/01/27/ecuador-mostrara-adaptacion-a-cambio-climatico-a-tecnicos-asiaticos/
None	None	Contribute to strengthening the Andean region integration by supporting the implementation of the *Andean Environmental Agenda*, focused on the generation of conceptual and methodological tools to assess the impact, and to design and implement adaptation measures to the impacts of CC on high mountain ecosystems.	The Andean Environmental Agenda establishes the need to work on these topics at the sub-regional level, but until now this has not been fully materialized.	The results of the different studies, and design and implementation of adaptation activities in all countries has been systematized. Good practices at the community, national and Andean sub-regional levels have been identified and disseminated in participating countries.	The project has contributed to increase the regional integration at the scientific, decision makers, and beneficiaries' levels creating spaces where knowledge, processes and experiences could be exchanged, as well as systematizing methodologies, processes and experiences that serve as tools for learning and replication. During the life of the project, two important Andean region documents were published: The Andean Strategy for Integrated Water Resources Management (http://www.comunidadandina.org/Upload/201238181959recursos_hidricos.pdf), and the Andean Environmental Agenda. Another activity that helped strengthening the regional dimension of the project was AndesPlus, a process that has required intensive cooperation of the four countries to prepare a regional database and regional guidelines for adaptation projects in the region. At the regional level, a systematization document of all pilot activities has been completed, underscoring for example the validation at the regional level of a community level methodology developed by CARE (Climate Vulnerability and Capacity Analysis). In Ecuador 5 systematization documents on the adaptation experiences were prepared: (i) CARE intervention in the activities of agroforestry, fire prevention plan (CARE 2013); (ii) adaptation

					activities in Papallacta and the inclusion of the adaptation to climate change variable in the development and zoning plans of the decentralized autonomous governments of Papallacta, Napo y Quijos (Pablo Rodríguez, 2013);(iii) adaptive practices for cattle management in Papallacta (ECOPAR, 2014); (iv) organizational strengthening process and community capacity building for the development of the water and sanitation system in the community of Valle del Tambo; (v) processes to recover and restore paramos and wetlands in degraded areas. Bolivia experiences have also been systematized including social engineering processes, capacity building manuals, and participative planning activities behind the implementation of community-based adaptation activities. Project experiences in Peru were systematized in a main document. Further, all project results and lessons have been organized in a web page (www.glaciaresandinos.com), including 12 virtual publications (e.g., CC scenarios for the Mantaro and Urubamba basins; climate atlas for the same basins; Integrated water resources management plan for Shullcas, etc.), and 44 videos that highlight the activities and studies developed under the project, including the testimony of national/regional authorities, as well as of beneficiaries.

PROJECT OUTPUT INDICATORS

Component 1: Generation of CC scenarios and tools to assess the impacts of CC and glacier retreat

Original Output Indicator (PAD)	Output Indicator (post MTR)	Baseline	Target	March 2014
Local, regional, and national institutions of Peru, Ecuador, and Bolivia have the capability to assess glacier retreat, runoff availability, and water regulation at basin levels for the selected glaciarized basins, as measured by impact map developed.	Climate change scenarios developed using data from a high-resolution global circulation model (Earth Simulator, MRI Japan) in Bolivia, Ecuador and Peru, generating useful information for the selected basins.	Availability of some scenarios based on other global circulation models with less resolution.	The three countries have generated CC scenarios with MRI data for the selected basins. This constitutes an input for assessing CC impacts on water balances on those basins.	CC scenarios (medium and long term as well as short-term predictions) have been developed by the three beneficiary countries with MRI and other CC models. • INAHMI and MAE in Ecuador developed CC scenarios for 2015 and 2039 at the national level and for the areas of Quito and Antisana. In addition, 4 hydro-climatic studies that provide inputs to estimate the impact of CC on hydrological resources were also developed. • Official CC scenarios were developed for the whole Bolivia. In addition, based on the data of 58 monitoring stations, SENAMHI developed its official 30-years data base 1976-2005 (available at www.senamhi.gob.bo/). With the help of the FClimdex tool, the data base was used for the determination of 27 basic indicators of the Expert Team on Climate Change and Indices (ETCCDI/CRD), used for the characterization, observation and detection of climate change in Bolivia. Technical

				assistance to generate CC scenarios and CC predictions based of these 27 indicators has been provided. • In Peru, CC scenarios for the 2030 and 2100 periods were developed for the Mantaro (Junin) and Urubamba (Cusco) basins. Scenarios of future water availability in both basins were developed as well. Also, impact scenarios based on agro-climatological models and adaptation measures against climate variability for primary agricultural products (potato and corn in Sta. Teresa (Cusco), and avocado, coffee and granadilla in Shullcas (Junin)) were developed and have informed activities in the project areas.
None	Generation of models and/or impact maps to the effects of climate change and glacier retreat in the selected basins in Bolivia, Ecuador and Peru.	There are no impact maps due to the effects of CC and glacier retreat for the selected basins.	At least one model or impact map has been developed by each country.	Countries have developed models and/or impact maps to the effects of climate change and glacier retreat. • In Ecuador CC impact maps were developed by CARE for the Papallacta area (Parroquia Papallacta). In addition, an impact model of CC on ecological flows was developed as part of the monitoring system of the high Guayllabamba basin. • Bolivia used the information of the CC scenarios to develop an impact atlas that related CC, risk disaster and food security (*Atlas de Cambio Climatico, Riesgo de Desastres, y Seguridad Alimentaria en la region Andina* of the UN World Food Program). A hydrological model of glacier retreat (http://cambioclimatico-bolivia.org/archivos/20140119214642_0.pdf) was developed and fed EPSAS master plan for water provision for La Paz and El Alto (executive summary available at http://paap.mmaya.gob.bo/PlanesMaestrosMetropolitanos/LPZ-ElALTO/PMM-LPZ-EA-INF.FINAL-FEB.2014/RESUMEN%20EJECUTIVO%20Reajustado.pdf). Short-term climate prediction tools have also been developed by SENAHMI and capacity building has been provided for their interpretation. • In Peru hydrological models (to assess current and future water balance) as well as agrometeorological impact maps (to assess the impact of agricultural production of primary products) were developed based on the CC scenarios and a climate atlas. A monitoring system to assess the impact of climate change on paramos has also been developed in Piura.
Component 2: Design and Implementation of adaptation pilots				
Original Output Indicator (PAD)	**Output Indicator (post MTR)**	**Baseline**	**Target**	**March 2014**
None	Participatory development at the regional/local level of CC adaptation strategies and/or plans (e.g.,	There are no CC adaptation strategies or plans for the selected basins. Also, the coordination among water users is very	At least one strategy and/or plan has been developed for each participating country.	Numerous plans and strategies have been informed to some extent by project activities. • In Ecuador, development and zoning plans of 2 local decentralized governments (Papallacta and Napo) that incorporate CC considerations have been developed in a participatory manner; a third local government (Quijos) is working on this same process. In addition, the provincial environmental agenda of Napo also includes CC

	integrated water management plan or zoning plan that considers CC and glacier retreat implications).	limited.		considerations. An Adaptation Management Plan for the Pita Puengasi water system was also developed. • In Bolivia, catchment management plans that include CC considerations were developed and adopted by the Municipality of Palca (Choquecota basin) and the Municipality of Batallas (Khullu Cachi basin). In addition, three sectoral plans have used information developed by the Project: Water and Sewage Metropolitan Master Plan for La Paz and El Alto; Multipurpose Plan for irrigation and water for the municipalities of Batallas, Pucarani and El Alto; EPSAS Quinquenal Plan 2013-2017. • In Peru, an Integrated Water resources management plan was developed for the Shullcas sub-basin. Also, 16 communal development plans which incorporate CC considerations were developed in Santa Teresa (these instruments facilitate the prioritization and development of more sustainable investments in the communities).
Sets of adaptation measures designed for the selected basins.	Indicator unchanged. Target values adjusted.	No adaptation activities have been designed in the selected basins.	At least two adaptation activities have been designed under each pilot. Each design includes its own M&E system able to generate information, beyond project closure.	Adaptation activities were designed in all selected basins in the three countries. Although M&E systems and/or arrangements are in place and need strengthening. In most places, relevant variables to be object of an M&E system to be designed and implemented by national entities have been identified. • In Ecuador, 3 measures were designed under the project pilot 1 in the Pita micro-basin (monitoring system for the high Guayllbamba basin, monitoring stations for paramos, paramos and wetland recovery demonstrative plots; the latter includes a good M&E system as part of its design), and 7 under the second pilot project in the micro catchments around the Antisana glacier (agroecological plots, fire prevention plan in paramos, community water and sanitation system, community ecotourism practices, adaptive practices for cattle management, strengthening of water and weather monitoring, climate and vegetation monitoring system with M&E system included (Gloria sites)). In addition, the Project contributed with a vulnerability and adaptation study for the Antisana Ecological Reserve. • In Bolivia, 3 adaptation activities were designed under the first pilot project that focused on pilot activities to strengthen the immediate, medium and long-term strategy of the water utility for La Paz and El Alto, EPSAS (reduction of unaccounted water in the distribution system, identification and design of rapid implementation measures to increase water supply, strengthening of integrated water management, climate change and social management capacity). Under the second pilot project in Batallas and Palca (highland valleys), 4 measures were designed, all of them supported with related capacity building (water irrigation systems and artisanal reservoirs, development of integrated water management plans for the Khullucachi and the Choquecota basins, crop integrated management (soil and pest

				management), use and revalorization of germplasm). Under the third pilot project in Bolivia a defensive system against increases in La Paz river flows was designed. This design was based on the development of a physical hydraulic simulation model of the river flow, the first of its kind in the country. • In Peru under the first pilot project in the sub-basin Shullcas 4 adaptation measures were designed (reforestation, infiltration canals and silvopastoral systems, improved watering practices including 4 water reservoirs and irrigation systems, and the improvement of an irrigation canal. In addition, an activity was implemented in collaboration with CARE to support the local water authority, SEDAM, strengthen water supply management. In Santa Teresa (Urubamba basin) several adaptation measures were designed as a contribution to a broader adaptation project implemented by the municipality of Santa Teresa (demonstrative plots to assess the impact of irrigation systems, agroforestry; capacity building to strengthen irrigation committees; development of inputs for the formulation of the integrated water management plan for the municipality). In addition, a pilot monitoring system to assess the CC impacts on paramos was designed and implemented in Piura.
Amount of water supply to be compensated/improved through the pilots in the selected microcatchments (Ecuador).	Implementation of adaptation activities to promote integrated water resources management in the selected basins in Ecuador.	No specific activities on fragile high-mountain ecosystems in Ecuador, which contribute to water regulation at the basin level, have been designed or implemented as an adaptation response to CC.	At least one adaptation measure implemented under each pilot in Ecuador, with its own M&E system.	All activities in Ecuador have been implemented. Adaptive measures to reduce the environmental impact on the paramo in Papallacta (a very important ecosystem that provides water for Quito), have been implemented including the conclusion of the community-level water supply and sanitation system, which is currently operational, improved cattle ranching, enhanced paramo fire prevention procedures, implementation of community ecotourism practices, and others. In the Antisana area, demonstration plots for paramo restoration activities have been installed and information is being collected by EPMAPS and FONAG. In addition, the Project contributed with a vulnerability and adaptation study for the Antisana Ecological Reserve. Medium to long-term M&E systems and/or arrangements are designed and need to be strengthened in order for them to continue retrieving data well after project closure.
Scope (# ha, # tons) of agricultural production to be compensated/improved through the pilots in the selected microcatchments in the Mantaro, Cusco Basins, Peru.	Implementation of adaptation activities to promote integrated water resources management, including demonstration activities for climate change resilient	There is no water resources planning that considers the impact of glacier retreat in any of the two selected sub-basins, and limited knowledge on climate change resilient agriculture practices amongst local farmers.	At least one adaptation activity has been implemented and tested in each sub-basin under each pilot in Peru, with their own M&E system. At least one of the activities includes demonstration pilot showcasing good	All designed activities in Peru have been implemented. Activities implemented in Shullcas aimed at addressing different water related issues in all sections of the sub-basin (e.g., improve water retention, water efficiency and monitoring). The result of the activities include: 1826 out of 1900 planned hectares have been reforested (the remainder will be finalized by AGRORURAL during 2014); 1,131 out of 300 planned hectares of infiltration tranches and silvopastoril systems; 922 out of 800 planned hectares of improved grassland; 4 water reservoirs for irrigation; 365 out of 330 planned water irrigated hectares (190 has. with new water irrigation system, and 175 has. irrigated with water from an improved canal). An activity led by CARE and the local water

	agriculture in the two selected sub-basins (Santa Teresa and Shullcas) as a result of glacier retreat in Peru.		agricultural practices and water efficiency.	authority, SEDAM, to improve water distribution monitoring by installing 285 water micrometers was also implemented. The result of the activities implemented in Sta. Teresa include: strengthening of 5 local irrigation committees, 5 agricultural demonstration plots to renew and improve planting areas; development of 16 communal plans; installation of 3 water irrigation modules; agroforestry systems in 15 plots, and others. In addition, and under the project umbrella, CARE implemented a pilot activity to seek new agricultural and non-agricultural sources of income and to reduce infant malnutrition. M&E systems and/or arrangements have been designed, several already provide useful information, and others need to be strengthened and owned by the country. Relevant variables to be object of an M&E system to be design and implemented by national entities have been identified.
Amount of water supply to be compensated/improved through the pilots in the La Paz and El Alto microcatchments in the Altiplano, Bolivia.	Implementation of adaptation activities to promote integrated water resources management in the cities of La Paz and El Alto, and in the selected sub-basins in Batallas and Palca in Bolivia.	Water distribution systems in La Paz and El Alto register unaccounted-for water (UFW) loses of more than 30%. There are no local level plans that include CC and glacier retreat considerations.	A proposal to reduce UFW and improve efficiency is delivered to EPSAS. At least one adaptation activity is implemented in Palca and one in Batallas, with their own M&E system.	All designed adaptation activities have been implemented. The pilot activities focused on improving the resilience of the short, medium and long-term strategy of the water utility company for La Paz and El Alto achieved very positive results. The activity to reduce unaccounted for water for La Paz and El Alto was concluded and it yielded a reduction of 19.61 lt/sec. (619 m3/year) equivalent to the water required for 18,697 connections of similar characteristics within a year. Further, the experience has already been replicated in two other districts achieving a reduction of 1,280,000 m3 and the replication on a third district is under way. As a result of a study on alternatives for short-term increase of water supply for El Alto, two options were selected, and EPSAS is moving towards their implementation. The full package of capacity building activities aimed at strengthening the capacity of EPSAS on social/negotiating skills with communities, as well as its capacity for water distribution management in the long-run, has been implemented. Pilot activities to promote integrated water resources management in selected sub-basins in Batallas and Palca have achieved very good results. The two pilot irrigation schemes, in Palca and Batallas, were concluded, and irrigations committees were conformed and operational procedures have been formalized and adopted. The irrigation project in Palca benefitted 70 families while the project in Batallas benefitted 85. Both municipalities prepared and adopted a sub-basin integrated management plan (sub-basin of Khullucachi and sub-basin Choquecota) with defined M&E systems according to the activities identified to be implemented under both plans. Other activities to increase the resilience of local communities were also implemented. These were based on strengthening local management, organizational and technical capacity and the development of within-community trainers to promote and develop activities to improve water management (i.e., artisanal reservoirs benefiting 59 families in Palca), water efficiency (irrigation

				systems) and integrated crop agricultural management (demonstrative plots, integrated pest management, selection of more resistant varieties, etc.). Indicators to assess the effectiveness of the demonstration plots have been measured and reported up to date.
Component 3: Monitoring of Glacier Retreat in the Region				
Original Output Indicator (PAD)	**Output Indicator (post MTR)**	**Baseline**	**Target**	**March 2014**
6 glacier monitoring stations that are established and capable of monitoring glacier evolution, weather and hydrological conditions in the glacier basin on a sustainable basis.	Number of high-mountain meteorological stations installed in glacier and high-mountain ecosystems, generating consistent data through time to monitor glacier evolution and meteorological conditions in the basins.	Limited availability of high-mountain meteorological data in the tropical Andes.	8 meteorological stations installed and operational, generating accessible data to all relevant stakeholders in the 4 countries (Bolivia, Colombia, Ecuador and Peru).	8 high mountain meteorological stations have been installed and are operational, generating accessible data to all relevant stakeholders in the 3 participating countries plus Colombia, who was also a beneficiary of the PHRD grant that covered this component The two stations in Bolivia, are the two highest in the country including one in Chacaltaya (5,200masl). The two stations in Colombia are installed in Glacier Conejeras (at 4759masl) and in Sierra Nevada del Cocuy (at 4391masl). The two stations in Peru were installed in the Huaytapallana Glacier in Junín (at over 4,670masl) and the Quisoquipina Glacier in Cusco (5,186masl, the second highest of the country). Of the two stations in Ecuador, one is located at the bottom of glacier 12 of Antisana (above 5,000masl) and the other in the paramos areas next to the glacier. In Colombia, a high-mountain monitoring network, collecting hydro-meteo data at three different locations, was also installed through the Project. Relevant meteorological and hydrological institutions in each country have become responsible of the operation and maintenance of the stations, and are entitled to change their locations according to need and appropriateness. Each country has developed protocols to access the data. The HYDRACCESS platform is being used to share data among the 4 countries (professionals in each country were trained in the use of this platform). Data is currently being collected at the SGCAN. A more suitable arrangement is being sought by the countries. In the case of Ecuador, and as part of the pilot activities, an automatic network of hydrometeorological monitoring stations for paramos was implemented which includes 15 stations (5 meteorological, 6 hydrological, and 4 pluviometric) all located above 3,000 meters which were transferred to INAHMI.
Increased capacity, i.e., quality, coverage, and frequency of provision of high-precision remote sensing data, of the national institutes of meteorological sciences of the participating countries to monitor	Availability and use of satellite images and/or aerial photographs to characterize glacier surface, assess the dynamic of glaciers and high-mountain ecosystems in the 4	ALOS images are not being used and very few photogrammetric analyses are being done to assess glacier behavior in the region.	Each country has at least generated one study on glacier cover evolution, using ALOS images and/or aerial photos obtained by the Project.	In Ecuador 2 studies of the Antisana glacier have been completed; one on glacier dynamics, and the other on the multi-temporal evolution of its retreat. Both studies were prepared in synergy with other initiatives of IRD, EPMAPS, INAHMI, EPN (Escuela Politecnica Nacional), and SENESCYT (Secretaria de Educacion Superior, Ciencia, Tecnologia e Innovacion) among others, and with the help of the Military Geographical Institute. Although the use of ALOS images for glacier studies proved to be challenging , they were useful in other project's studies and work carried out by consultants and strategic partners such as ECOPAR, CONDESAN, CARE and local government of Papallacta within the project (e.g., zoning work in paramos).

gradual process of glacier retreat and associated ecosystems in the region.	countries.			Bolivia updated and completed its national glacier inventory covering all its mountain ranges (Real, Tres Cruces, and Apolobamba) for the years 2009-2010 (latest available was for the 1980s), and estimates that surface glacier loss since the 80's account for 37%. Additionally, the first inventory of water bodies and paramos was completed. These tools have become important decision making and negotiating tools. The same ALOS images were used on other important research work including the zoning of risk areas in La Paz. A series of scientific articles and papers have been published in peer-reviewed journals (e.g., Annals of Glaciology), and the results of these works have been presented in international fora. Two studies on glacier behavior using ALOS and LANDSAT were developed in Peru: Huaytapallana (Junín) and Salkantay (Cusco). The studies report a loss of glacier mass of 14.26% during 2006 and 2010 in the case of Huaytapallana, and of 21% for the same period in the case of Salkantay. Colombia participated on the training on use and application of satellite images. They used 50 ALOS images to update its national glaciated area for 2009 and 2010.
Increased capacity in: (i) the analysis and monitoring of the behavior of tropical glaciers and associated ecosystems in the face of climate change; (ii) role played by paramos (mountain wetlands) in fixing (collecting) atmospheric carbon and in the water cycle.	Development of capacity to analyze and monitor high-mountain ecosystems' (paramos) behavior to CC, in reference to the water cycle and their role in fixing carbon.	There is no knowledge about the impacts of CC on paramos.	The study on the role of the paramos on the water and carbon cycle in Peru and Ecuador has been finalized.	Pilot monitoring systems to improve the understanding of the link between climate change, paramos and hydrology have been developed in Ecuador and Peru. Studies on the role of role of paramos in carbon fixation need much longer time horizons that go beyond project scope. However, the monitoring system was set up in Piura-Peru to collect the baseline information needed to produce estimates in the future. A study on hydrological monitoring in paramos, which is part of the experimental activities to promote regeneration of paramos, has been launched by FONAG, EPMAPS, and CONDESAN with the support of other academic institutions within the project in Ecuador. The engagement of FONAG and EPMAPS, institutions interested in ensuring the supply of water for Quito, play a key role in fostering an adequate monitoring of the demonstration activities. In Peru a monitoring system to assess the impact of the paramo in the hydrological cycle has been implemented in Piura. It is based on the methodology of the Regional Initiative of Hydrological Modeling of Andean Ecosystem (IMHEA) of "twin basins" (two similar basins are compared in which one is intervened and the other one not). This activity is linked to IMHEA activities in the region and is run by a consortium of institutions which will continue with this work beyond the life of the project. The work is being led by Nature and Conservation International, CONDESAN and is supported by a network of other relevant institutions led by the regional government of Piura and the local authorities of the province of Ayabaca.
None	Increase knowledge about the economic implications of glacier retreat in the	There is no economic information about the impacts of rapid glacier retreat in the region.	Studies on the economic impacts of glacier retreat have been finalized in all	Recognizing the difficulties of applying a unique methodology to assess the impact of glacier melting, this activity was carried out through the implementation of a regional capacity building activity where methodologies to evaluate the economic impact of glacier melting where presented and discussed.

	region.		countries based on the methodology agreed by all.	Relevant participants (technical professionals and decision makers) of Ecuador, Bolivia, Peru, and Colombia, were trained on these methodologies, with a focus on selected sectors such as water supply or agriculture. During the training, some specific estimates were done by country, but their value is more demonstrative of the approach rather than the final real figures. In addition. Colombia carried out a flagship study on the evaluation of economic, ecological and social value of ecosystem services provided by glaciers, and another on the social vulnerability of selected high-mountain communities to rapid glacier retreat.
Component 5: Regional Perspective of Glacier Retreat				
Original Output Indicator (PAD)	**Output Indicator (post MTR)**	**Baseline**	**Target**	**March 2014**
None	Availability of a methodological guide to formulate baselines and adaptation measures in high-mountain ecosystems.	There are several methodologies but none specifically designed for high-mountain ecosystems.	Methodological guide is available.	The guide has been completed through the AndesPlus activity. An executive summary has been prepared, and published as a stand-alone piece. This was distributed during the project closing workshop in November 2013. The preparation of the methodological guide was a highly participatory approach, which span over several years, and engaged top scientists and decision makers of the participating countries, moderated and led by a consortium of cutting edge research institutions directed by the University of Zurich.
None	Systematization and analysis of the different methodologies used for glacier monitoring in the Andean sub-region.	Each country applies its own methodology and generates data, but there is no exchange of information generated by the project among countries.	At least one workshop to exchange know-how on CC scenarios development and glacier monitoring has taken place. A document that systematizes the experiences of Bolivia, Ecuador and Peru on this topic is also available.	A number of regional workshops were implemented, with participation of national experts. These workshops aimed at promoting the exchange of know-how and expertise across the region, establish guidelines and identify research needs within the region. They covered a variety of topics including modeling of climate change scenarios, use of ALOS images, hydrology monitoring and modeling. In addition, the starting point for an information exchange protocol, the first of its kind for glacier dynamics in the region, was agreed by all participants including the definition of standardization criteria of glacier monitoring, and the standardization of the database for the glacier retreat information generated by high altitude monitoring stations using HYDRACCESS, among others. A capacity building workshop on HYDRACCESS was also provided and countries have started reporting data from the stations acquired thorough the project. Data is currently being collected at the SGCAN, but a longer-term solution needs to be agreed by all countries. Summary documents of al workshops have been prepared.
None	Systematization and analysis of the different adaptation processes applied in the different pilots financed by the project.	There is no or very limited regional exchange on this topic, and if done, is not formal.	At least one workshop to exchange know-how on adaptation processes. A document that systematizes the experiences of Bolivia,	A regional workshop to exchange experiences on implementing adaptation activities, covering methodological issues and results took place in 2013. This was complemented by a study tour of community leaders, local beneficiaries of activities in Bolivia, Peru and Ecuador that visited the projects and communities in all three countries. The closing workshop of the entire project was held in November 2013, with participation of the different levels of government, partners, NGOs, and project

			Ecuador and Peru on this topic is also available.	beneficiaries. There is a regional systematization document of component two (design and implementation of pilot activities), which showcases an articulated and integrated vision of all activities under the project at a macro level, including scientific activities. In addition, a series of systematization documents by country have also been generated, and each participating country is currently archiving them and making them available to the public in an organized manner. A good example to follow to implement this recommendation is the web page designed by the project in Peru. In addition, it is also important that all documents by country be systematized in a unique document also by country. This would allow visualizing the logic behind the set of implemented activities rather than being seen as isolated interventions. Peru has achieved this but only at a draft level.
At least 10 dissemination notes to reach and raise awareness of local impacts of climate change.	Dissemination among the communities, local governments involved, specialized institutions and other stakeholders of the participatory working experiences and results on the topic of adaptation to CC.	Limited formal understanding by the communities of the problematic of CC, glacier retreat and the role of the high-mountain ecosystems on the water cycle. Very few press articles and publications at the community level on this in the Andean region.	Project web page that integrates information about the topic, experiences, and results at the local and sub-regional level is operational. Project closing workshop and Report.	As previously described further above, multiple workshops and a study tour took place. Audience varied ranging from technical experts, scientists, decision makers, and community project beneficiaries. A 2-day closing workshop that reunited all types of actors involved throughout the project also took place. A summary report of the project is available, although its content is more focused on the scientific activities. There is a dedicated project page at the SGCAN, although it is not complete. The project team of Peru did prepare a comprehensive page. The web site (www.glaciaresandinos.com) is an excellent tool that showcases what was done by the Project in Peru in an organized manner. It was recommended that this web site is integrated into the Ministry of Environment web page. It was recommended to both Bolivia and Ecuador to design and implement similar tools.

Annex 4. Economic and Financial Analysis

Estimating both the benefits and costs associated to increasing the resilience of the Tropical Andes to the impacts of glacier melting and the resulting effects on water availability is challenging. Adaptation activities go beyond standard investment activities, as they try to address additional needs (e.g., reforestation has an impact on water retention, thus helping regulate water flow), and the adaptive result of these interventions will be accrued over long periods of time that escape the timeframe of the Project. Further, the Tropical Andes wider area of influence is a complex composite of relatively highly populated centers, fragile ecosystems and small communities. The water flowing from a glacierized basin originates from glacier melt, rain and snowmelt runoff, underground water, and is used both by natural ecosystems (*paramo*, mountain forests) as well as by several sectors such as water supply, irrigation, and energy to name a few. All these uses compete among each other for the resource, and therefore the benefits accrued by one sector will have an (expected positive) externality on another (e.g., savings in one sector obtained through water efficiency practices decreases demand, freeing resources for other uses).

Given the ample scope of the Project and the number of activities implemented, this annex focuses on a few examples to provide arguments (qualitative and quantitative when possible) to support the cost effectiveness of the implemented measures. An approach used to provide a sense of some indirect benefits of specific activities is to look at the costs to implement alternative solutions to tackle the same problem.

Water Supply. One of the key sectors addressed by the Project was water stresses caused by CC and glacier retreat, and their impacts in availability for supply purposes (Quito - Ecuador, and La Paz and El Alto - Bolivia). The financial benefits of additional water availability (or savings in losses) could be quantified based on the price of water in each case; however this measurement underestimates the actual economic benefits. In the case of Bolivia for example, savings in water losses as the results of the efficiency improvements implemented by the Project, allowed EPSAS in the short term to decrease water disruption to areas that were not adequately served (the pilot activity yielded a reduction of 19.61 lt/sec. (619 m3/year) equivalent to the water required for 18,697 connections of similar characteristics within a year) with the consequently expected benefits on health for example, plus reduced social tensions due to water shortage. In the medium and long term, it is expected that savings in water would reduce the pace by which new sources of water and water systems are required, thus decreasing the social tensions that have developed historically in La Paz and El Alto, in addition to the financial costs of identifying, designing and constructing new systems. The fact that EPSAS has already replicated the efficiency improvement activities in three other districts is an indication that addressing water losses is a cost effective measure compared to just focusing on finding and developing new sources of water.

In the case of Quito, the deep engagement and leadership of EPMAPS and FONAG in undertaking pilot activities to reduce degradation and promote recovery of the *paramo* ecosystem, is a clear recognition of this ecosystem's specific importance in the supply of water. The alternative to improve water retention and infiltration by protecting the *paramo* ecosystem would be for EPMAPS to look for new catchments to extract additional water for the capital, all of which, as stated by the utility company, would require seeking sources that are further and further away from Quito, investing in costly infrastructure, and engaging in social negotiating processes which are not easy to carry out. As opposed to those works, a very small investment focused on conservation and promotion of water resources, could yield, as it is being evaluated by the pilot activities, very

significant water availability gains. In addition, *paramo* restoration encompasses a variety of other benefits including carbon sequestration and enhanced biodiversity protection.

At a smaller scale also in Ecuador was the pilot activity to provide access to potable water for the Valle del Tambo community. The literature provides extensive arguments in favor of improved access to clean water (e.g., reduce child mortality, health benefits), but the actual benefits from an adaptation point of view go beyond those describe by the literature. If basic needs and daily challenges are not addressed, the chances that communities get involved in adaptation activities that can yield benefits beyond the immediate future and to the global public goods as a whole, are minimal. In addition, the benefits linked to this pilot should be seen beyond the actual infrastructure, and take into account the strengthened organizational capacity of the water and sanitation committee.

Strengthened monitoring capacity and the knowledge base. As stated in different places of this document, a key element in addressing adaptation is the need to understand and evaluate the impacts of climate change, and the vulnerability of population, ecosystems, and economic sectors. The only way to keep improving the quality of vulnerability assessments and therefore the identification of adaptation requirements is to keep investing in stronger institutions and strengthened monitoring capacity, measured in terms of available hard and soft equipment to generate data at a local scale, and the human capacity to analyze the data and provide information for decision-making. Costs of adaptation have been estimated and are available from specialized literature, all of them in the billion figure. The more accurate adaptation measures can be designed, the less use of resources required for trial and error, and every adaptation design starts with the use of good data. This becomes more important in regions such as the Tropical Andes, because their unique topography makes downscaling of global models more challenging.

Efficient irrigation. Cost benefit analysis of irrigation activities as those implemented in Shullcas, Peru, were done based on the actual costs (of the infrastructure, capacity, supervision), and benefits measured by the expected increased productivity at market prices. These analyses yielded internal rates of return of approximately 46%. The ability to measure actual benefits on productivity requires a timeframe beyond Project closure. Still, from an adaptation perspective, it is important to realize that the benefits related to an efficient use of water for irrigation go beyond the increased productivity, and the reduced demand (and thus competition) for the water resource should be accounted for.

Food Safety. The benefits of rural community activities in Bolivia related to resilient agriculture by promoting the use of more resilient crops (e.g., quinoa) under different conditions, and the introduction of more varieties of native potato species, are not only significant in terms of increased productivity. Potatoes and basic cereals represent the staple food of these communities, and therefore their basic source of nutrition. Thus, increasing crop resilience to CC impacts, and ensuring a less climate variability-dependent food production throughout the year, has also direct benefits on health and wellbeing. This is also valid for similar activities in Papallacta, Ecuador. Moreover, improved food safety prevents to some extent encroachment and other practices that could damage global public goods and degrade critical ecosystems that provide needed services. An indirect, efficient way to protect these services, is to ensure food safety and viable livelihoods for the communities in and around those ecosystems.

Annex 5. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Walter Vergara	Lead Chemical Engineer	LCSEN	TTL
Alejandro Deeb	Consultant	LCSEN	Hydrologist
Alonso Zarzar	Social Scientist	LCSEO	Social Safeguards
Alfred Grünwaldt	Environmental Specialist	LCSEN	Engineer
Seraphine Haeussling	Consultant	LCSEN	Economist
Keiko Ashida	Environmental Specialist	LCSEN	Operations Analyst
Evelyn Villatoro / Francisco Rodriguez	Procurement Specialist	PCSPT	Procurement
Xiomara Morel / Nelly Ikeda	Financial Management Specialist	LCSFM	Financial Mgment
Patricia Hoyes	Disbursement Specialist	LOAFC	Disbursements
Fabiola Altimari	Counsel	LEGLA	Lawyer
Supervision/ICR			
Daniel Mira-Salama	Environmental Specialist	GENDR	TTL
Gabriela Encalada	Environmental Specialist	GENDR	Technical support
Carla Della Maggiora	Consultant	GENDR	Env. Safeguards
Alonso Zarzar Casis	Sr. Social Scientist	GURDR	Social Safeguards
Beatriz Iraheta	Language Program Assistant	GENDR	Team support
Erwin de Nys	Sr Water Resources Specialist	GWADR	Former TTL
Jimena Garrote	Sr Counsel	LEGLE	Lawyer
Jorge Treviño	Sr. Water Resources Mgment Spec.	GWADR	Bolivia support
Jose Yukio Rasmussen	Sr Procurement Specialist	GGODR	Procurement
Lelia Sampaio Werner	Sr Finance Assistant	CTRLN	Disbursements
Lourdes Consuelo Linares	Sr Financial Management Specialist	GGODR	Financial Mgment
Maria Virginia Hormazabal	Finance Analyst	CTRLN	Disbursements
Monica Tambucho	Sr Finance Officer	CTRLN	Disbursements
Morten Blomqvist			Bolivia support
Nelly Ikeda	Financial Management Specialist	GGODR	Financial Mgment
Patricia De la Fuente Hoyes	Sr Financial Management Specialist	GGODR	Financial Mgment

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	USD Thousand Labor	USD thousand (including travel and consultant costs)
Lending		
FY06	36	33
FY07	61	53
FY08	63	40
Total:	**160**	**126**
Supervision/ICR		
FY08	18	8
FY09	19	54
FY010	33	21
FY011	73	98
FY012	3	28
FY013	7	25
FY014	32	38
Total:	**185**	**272**

Data extracted from the World Bank's Operations Portal on September, 2014.

Annex 6. Stakeholder Workshop Report and Results

A final Project stakeholder-wide workshop was held in Lima, Peru, on November 28 and 29, 2014. It was hosted by the General Secretariat of the Andean Community, and included all main Project stakeholders. It was attended by decision makers and authorities of the three participating countries plus Colombia (due to its engagement on the third Project component), from the national, regional and local levels; scientists from the meteorological and hydrological research centers of the four countries; representatives from the water utility companies EPSAS and EPMAPS; key staff from CARE, AGRORURAL and IRD (the French Institut de recherche pour le développement); representatives from the beneficiary communities, some of them of indigenous origin; the World Bank team and others.

Some of the main findings during the two day event, which were also reflected on an Aide Memoir, are summarized below.

- Representatives of the different groups involved agreed on the Project's success in bring them together and making them work in a coordinated way. Scientists talking to beneficiaries, to decision makers and to utility companies proved to be powerful and enriching for all. Moreover, the engagement of CARE, organization that promoted community engagement in development activities around the climate change theme, was positively rated, especially for Bolivia and Peru.

- The experiences gained by the Project underline the necessity, moving forward, to continue bridging the gap between different actors at different government levels, beneficiaries and the knowledge community, as a regional government representative noted.

- Workshop participants praised the Project's vocation to disseminate results and to facilitate outreach to other areas (communities and other local governments) not directly involved in it.

- It was noted that, although the Project's primary vocation was not to influence public policy, it managed to do it on a very articulated way, by first strengthening the knowledge base, then bringing it to action through pilot projects, and finally trickling down the experiences into regulations, strategies and investment plans.

- The Project's focus on glaciers and glacierized basins was relevant to raise awareness and increase the level of attention to a critical issue. Glaciers are however not isolated, and future activities will have to underline the key linkages and interrelations with other areas in the region.

- Moving forward, and as more data becomes available, workshop participants urged the different actors involved (especially regional governments and CARE) to communicate and advocate for the positive results obtained in the Project, using as one parameter their cost effectiveness. CARE agreed to present results of their analyses in the near future.

- Another clear lesson learned from the Project, stressed by all, was the Project's vision to work from local to national, and that an adaptation program cannot be implemented solely at the national level, but a strong, participatory approach is needed, involving local actors and beneficiaries from the early stages of design. The Project has provided several good examples on how to do this.

- As a final thought, participants praised the Project, indicated that there are numerous lessons and experiences to learn from, and requested the Andean Secretariat to stress their efforts to better disseminate them, reaching out to decision makers and civil society.

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

The recipient of this regional Project was the General Secretariat of the Andean Community (SGCAN) on behalf of the Plurinational State of Bolivia, the Republic of Ecuador and the Republic of Peru. Moreover, the Republic of Colombia was a Project beneficiary for selected activities. An ICR draft was shared with all the institutions above, and feedback collected during a 4-week period. The comments received are translated and summarized below.

The SGCAN, through its Projects and Cooperation area, indicated full satisfaction with Project achievements and success. Through the Project, specific answers and solutions have been given to challenges to ecosystems and economies posed by glacier retreat in the Tropical Andes. SGCAN states that the successful implementation of activities has allowed to achieve Project objectives and complete all activities foreseen in the different Project components. Finally, SGCAN stresses that their management of the Project was accomplished following all procedures and regulations, statement that is backed up by the Project Audits.

Ecuador, through the Ministry of Environment, emphasizes that the Project has been instrumental in implementing adaptation measures that compensate ecosystem service losses caused by rapid glacier retreat and ecosystem degradation. The Ministry also mentions that, in order to ensure long-term sustainability of several investments, continuous efforts are still needed by Project beneficiaries, local governments and Ministries. Ecuador has used ALOS images to monitor and characterize paramo dynamics and vulnerability assessments. In their opinion, there was no lack of empowerment from countries (as the ICR notices in Section 5.1b), but they agree with the fact that Government staff changes and norms are a key reason for delays and uncertainties. They indicate that each country's performance is different from the others and this should be taken into account. Finally, they indicate that the social engineering was oftentimes achieved through concerted efforts by the NTS, beneficiaries and local governments, whereas in other specific activities it was achieved with CARE's support (demonstration plots, reforestation, silvo-pastoril systems, forest connectivity actions, and fire prevention plan).

Bolivia, through the Ministry of Environment and Water, praised the ICR, and emphasized that the Project managed to strengthen research institutions and promote real applied research. Said research generated information that is directly being used to inform decisions.

Peru, through the Ministry of Environment, indicated its agreement with the document, stating that it appropriately describes the technical, operational and financial aspects of the Project. Other specific comments were: (i) Their satisfaction with the results obtained, which have allowed the Ministry to implement on the ground investments, generate technical and scientific information useful for decision making, and provide a platform to coordinate different national and regional stakeholders, promoting synergies and concerted efforts. The role played by the Ministry, as a convener and facilitator of efforts at the three government levels is stressed in this regard; (ii) The Project success in "thinking globally and acting locally", being able to implement specific actions at local level, which created empowerment and ownership; (iii) The Project achievements are especially relevant as they dealt with high-mountain ecosystems and glaciers, prioritized under Peru's National CC Strategy and COP20; (iv) The pilot projects completed and the lessons learned and extracted throughout this initiative are an important input to build public policy at regional and local levels, especially for high mountain ecosystems. The Project activities could be replicated in other vulnerable areas of the country; (v) The Ministry of Environment, through its CC General

Directorate, will continue to promote and facilitate climate change adaptation processes and initiatives, replicating what the Project achieved, seeking the leadership from regional and local governments to ensure success. This entails continuous engagement in governance and institutional work, sensitization, and the establishment of the necessary financing mechanisms. The Peru priorities would be to mainstream CC in development activities, engage as many stakeholders as needed, strengthen capacities, promote top to bottom approaches and vice versa, and include more research institutions into the process; (vi) A number of lessons learned, from the Ministry's perspective, were mentioned, such as better integrating scientific and traditional/community knowledge, establishing monitoring systems for long-term characterization of outcomes, better engaging stakeholders with an implementing role in projects (universities for knowledge creation, local governments to replicate around Project intervention areas and capacity building), better integrating regional dimensions in order to generate supra-national processes, and establishing better communication strategies in order to have greater impact at different levels.

Colombia, through IDEAM, commended the document, and mentioned that the quality and depth of activities carried out in Colombia as part of the Project merited more specific acknowledgement. Through the Project, the country has: strengthened its high-mountain monitoring network with two high-mountain stations; Installed an additional monitoring network on a critical glacierized basin; Carried out a flagship study on the evaluation of economic, ecological and social value of ecosystem services provided by glaciers; Carried out a study on the social vulnerability of selected high-mountain communities to rapid glacier retreat; and performed other activities such as studies using ALOS satellite images.

Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders

The ICR was reviewed by CARE, institution that has partnered with the Project and financed several complementary activities with own resources. CARE underlines that, in Peru, and thanks to Project promotion of climate change adaptation, the regional government of Junin established a regional conservation area (in Huaytapallana) and is currently considering the establishment of a payment for environmental services scheme in coordination with the Ministry of Environment. CARE continues to be engaged in the Santa Teresa – Cusco area, and as a follow-up of Project initiatives, is currently implementing an early warning system as a disaster risk management tool. CARE underlines their valuable contributions in both technical and institutional aspects of the Project, especially in Peru (preparation of technical documents that originated the creation of the regional conservation area, implementation of the early warning system, validation of on-the-ground adaptation investments carried out by the Project through scientific research together with local universities, and others). This strengthens CARE's community-driven approach to adaptation, which has a strong social component but also technical depth. CARE notes that the gender dimension has also been significant in Peru's activities, with initiatives targeted towards improving income and food security for women in Santa Teresa, Cusco, and other activities in Shullcas, Junin.

Annex 9. List of Supporting Documents and Relevant Publications

Supporting documents for the preparation of this ICR:

World Bank Documents:

- Project Appraisal Document; Global Environment Facility Trust Fund Grant Agreement
- Implementation Status and Results Reports (ISRs)
- Aide Memoires from Supervision Missions
- Mid-Term Review; Operational Manual; Environmental Management Framework
- Restructuring Paper

Other Documents:

- Adaptación al Cambio Climático y Glaciares, Avances en los Andes Tropicales, SGCAN.
- Análisis Situacional de la Implementación de las Medidas de Adaptación en el Marco del PRAA y CARE Perú en las zonas de Shullcas y Sta Teresa, Ing. Julio Salcedo, Marzo 2014.
- Documento de Sistematización de la Experiencia: Restauración de Áreas Degradadas de Páramo a Pequeña Escala y Diseño de un Plan Piloto de Manejo Adaptativo para zonas de Amortiguamiento dentro de las Microcuencas Antisana y Pita en áreas de Aporte a los Sitemas de Agua Potable del Distrito Metropolitano de Quito, CONDESAN, Diciembre 2013.
- Experiencia y Lecciones Aprendidas Durante el Diseño e Implementación del Piloto II Proyecto PRAA-Ecuador, CARE Ecuador: http://www.care.org.ec/wp-content/uploads/2014/03/EXPERIENCIAS-Y-APRENDIZAJES-PRAA-PILOTO-II-ABRIL-2013-1.pdf.
- Informe Final de Cierre, Proyecto de Adaptación al Impacto del Acelerado Retroceso Glaciar en los Andes Tropicales-PRAA, 30 octubre 2013, SGCAN.
- Memoria "Taller Regional de Clima y Escenarios de Cambio Climático", Elizabeth Silvestre Espinoza, 25 de julio 2013.
- Memoria "Primer Taller Regional de Glaciología", Elizabeth Silvestre Espinoza, julio 2013.
- Memoria "Taller de Capacitación en HYDRACCESS", Elizabeth Silvestre Espinoza, julio 2013.
- Memoria "Taller Regional de Adaptación: visita de intercambio de experiencias en procesos de adaptación", Elizabeth Silvestre Espinoza, julio 2013.
- Memoria "Taller de Capacitación en Uso de Imágenes Satelitales - ALOS", Elizabeth Silvestre Espinoza, julio 2013.
- Memoria "Taller Regional de Hidrología", Elizabeth Silvestre Espinoza, julio 2013.
- Primer Informe Borrador "Análisis y Sistematización de Experiencia y Lecciones Aprendidas durante la Implementación del Proyecto Piloto 1" del Proyecto Regional de Adaptación al Impacto del Retroceso Acelerado de los Glaciares en los Andes Tropicales (PRAA) en Bolivia.
- Primer Informe Borrador "Sistematización de Experiencia y Lecciones Aprendidas del proyecto Piloto 2: Resilencia Rural – Manejo de Agua en Batallas y Palca" del Proyecto Regional de Adaptación al Impacto del Retroceso Acelerado de los Glaciares en los Andes Tropicales (PRAA) en Bolivia, Aida Ruegenberg Jerez, Noviembre 2013.
- Propuesta de Sostenibilidad para el manejo de los Microinvernaderos implementados como medida de adaptación al cambio climático en la Comunidad Valle del Tambo en la Zona de Intervención del PRAA Ecuador, Pablo Rodríguez Ormaza, Mayo 2013.

- Reporte Final de Ejecución y de Sistematización de "Implementación de Buenas Prácticas para el manejo Adaptativo del Sistema Pecuario y la Conservación del Ecosistema Páramo en la Microcuenca de Papallacta", ECOPAR, Noviembre 2013.
- Sistematización de Experiencias y Lecciones Aprendidas durante la Implementación del Proyecto Piloto 2 del PRAA en Ecuador y del Proceso de Incorporación de la Variable de Adaptación al cambio Climático en los Planes de Desarrollo y Ordenamiento Territorial de los Gobiernos Locales en la Zona de Intervención del PRAA, Pablo Rodríguez Ormaza, Mayo 2013.
- Sistematización del Componente 2 del Proyecto PRAA, Fundación Intercoperación América Latina, Noviembre 2013.
- Sistematización Proyecto de Adaptación al Impacto del Retroceso Acelerado de Glaciares en los Andes Tropicales – PERU, Maritza Mayo D'Arrigo.

Other relevant publications

Regional

Strategy:

The Andean Strategy for Integrated Water Resources Management in Spanish):
http://www.comunidadandina.org/Upload/201238181959recursos_hidricos.pdf

Methodologies:

Metodologías para la formulación de Líneas de Base y Medidas de Adaptación al Cambio Climático en Ecosistemas de Alta Montaña (Andes Plus), Universidad de Zurich (in Spanish):
http://www.geo.uzh.ch/~chuggel/files_download/andesplus/AndesPlus_Producto5_Final.pdf

Bolivia:

Scientific Publications

Final Report "Asistencia Tecnica para la Generacion de escenarios de Cambio Climatico y pronósticos Climaticos" (in Spanish):
http://www.senamhi.gob.bo/praa/praa/informes/InformeFinalPronosticoCPT.pdf

Other Publications:

- Master Plan for Water and Sewage for the Cities of La Paz and El Alto (Executive summary in Spanish): http://paap.mmaya.gob.bo/PlanesMaestrosMetropolitanos/LPZ-ElALTO/PMM-LPZ-EA-INF.FINAL-FEB.2014/RESUMEN%20EJECUTIVO%20Reajustado.pdf
- Balance hidrico, glaciares y escenarios (in Spanish): http://cambioclimatico-bolivia.org/archivos/20140119214642_0.pdf
- Multipurpose Irrigation and Water Plan for the municipalities of Batallas, Pucarani and El Alto
- Five-year investment plan of the water utility for La Paz and El Alto,
- Integrated management plans for Choquecota (Palca) and Khullu Cachi (Batallas)
- Atlas tematico y de vulnerabilidad Choquecota
- Estrategias de intervención, metodologías y herramientas para manejo de conflictos, Guía metodológica, CATIE
- Atlas Temático de las Cuencas Hampaturi y Palcoma del Municipio de La Paz, CATIE

- Conflicto socioambiental EPSAS -comunidades ayllu Hampaturi por la construcción de la represa Hampaturi Alto, Sistematización del proceso
- Manual de Herramientas para facilitadores en medidas de adaptación para la agricultura
- Cartilla Proceso Enseñanza aprendizaje MIC GIRH
Inventario de glaciares, lagunas y bofedales de la Cordillera Real, Iinforme final (in Spanish): http://sania.comunidadandina.org/UpLoad/Contenido/9/52/Informe%20Edson-%20parte%201.pdf
- Manejo de Piloto integrado de Cuencas afectadas por la Retraccion de Glaciares para Palca, procesos, implementación y resultados, CATIE (presentation in Spanish): http://sania.comunidadandina.org/Upload/Contenido/81/3/CATIE%20-%20Presentaci%C3%B3n%20Oficial%20PRAA.pdf
- Elaboración del Programa Integrado y de Gestión Sostenible de Reducción de Agua No Contabilizada (in Spanish): http://sania.comunidadandina.org/Upload/Contenido/9/51/QUANTUM%20_%20Informe%20ABS%20QUANTUM.pdf

Ecuador:

- National Strategy on Climate Change:
- Development and Zoning Plan for the decentralized government of Papallacta:
- Development and Zoning Plan for the decentralized government of Quijos:
http://gaceta.quijos.gob.ec/pdot/
- All publications below are available in the following link (in Spanish):
http://suia.ambiente.gob.ec/web/suia/descargas

Generation of information: includes documents related to the following topics.

- Escenarios Cambio Climático TL959 and others
- Estimación Impactos Cambio Climático Sector Hídrico
- Mapas de vulnerabilidad
- Priorización Medidas de Adaptación

Design and Implementation of Adaptation Activities: includes documents related to the following
- Incremento en la Resiliencia del Sistema de Agua del Distrito Metropolitano de Quito
- Plan de Manejo Integrado de Microcuencas
- Incorporación Implicancias de Retroceso Glaciar

Glacier Monitoring: includes documents related to the following
- Capacitacion y Evaluacion Economica
- Diseño e Implementación Estaciones
- Monitoreo de Glaciares y Sensores Remotos
- Uso de Imágenes Fotogramétricas

Peru:
Publications below available at: http://www.glaciaresandinos.com/

General:
- Climate Change in the Tropical Andes, Part I: The Scientific Base (in English)
- Climate Change in the Tropical Andes, Part II: Climate and Glacier Monitoring (in English)

- Climate Change in the Tropical Andes, Part III: Future Recommendations (in English)
- Infografía Escolar: La deglaciación de los Nevados
- ¿Qué hacer ante el Retroceso de los Glaciares?
- El Clima está cambiando: Escenarios Climáticos en el Perú

Cusco:
- Cambio Climático en la Cuenca del Rio Urubamba
- Atlas Climático en la Cuenca del Rio Urubamba
- Variabilidad Climática: Percepciones e Impacto en los Cultivos de Café, Granadilla y Palto en la Subcuenca de Santa Teresa – Cusco
- Estudio de mapas ALOS, Cusco
- Disponibilidad Hídrica Actual y Futura en Santa Teresa, Cusco
- Caracterización y Aptitud Agroclimática de los Cultivos de Café, Granadilla y Palto en el Distrito de Santa Teresa – Cusco
- Caracterización y Evaluación de la Utilización de la Agrobiodiversidad Subtropical y Andina como Medida de Adaptación al Cambio Climático en Santa Teresa – Cusco
- Impacto del Cambio Climático y Medidas de Adaptación para los Cultivos de Café, Ganadilla y Palto en la Subcuenca de Santa Teresa, Cusco
- Escenarios de Cambio Climático en la Cuenca del Rio Urubamba para el año 2100
- Los Cambios del Clima y sus Impactos en Santa Teresa - Cusco

Junín:
- Cambio Climático en la Cuenca del Rio Mantaro
- Atlas Climático en la Cuenca del Rio Mantaro
- Variabilidad Climática: Percepciones e Impacto en los Cultivos de Papa y Maíz Amiláceo en la Subcuenca del Rio Shullcas, Junín
- Estudio de mapas ALOS, Junín
- Disponibilidad Hídrica Actual y Futura en la Subcuenca del Rio Shullcas, Junín
- Caracterización y Aptitud Agroclimática de los Cultivos de Papa y Maíz Amiláceo en la Subcuenca del Rio Shullcas, Junín
- Impacto del Cambio Climático y Medidas de Adaptación para los Cultivos de Papa y Maíz Amiláceo en la Subcuenca del Rio Shullcas, Junín
- Evaluacion de Praderas del Proyecto: Conservacion de Praderas
- Plan de Gestión Integrada de Recursos Hídricos de la Subcuenca del Rio Shullcas
- Escenarios de Cambio Climático en la Cuenca del Rio Mantaro para el año 2100
- Determinación de la Disponibilidad Hídrica Presente y Futura en la Subcuenca del Rio Shullcas
- Los Cambios del Clima y sus Impactos en Shullcas - Junín

Piura:
- Evaluación de los Impactos del Cambio Climático en la Hidrología de Montaña
- Modelamiento de la Contribución de Paramos en la Hidrología del Perú

Also available at http://www.glaciaresandinos.com/ are Project videos, including two in English:
- Adaptation to the Impacts of Rapid glacier Retreat – PRAA Peru Project in Cusco
- Adaptation to the Impacts of Rapid glacier Retreat – PRAA Peru Project in Junin

Annex 10: Detailed description of original components

Project components, as described in the Project Appraisal Document, were:

Component 1 (Planning). Detailed design of key selected adaptation measures (GEF-SCCF contribution US$0.4 million; total cost US$1.1 million):

The objective of this component is to complete the design of at least six strategic adaptation measures to be implemented under Component 2. The objective will be achieved through the following activities:

Subcomponent 1.1. Design of glacierized basin impacts map (GEF-SCCF contribution US$0.1 million; total cost US$0.6 million): This subcomponent will apply global climate circulation models developed and run by the Earth Simulator in Japan and use the data generated through project preparation funds to quantify impacts on glacier retreat, runoff availability, and water regulation at basin levels. Under this activity, participating countries will develop an impacts map for the selected glacierized basins. The basins were selected through a set of agreed criteria and in consultation with key stakeholders during Project preparation.

Subcomponent 1.2. Detailed design of specific adaptation measures (GEF-SCCF contribution US$0.2 million; total cost US$0.4 million): This subcomponent will overlay the impacts map designed under Subcomponent 1.1 on the existing and/or planned regional government programs and investments to adapt to glacier retreat impacts. This activity will support the detailed design of specific adaptation measures, already selected through a broad consultation with major stakeholder groups in each of the participating countries. Design of the pilot adaptation measures will also include a strong monitoring mechanism to generate data (e.g., on costs) to feed into the overall monitoring and evaluation (M&E) system of the Project developed under Component 3.

Subcomponent 1.3. Public outreach and dissemination of information (GEF-SCCF contribution US$0.100 million; total cost: US$0.100 million)**:** This subcomponent has the following objectives: (i) to improve public knowledge of the actual and expected local impacts of climate change on tropical glaciers and how their recession will directly affect associated catchments' ecosystems and socioeconomic activities in the Andean region; (ii) to disseminate existing information on climate change, high mountain ecosystems, and glacier retreat recession, and their impacts on: 1) water supply systems for human consumption and agricultural and livestock use, and the 2) energy sector; and (iii) raise international awareness on the economic and social costs of tropical glacier retreat.

Outcomes of this component: Integration of the issue of glacier retreat in the regional/local planning of relevant glacierized basins.

Component 2 (Investment). Implementation of pilot adaptation measures (GEFSCCF contribution US$5.94 million; total cost US$25.55 million):

Most of the Project's funding will go into investments in specific adaptation measures addressing the most pressing priorities in each country, on a pilot basis. The component includes the following activities:

Subcomponent 2.1. Implementation of pilot adaptation measures in selected communities and sectors highly vulnerable to the effects of glacier retreat. The following pilot adaptation

interventions for each country have been selected on the basis of magnitude of the impacts and cost and will be designed during the first year of Project implementation.

ECUADOR

Pilot 1: Increasing water supply resilience for Quito (compensation of regulation loss in the Antisana watershed) (GEF-SCCF contribution US$0.668 million; total cost US$5.868 million). The objective of this pilot is to implement a climate change adaptation strategy for water supply to the city of Quito and surrounding *parroquias*. The pilot will include following subactivities: (i) support to the development of a new potable water supply project for the Quito metropolitan district (QMD), (ii) implementation of climate change adaptation measures aimed at conserving and managing other basins that supply potable water to QMD, specifically focused on water demand management aiming at reductions in per capita use, for example, the adoption of water efficient devices for domestic use; and (iii) implementation of a monitoring system to assess water availability and the evolution of the impacts associated with global warming. The new potable water supply will be implemented in a manner that would avoid impacts on other users (i.e., through the tapping of sources that are not currently in use by other communities, including non urban communities to ensure there is no negative impact on them).

Pilot 2: Integrated Watershed Management Plan for the Antisana microcatchments to better cope with the impacts associated with glacier retreat (GEF-SCCF contribution US$1.282 million; total cost US$2.027 million). The objective is to: (i) compensate for the decrease in the effectiveness of water storage capacity, due to increases in precipitation variability in selected catchments; (ii) minimize the potential negative effects of climate change on highly vulnerable local communities in the area, which in most cases live in poverty conditions; and (iii) develop a participatory páramos management plan in order to protect and maintain healthy associated ecosystems and hydrological balance, and implement its main strategic adaptation measures. The main activities include the development and adoption of a community-based Catchment Management Plan including: (i) development of participatory integrated management plans for selected microcatchments and *Páramo* ecosystems; (ii) implementation of a community strengthening program for each participating community; (iii) focusing attention on sectors where climate change will most seriously impact the existing ecosystems, and where adaptive practices are more relevant; and (iv) implementation of alternative productive programs within a production chain approach suitable for local communities and other relevant actors. On the ground measures are: revised water demand management plan (with emphasis on net reductions on per capita water usage), climate resilient agricultural plan (with emphasis on promotion of drought resistant cultivars for crops raised in the community), fire management plan for Paramo vegetation (with an emphasis on fire prevention and response system). All mentioned activities will incorporate climate change considerations, including assessments of glacier runoff and of increased evapotranspiration and temperature in the high mountain ecosystems of the Andes.

BOLIVIA

Pilot 1: Integrated Watershed Management in the Tuni and Condoriri basins, incorporating the impact of rapid glacier retreat (GEF-SCCF contribution US$1.2 million; total cost US$2.873 million). This activity seeks to include provisions that compensate for the impacts of glacier retreat on water availability through: (i) development of a strategic water management plan for the Tuni and Condoriri basins; (ii) replacement of water regulation loss through the design and set up of water impounding schemes and other key, high-priority interventions (i.e., optimization of existing

infrastructure to reduce losses in water supply to urban users) required to compensate for the loss of water regulation capabilities in the glaciers; (iii) operation of a monitoring and evaluation system to identify lessons learned and guide policy dialogue.

Pilot 2: Integrated Pilot Catchment Management Plan for watersheds affected by rapid glacier retreat in the Bolivian plateau and high valleys (GEF-SCCF contribution US$0.75 million; total cost US$1.1 million). This pilot will support activities to adapt agriculture and livestock activities to the loss of water regulation and supply caused by glacier runoff in the Bolivian plateau and high valleys. Specific activities include: (i) building and operating small civil structures in selected places where water scarcity induced by glacier retreat is projected to stress local economic activities; (ii) implementing reforestation and revegetation to decrease erosion rates, and promote infiltration; (iii) applying water conservation practices (drip irrigation and mulching, closed water tanks) for agricultural and livestock activities; (iv) implementing a Water Management Plan with the help of local communities to make efficient use of reduced water resources in their daily activities.

Pilot 3: Mainstreaming Adaptive River Defense for the Huayhuasi and El Palomar Settlements (WB US$0.427 million; total cost US$0.477 million). The objective of this pilot is to develop a social model that entails the implementation of measures for disaster prevention and reduction of vulnerabilities to climate change impacts. The pilot aims to decrease risk and vulnerability to extreme events (floods) of the Huayhuasi and El Palomar rural communities in the La Paz River. This will be done through the implementation of adaptation pilots (improved adaptive construction), which will count on communal participation for the regulation and control of the La Paz River by means of adaptive best practices for disaster risk management.

PERU

Pilot 1: Implementation of a Water Management Plan aimed at: (i) improving water use practices in the agricultural and livestock sectors, and (ii) improving water storage infrastructure at selected basins' headwaters to address negative effects caused by temporary increase in runoff (GEF-SCCF contribution US$0.815 million; total cost US$4.640 million). The activity seeks to improve water availability and its use for agriculture and livestock through: (i) the implementation of a Water Management Plan to improve water use practices (systems for irrigation, improvement in efficiency of water use to compensate the reduction in water regulation induced by glacier retreat); (ii) the improvement infrastructure for water storage in selected areas to prevent negative impacts due to overflows caused by temporary increase in runoff from accelerated glacier melting to address negative effects caused by temporary increase in run-off : (a) a glacier lake outbursts early warning systems to prevent negative impacts due to overflows caused by unstable moraine-dammed glacial lakes; (b) a disaster prevention program to protect local communities from catastrophic events such as glacier outburst floods, including an action plan to help communities cope with glacier catastrophes caused by rapid glacier retreat; the resources will be applied, as a pilot, in the upper Mantaro Valley. (iii) the development of a reforestation program at the basin headwaters in Shullcas (Mantaro Valley, Junín) and Santa Teresa (Vilcanota–Urubamba Valley, Cusco), which may include the following activities: 1) Preparing plants in nurseries for the reforestation of 1,900 hectares at the basin headwaters in Shullcas and reforestation of 400 hectares in Santa Teresa. 2) Developing and implementing a forestry management plan and training sessions for its execution by local communities. (iv) the implementation reforestation to promote water retention. It will also facilitate the creation of a protected natural area for the purpose of protecting and conserving the hydrological system of the Huaytapallana glacier and associated small lakes as

the principal source for the generation of water resources, biodiversity, and the scenic beauty of the upper zone of the Shullcas River basin. **(v)** Facilitating the generation of specific projects that are in line with development and research aimed at the conservation of the area's natural resources

Pilot 2: Implementation of an Agricultural Production Plan that compensates for reduction of water availability to the agricultural sector as a result of rapid glacier retreat (GEF-SCCF contribution US$0.965 million; total cost US$6.965 million). This pilot will implement a plan for the diversification of agricultural production which will aim to improve competitiveness and food security, reduce agricultural production losses, and implement agricultural good practices adapted to the anticipated consequences of glacier retreat in the area. It would include the following actions: (i) identification and implementation of pilot plots of drought-resistant crops; (ii) facilitate the purchase of seeds and inputs to promote drought-resistant cultivars in the areas of the Shullcas and Santa Teresa sub-basins; (iii) promote changes in agricultural exports to adapt to anticipated conditions and address the basic needs of financing for the purchase of seeds and inputs for production in the areas of Shullcas and Santa Teresa sub-basins; (iv) develop a program for the application of adapted agricultural practices; and (v) develop a program for technology transfer to sustain adapted agricultural practices in the Mantaro Valley.

Pilot 3: Implementation of an Integrated Water Management Plan that incorporates reductions in glacier runoff contributions in Huancayo (GEF-SCCF contribution US$0.260 million; total cost US$1.155 million). **Objectives:** To improve the availability of water for human consumption by rationalizing the use of water and through research on alternative sources of water supply. The following activities are contemplated: (i) implementing improvements, as required, of the drinking water supply infrastructure (storage tanks and reservoirs and rain collection systems); (ii) implementing a strategy to plan the use of drinking water and agricultural water; (iii) developing a program with local communities on the rationalization and efficient use of water for human consumption (adoption of water-saving practices and tools).

Outcomes of this component: The key outcome of this component is the incorporation ofglacier retreat impacts in sector policies in the areas of intervention.

Component 3 (Scientific Support). Monitoring of glacier retreat in the region (GEFSCCF contribution US$0.450 million; total cost US$2.30 million)**.** The first two subcomponents (3.1 and 3.2) would support, primarily with assistance from a Climate Change Implementation Grant and from other technical and scientific institutions, the installation and operation of a monitoring network to measure the gradual process of glacier retreat in the region in order to enable better long-term planning for further adaptation of policy and interventions. The third subcomponent (3.3) is financed by GEF-SCCF and is aimed at analyzing and monitoring the behavior of tropical glaciers and related wetlands in light of climate change. Component 3 will not only be supported by GEF-SCCF and CCIG grants but it will also receive contributions from the Japanese Space Agency, NOAA, and IRD.

The monitoring program has three subcomponents:

Subcomponent 3.1. Design and set-up of field stations to monitor tropical glaciers of economic relevance**.** This component will finance the design, installation, and operation of eight glacier monitoring stations, located at or near tropical glaciers of economic relevance.

Subcomponent 3.2. Use of high-precision remote sensing to monitor tropical glaciers and associated ecosystems through the use of the Japanese Space Agency ALOS satellite (Advanced Land Observing Satellite or DAICHI). This component will support the use of ALOS data for remote sensing of tropical glaciers. Specifically, the component will support: a) data access from ALOS; b) data compilation and storage; and c) data interpretation and use. ALOS data will be complemented with photogrammetry for specific glaciers.

Subcomponent 3.3 (Peru). Analysis and monitoring of the behavior of tropical glaciers and their associated mountain wetlands in light of climate change. This subcomponent will be financed by GEF-SCCF and includes the following activities: a) compilation and analysis of baseline data and analysis of the expected behavior of tropical glaciers in light of climate change: estimates of future glacier retreat for several CC (SERES) scenarios for a variety of GCM and RCM (dynamic downscaling) options. The work would include the analysis of watershed response (hydrology) for selected basins; b) compilation and analysis of baseline data and analysis of the role played by *páramos* (mountain wetlands) in fixing (collecting) atmospheric carbon and in the water cycle, including the monitoring those changes, and providing a sound basis for planning adaptation measures; c) monitoring of water cycles in specific glaciated basins of major economic relevance; d) design and set up of field stations to monitor the hydrology and carbon cycle of mountain wetlands.

Outcomes of this component: Effective use of the monitoring network's information as an input to planning and to decisions taken to support its long-term operation.

Component 4. Project management (GEF-SCCF contribution US$0.70 million; total cost US$3.77 million). This component will support the overall technical coordination of Project activities (including the implementation of a technical monitoring system) as well as the Project's administrative and financial management. It will include goods, consultancy services, travel, and operating costs undertaken by Project management. Specifically, this component will finance the project coordinator, the procurement specialist, other required personnel for project management, and the project's external audits.

Annex 11: Approved changes in Components after MTR

Changes at the component level included the following:

Reorganization of activities to create a new Component: a fifth component focused on the development of regional knowledge and learning activities on adaptation to climate change and glacier retreat was added to the Project. This was requested in order to: (i) provide a more robust regional depth to the Project, with targeted joint regional activities that would benefit from the regional cover and vocation of the activities (the Tropical Andes is a regional hotspot); and (ii) the Project was generating scientific knowledge, methodological approaches and operational expertise in each of the participating countries that could be better systematized, utilized and disseminated by the other participants. The component would promote South-South cooperation, bring worldwide cutting edge research institutions to the region, and support SGCAN on its mandate to promote integration among their member countries on topics relevant at the regional level.

Reorganization of components: the components were reorganized (i.e. some components renamed, some sub-components and activities rearranged) in order to better reflect the logic and interventions of the Project (see the table below). In the original Project, component 1 included both scientific research and the design of the pilot adaptation measures, while component 2 involved the implementation of the pilots. At the time of the MTR it was clear that adaptation measures could not be accomplished independently, there must be an integration of the processes of identification, prioritization and implementation of activities. Sub-component 1.2 (detailed design of specific adaptation measures) was therefore incorporated into component 2 (which was therefore renamed as Design and Implementation of Pilot Adaptation Measures). Sub-component 1.3 (public outreach and dissemination of information) and Sub-components 3.3 b and c were included under the new component 5 to enhance the regional character of dissemination activities.

List of original and restructured Components and sub-components

Original approved project documents	Restructured
Component 1: Detailed design of key selected adaptation measures: (SC1.1) Design of glacierized basin impact maps; (SC1.2) Detailed design of specific adaptation measures; (SC1.3) Public outreach and dissemination of information	Component 1: Development of climate change scenarios and glacier-fed basin impact maps and models
Component 2: Implementation of pilot adaptation measures in selected communities and sectors highly vulnerable to the effects of glacier retreat.	Component 2: Design and implementation of pilot adaptation measures in selected communities and sectors highly vulnerable to the effects of glacier retreat.
Component 3a: Monitoring of glacier retreat in the region: (SC3a.1) Design and set-up of field stations; (SC3a.2) Access and use of high precision sensing to monitor glaciers; (SC3a.3 specific to Peru) Analysis and monitoring of the behavior of tropical glaciers and their associated mountain wetlands; (SC3a.4) Capacity building and Economic Evaluation of rapid glacier retreat* Component 3b: Development of scientific baseline for high mountain ecosystem. Component 3c: Development of specific guidelines for adaptation measures in high mountain ecosystems	Component 3a: Monitoring of glacier retreat in the region: (SC3.1) Design and set-up of field stations; (SC3.2) Access and use of high precision sensing to monitor glaciers; (SC3.3 specific to Peru) Analysis and monitoring of the behavior of tropical glaciers and their associated mountain wetlands; (SC3.4) Capacity building and Economic Evaluation of rapid glacier retreat*
Component 4: Project management.	Component 4: Project management.
	Component 5: Development of regional activities: SC5.1 Public outreach and dissemination of information; SC5.2 Development of scientific baseline for high mountain ecosystems SC5.3. Development of specific guidelines for adaptation measures in high mountain ecosystems SC5.4 Systematization and dissemination of country experiences on design and implementation of adaptation activities, climate change scenarios, glacier monitoring and other studies.

*This sub-component was financed with PHRD resources

Annex 12: Additional changes as part of the Restructuring of the Project

a. Adjustment of pilot adaptation measures: descriptions of pilot adaptation measures in Bolivia, Ecuador and Peru were updated, reflecting the progress made in the identification, prioritization and design of the pilots during Project implementation. For some pilots, the target was adjusted, to take into account the request of the Implementing Agency to limit the number of civil works under the Project, and that the design of several pilots had taken longer than anticipated in the original Project design, because they were complex interventions that required contributions from many institutions, sectors and actors. None of the proposed modifications changed the objectives of the pilot adaptation measures or the scope of the Project.

Modifications proposed for Peru's adaptation pilots did not imply any substantive change. Activities would be carried out as planned, however the pilots would be re-organized to focus on two regional areas (Shullcas and Santa Teresa) instead of type of activities (e.g., agriculture, and water management).[9] This regrouping of activities around areas and not themes reduced the number of pilots from the original three to two (one in Shullcas, one in Santa Teresa) which nevertheless included the same activities foreseen formerly but clustered differently.

In Ecuador, the Project was promoting activities in two different locations with different partners, divided into two pilot projects. The objective of pilot project 1 remained to increase the climate resilience of the water supply to Quito, and the restructuring centralized efforts on the development of knowledge activities to increase the resilience of an existing water supply system for Quito (Pita-Puengasí), as well as small scale interventions to protect the higher areas of the catchment - where most of the water for Quito is extracted- from anthropogenic activities. The pilot would also contribute to the development of a water resources and climate monitoring system and support the generation of data needed for water resources planning in the Pita basin. The content of pilot 2 remained largely unchanged.

In Bolivia, the objectives of the three pilots remained largely unchanged, and the restructuring provided further description for each of them (original Project designs and descriptions were prepared at a general conceptual level). .

b. Adjustment of the Results Framework: outcome (indicated in section 1.3 above) and output indicators in the Results Framework were adjusted to (i) include new indicators for the new Component 5 (regional activities), (ii) revise the targets in function of the Project pace of implementation, and (iii) put more emphasis on the quality of the processes involved in the identification, prioritization, design and implementation of pilot adaptation measures; as well as the ownership by key agencies and institutions. The aim of the changes was to: (i) establish a clear link between Project's objectives and outcomes; and (ii) establish a clear link between outputs and outcomes. The Results Framework (indicating original and restructured indicators) is presented in Annex 2.

[9] The original project documents described a wide variety of activities to be undertaken under each pilot. The amendment focused on developing a set of activities that as a group, aimed at the same objectives of the original pilot descriptions, organized by geographical location instead, rather than by topics.

c. Reallocation of proceeds: the GEF proceeds were reallocated among components:

Table 1: Revised disbursement

Category of Expenditure		Allocation	
Original	Revised	Original	Revised
1. Goods, consultants' services, workshops and non-consultants' services under Part 1 of the project.	1. Goods, consultants' services, workshops and non-consultants' services under Part 1* of the project.	400,000	325,087
2. (a) Works, goods, consultants' services, workshops and non-consultants' services under Part 2 (a) of the project.	2. (a) Works, goods, consultants' services, workshops and non-consultants' services under Part 2 (a)* of the project.	1,950,000	1,907,127
2. (b) Works, goods, consultants' services, workshops and non-consultants' services under Part 2 (b) of the project.	2. (b) Works, goods, consultants' services, workshops and non-consultants' services under Part 2 (b)* of the project.	1,950,000	1,816,807
2. (c) Works, goods, consultants' services, workshops and non-consultants' services under Part 2 (c) of the project.	2. (c) Works, goods, consultants' services, workshops and non-consultants' services under Part 2 (c)* of the project.	2,040,000	2,090,414
3. Works, goods, consultants' services, workshops and non-consultants' services under Part 3 of the project.	3. Works, goods, consultants' services, workshops and non-consultants' services under Part 3* of the project.	900,000	350,565
4. Operating costs, workshops, goods, consultants' services, and non-consultants' services under Part 4 of the project	4. Operating costs, workshops, goods, consultants' services, and non-consultants' services under Part 4 of the project	700,000	700,000
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		7,940,000	7,940,000

d. Updates to the Financing Plan: a number of adjustments were made to reflect the change in the costs of the updated components. Sources of co-financing were updated to reflect the reality of Project implementation as well.

Table 2: Revised Financing Plan (US$M)

Source	**Local**		**Foreign**		**Total**	
	Original	**Updated**	**Original**	**Updated**	**Original**	**Updated**
Borrower/Recipient	**14.14**	**7.93**	**0.0**	**0.0**	**14.14**	**7.93**
GEF	**0.0**	**0.0**	**7.94**	**7.94**	**7.94**	**7.94**
Others	**1.2**	**1.84**	**9.89**	**15.07**	**11.09**	**16.91**
FAO	0.0	0.0	1.0	0.0	1.0	0.0
CCIG	0.0	0.0	0.86	0.86	0.86	0.86
Bilateral Agencies (MRI,GFDRR, IRD, NOAA) and SGCAN	0.0	0.0	1.77	1.46	1.77	1.46
World Bank finance	0.0	0.0	6.26	12.75	6.26	12.75
CARE	1.2	1.84	0.0	0.0	1.2	1.84
Total	**15.34**	**9.77**	**17.83**	**23.01**	**33.17**	**32.78**

e. Operational Manual: in addition to the updates in components and everything that entailed from an operational perspective, two main changes were included:

- Revision and inclusion of a clear definition of the flow of internal procedures within the SGCAN to expedite starting of activities, issuance of contracts, payments, among others. The Project had been experiencing long delays in handling operational procedures and clear guidelines, with specific time frames applicable to the Project were missing.
- An update of the environmental management framework. Further detail is provided in section 2.4 of this ICR.

MAP

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