



PROJECT EXECUTIVE SUMMARY
REQUEST FOR Council Work Program Inclusion
UNDER THE Special Climate Change Fund

GEFSEC PROJECT ID: 2902
IA/ExA PROJECT ID: P098248
COUNTRY: Bolivia, Ecuador and Peru
PROJECT TITLE: Adaptation to the Impact of Rapid Glacier Retreat in the Tropical Andes
GEF IA/ExA: World Bank
OTHER PROJECT EXECUTING AGENCY(IES): Andean Community of Nations (*Comunidad Andina de Naciones, CAN*)
DURATION: 5 years
GEF FOCAL AREA: Climate Change
GEF STRATEGIC OBJECTIVES: Adaptation for Reduction of Disaster Risks Resulting from Climate Change
GEF OPERATIONAL PROGRAM: Special Climate Change Fund (SCCF)
PIPELINE ENTRY DATE: January 27, 2006
EXPECTED STARTING DATE: October, 2007
EXPECTED CEO ENDORSEMENT: August, 2007
IA/ExA FEE: \$674,000

FINANCING PLAN (\$)		
	PPG	Project*
GEF Total	590,000	6,900,000
Co-financing	(provide details in Section b: Co-financing)	
GEF IA/ExA		
Government	200,000	7,200,000
Others	110,000	14,550,000
Co-financing Total	310,000	21,750,000
Total	900,000	28,650,000
Financing for Associated Activities If Any: US\$194 million		

** For multi-focal projects, indicate agreed split between focal area allocations

FOR JOINT PARTNERSHIP**		
GEF PROJECT/COMPONENT (\$)		
(Agency Name)	(Share)	(Fee)
(Agency Name)	(Share)	(Fee)
(Agency Name)	(Share)	(Fee)

*** Projects that are jointly implemented by more than one IA or ExA

CONTRIBUTION TO KEY INDICATORS IDENTIFIED IN THE FOCAL AREA STRATEGIES: The proposed project contributes to the objectives of the Climate Change Focal Area and the Special Climate Change Fund. It specifically focuses on the implementation of key pilot adaptation measures to reduce the anticipated impacts from the catastrophic glacier retreat induced by climate change in the three Andean countries.

Approved on behalf of the World Bank. This proposal has been prepared in accordance with GEF policies and procedures and meets the standards of the GEF Project Review Criteria for work program inclusion.

Steve Gorman
 GEF Executive Coordinator
 Date: (Month, Day, Year)

Jocelyne Albert
 Project Contact Person

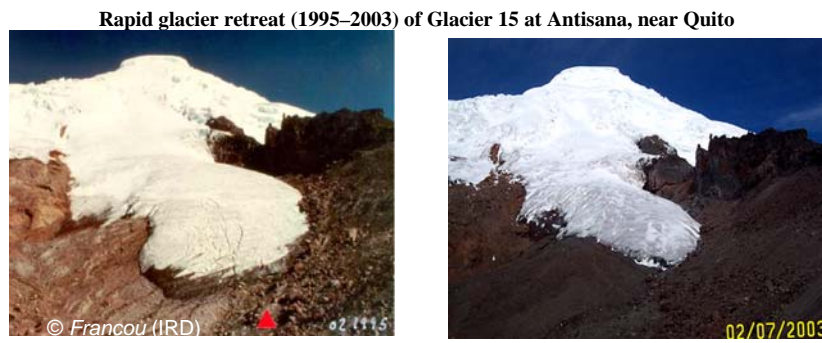
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1. PROJECT SUMMARY

a) PROJECT RATIONALE, OBJECTIVES, OUTCOMES/OUTPUTS, AND ACTIVITIES.

1. Climate change represents a global challenge and is caused by accelerated increases in greenhouse gas concentrations in the atmosphere. The Fourth Assessment Report, Summary for Policy Makers of the Intergovernmental Panel for Climate Change (IPCC-SPM 2007), concluded that the global average surface warming following a doubling of carbon dioxide concentrations over pre-industrial levels, is likely to be in the range of 2 to 4.5°C with a best estimate of about 3°C, and is very unlikely to be less than 1.5°C. A temperature increase of this magnitude is unprecedented. The report also indicates that current CO₂ concentration in the atmosphere in 2005 exceeded by far the natural range during the last 650,000 years. Doubling of CO₂ is now expected to occur within this century. The IPCC's Third Assessment Report summarizes the anticipated climate changes, including warmer temperatures, alterations of the hydrological cycle, drier soils, changes in weather extremes, rising sea levels, changes in agricultural productivity and ecosystem composition. Many of these changes will restrict access to natural resources and environmental goods and services, ultimately affecting both ecosystem stability, and human well-being.

2. **Recent research shows that climate change will be even more pronounced in high-elevation mountain ranges** (Bradley et al. 2006). While much attention has been paid to climate change in the polar region, those mountains that extend into the troposphere have been warming faster than adjacent lowlands. Thus, heavily populated, high-elevation



Source: Cartier 2007

areas in the tropics, such as the tropical Andes, are now experiencing, and will likely continue to experience, dramatic changes in climate. In particular, global warming has been linked to the accelerated retreat of tropical glaciers in the Andes and to an increase in the weather variability and weather extremes affecting the Andean ecosystems with immense repercussions on ecosystem integrity and the welfare of local populations.

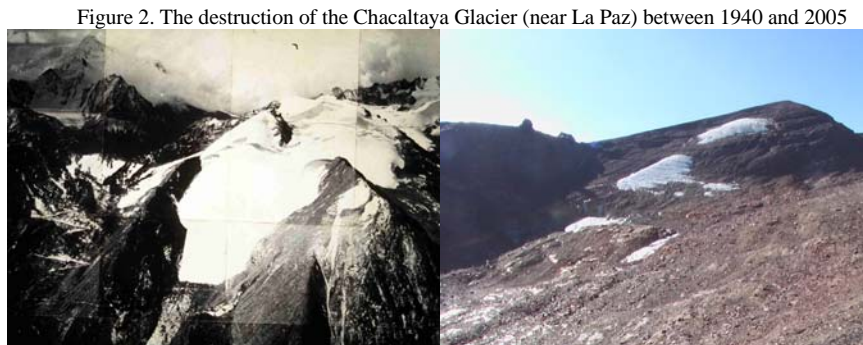
3. **Runoff from tropical glaciers plays a critical role in mountain ecosystem integrity and its reduction will have lasting and pervasive implications for water supply in the Andes.** In the Andes, runoff from glaciated basins is an important element of the regional water budget, and is essential to the integrity of mountain ecosystems (Vergara et. al., 2007). Many Andean valleys are seasonally dry and depend on glacier runoff to maintain extensive mountain biomes. Specifically, glaciers play an important role in freshwater regulation in associated watersheds, assuring year-round water flows for agriculture, potable water, power generation, and the stability of mountain biomes. Thus, glacier retreat in the Andes places in doubt the sustainability of current patterns of water use and ultimately the viability of the economies and ecologies of glaciated basins, and may also have wider impacts on the entire Andes region. The changes induced by tropical glacier retreat constitute an early case of the need for adaptation and therefore an example of the type and size of associated economic and social impacts caused by climate change.

4. **The threat of changes in water supply associated with tropical glacier retreat has only recently received attention.** Global projections rely on models which, due to their coarse resolution, are inadequate to resolve the steep topography of long and narrow mountain chains, such as the Andes. As a consequence, climate change in high tropical locales is not well simulated in these models. Indeed, when considering the rate of warming in the free troposphere (e.g., Bradley et al. 2004, 2006) rather than at the surface, it becomes evident that warming in the tropical Andes is likely to be of similar magnitude as in

the Arctic, and with consequences that may be felt much sooner and that will affect a much larger population.

5. **The pace of glacier retreat has accelerated and thus requires urgent actions to understand and address its implications.** Field observations and historical records have been used to document the reduction of tropical glaciers over the length of the Andes. This information shows that glacier retreat rates used to be moderate but have accelerated in recent decades. Glacier retreat in the Andes is consistent both with upward shifts in the freezing point isotherm and the Equilibrium Line Altitude (ELA), where glacier accumulation balances with ablation. Thus, although sensitivity to temperature for specific glaciers is dependent on local climate characteristics, this retreat coincides with an overall warming of the Andean troposphere. Recent work done in the process of formulation of the proposed project indicate that global warming will induce a very rapid glacier retreat in the tropical Andes region that will further exacerbate changes already measured.

6. Tropical glaciers in the Andes (those located between Bolivia and Venezuela) 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.



Source: Ramirez 2007

The largest of these glaciers in the Cordillera Blanca have lost 15 percent of their glacier surface area in a period of 30 years. Many of the smaller glaciers in the Andes have already been heavily affected and others are likely to completely disappear within a generation. For example, the Chacaltaya glacier (located in Bolivia, see figure 2) has lost most of its surface area, and may completely disappear by 2010 (Francou et. Al., 2006).

7. **Glacier retreat will affect regional water supply.** Changes are expected in regional water supplies, including in areas that are already water short, placing millions of already economically and environmentally stressed ecosystems and inhabitants at further risk of inadequate supplies (Vergara et. al. 2007). Glacier retreat results in a temporary increase in runoff. Once glaciers melt, water availability will be severely affected. For large urban centers such as Quito in Ecuador (pop. 2.0 million) where glaciers (Antisana and Cotopaxi in particular) supply one-third of Quito's drinking water, or La Paz and El Alto in Bolivia (pop. 2.3 million) where the glaciers of the Cordillera Real have until recently supplied 30–40 percent of potable water, the changing circumstances can affect costs of supply and ultimately the ability of urban centers to maintain vibrant economies.

8. **Glacier retreat and other climate changes will impact local agriculture.** Semiarid mountainous ecosystems in the region are highly vulnerable to disruption of local hydrological patterns, placing subsistence agriculture and consequently rural livelihoods at risk. Anticipated dramatic fluctuations in the hydrological cycle will exacerbate already stressed ecosystems and reduce biodiversity and productivity of highland agricultural lands because of unreliable water supply. The adaptive limitations of less-developed areas will likely increase the disparity in food production and food security in rural highlands. As much of the lowlands' basins depend on tributary streams coming from the Andes, impacts will also be felt downstream.

9. **Glaciers fed rivers are major source of hydro power in these countries.** The region relies on hydropower to cover most of its power requirements, and many rivers that are used to generate hydroelectricity are glacier- or mountain-lake fed. Indeed, most power generation in Peru (80 percent) and Ecuador (50 percent) is met through hydropower. Reduction in water flows will reduce the potential for

power generation and directly induce a carbonization of the power sector (countries returning to thermal power plants to make up for reduced hydropower potential), therefore increasing the greenhouse gas emissions of these systems. Recent studies in Ecuador suggest that during the low-water period, the Paute Project (Paute River basin) would only be providing between 43 and 45 percent of average power capacity; this represents a deficit of about 27 percent compared to energy production under normal conditions.

10. Although the Andean countries contribute little to the cause of this problem, they face potential social, ecological and economic costs from climate change induced impacts. To understand vulnerability, adaptive capacity and devise mechanisms to address these potential impacts, these countries have already initiated a number of activities, in particular:

- **PERU:** The Government of Peru has formed the National Council on Climate Change (CNCC), a consultative technical group which is part of the Structural Framework of Environmental Management. The result of this effort is a National Climate Change Strategy, which is a basis for the formulation of a nationwide program on climate change, with an emphasis on adaptation to anticipated impacts. The strategy calls for: i) Strengthening of regional and national climate observation systems to facilitate their integration with worldwide networks; ii) Identification of a National Research Agenda; iii) Evaluation of the country's present and future vulnerability; and (iv) Prioritized evaluation of specific ecosystems, for example, mountain ecosystems and the availability of glacier-fed water resources.
- **ECUADOR:** The Government of Ecuador has strengthened the planning process and initiated a national development plan for the period 2007–2015. In this context, the National Committee on Climate has begun a process aimed at having the National Government declare a national climate policy as an essential element for sustainable development. This policy is already drafted and is in the process of being discussed with different stakeholders. Various State agencies, as a result of studies and research associated with their specific areas of expertise (climate data generation, power generation, provision of drinking water, etc.), have generated guidelines related to water resources and climate change that have been incorporated, or are in the process of being incorporated, into the respective planning.
- **BOLIVIA:** The Government of Bolivia has promoted a series of activities on climate change that include: i) Greenhouse gas reduction and carbon sequestration, in which the State participates as the owner of natural resources, in the generation of surpluses through certification, international negotiation, fair and supportive sale and distribution of the benefits generated by marketing in international carbon bond markets; ii) Adaptation to global environmental climate changes; iii) Implementation of the international environmental agenda in Bolivia as an instrument to enable the country's economic and social development, promoting productive empowerment and transformation, and strengthening investment initiatives for sustainable development; iv) Consolidation of a National Strategy for Implementation of the Climate Change Convention, promoting climate change adaptation efforts that enable rural development and the generation of national skills to fight against the risks and impacts of climate change by including communities in a process that enables their socioeconomic development; and v) promotion of the use of the Clean Development Mechanism.

11. Nevertheless, the urgency of the climate change induced crisis on the Andes region require of the development and implementation of specific adaptation measures that can illustrate the costs and benefits of adaptation and serve as a basis for a scale up effort in the future. In addition, limited experiences at global scale hinder the design of any adaptation measures that can be readily applied in these countries. Therefore, any large scale adaptation activities need to be designed only after drawing lessons from few pilot investments and evaluation of these pilot investments. Also, there remain gaps in the understanding of the dynamics of these changes that require additional attention.

12. To address these gaps, the Andean governments have requested the World Bank and the Global Environment Facility (GEF) and other agencies, for support in designing and carrying out the activities under the proposed project. This proposed project will complement the existing programs and activities funded by these governments, bilateral and multilateral donors, and other institutions. With the existing portfolio of mitigation and adaptation projects and significantly large portfolio of sectoral investments, the World Bank has gained vast knowledge to provide assistance to the Andean countries in addressing the impacts of catastrophic glacier retreat in water and power supply. In addition, the strong partnership between the Bank and GEF provides unique opportunity for these government in devising appropriate adaptation measures and climate proofing their programs and investments.

13. **The development objective of the proposed project is to implement adaptation measures to meet the anticipated consequences of the catastrophic glacier retreat induced by climate change.** This will be achieved by: a) supporting the detailed design of selected adaptation measures; b) implementing regional and strategic adaptation pilots to address key impacts from rapid glacier retreat on selected basins; and c) supporting continuing observation and assessment of glacier retreat and the associated impacts on the region (no GEF resources requested for this activity). The measures will be located in vulnerable highland glacial-dependent watersheds, other associated ecosystems, and regions of mutual interest to participating member countries, where the combined impacts of glacier retreat on global commons and on the prospects for local sustainable development are the highest.

14. The total cost of the project is \$28.65 million of which \$6.9 is being requested from Special Climate Change Fund (SCCF). Remaining cost will be financed by: (i) the Republic of Peru, Ecuador and Bolivia (US\$ 7.2 m); (ii) the Swiss Development Corporation (SWF 5 million, US\$5.5 m equivalent); (iii) a Climate Change Implementation Grant (US\$ 0.9 m); (iv) the United States NOAA (US\$0.3 million) (v) the Meteorological Research Institute of Japan (US\$1.0 million); (vi) *Empresa de Acueducto de Quito* (US\$4.7 million); (vii) The Andean Community of Nations (US\$0.25 million); and (viii) other donors (US\$1.9 million, to be confirmed).

15. The adaptation project is associated with four Bank investments in the region with a total cost of US\$194 million, to which the project adds US\$28.7 for a total of US\$222.7 million. The Bank investments were designed in parallel but now with the contributions of the adaptation project will be able to incorporate a climate change overlay, specifically targeting the impacts of rapid glacier retreat. These investments and their linkage to the adaptation project are detailed in page 89 of the PAD.

Associated Bank Investments			
Country	Associated Bank investment	Associated Bank investment Project Cost	Adaptation Project link
Ecuador	Ecuador: Rural and Small Towns Water Supply and Sanitation Project II (PRAGUAS)	US\$ 48 million	Pilot adaptation activities in rural communities in the Antizana Plateau will be considered for replication under PRAGUAS
Peru	Peru: Agricultural Research and Extension APL Phase 2	US\$ 69 million	Adoption of agricultural practices in glacier-dependent watersheds will inform the agricultural research and extension activities under the APL phase two. Practices are expected to benefit from the results of the pilot.
	National Rural Water Supply, Sanitation and Health Project	US\$ 50 million	Information from the pilot adaptation activities will be used to further strengthen community management abilities, and introduce new concepts to better cope with the impacts of rapid glacier retreat in communal economic and social activities under the National Rural Water Supply project.
Bolivia	Community-Based Land Distribution Project	US\$ 17 million	In the Bolivian Plateau, the adaptation project 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. The data from these activities will be direct benefit to actions under implementation by the land distribution project in the common area of influence of both initiatives.
Total		US\$194 million	US\$28.7

Baseline Scenario and Additionality of Proposed Project:

16. The proposed Regional Andes Adaptation Project baseline is represented by a scenario in which the adoption of specific measures to address the impacts caused by glacier retreat will not take place. This is due to critical but progressive needs which compete with immediate economic development requirements. The following projects have been identified as the baseline scenario in the three participating countries and how the proposed project adds on to the baseline to integrate the climate change induced impacts in these investments:

- Ecuador: Rural and Small Towns Water Supply and Sanitation Project II (PRAGUAS)

This US\$ 48 million World Bank operation addresses the main shortcomings identified for the Water Supply and Sanitation (WSS) sector in Ecuador. The second phase seeks to promote better service in 25 intermediate towns by strengthening and empowering local authorities to delegate WSS services to autonomous operators. The selected approach will improve water service provision, but will do so by concentrating efforts in the short to medium term.

How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Ecuador?

The proposed Adaptation pilot will focus in the area of Antizana glacier, including rural communities and will explore, within the scope of existing good practices and government programs, options to cope with the consequences of rapid glacier retreat. Emphasis will be given

to adaptive planning (planning based on climate projections) as well as on water conflict resolution alternatives, as it is expected that in the future water scarcity has the potential to trigger social and economic tensions. Lessons learned would be replicated in other towns sited in glacierized basins that could be sponsored through the baseline project.

- Peru: Agricultural Research and Extension APL Phase 2

This US\$ 69 million World Bank project will contribute to the expansion, strengthening, and institutional development of the rural agricultural technology and innovation system led by the private sector. It will advance a decentralized market for professional services for agricultural innovation. It will strengthen producer organizations as clients of quality services, and improve entrepreneurial capacity of private service providers. It will also strengthen agricultural research and technological development for innovation in strategic areas of national importance, and to strengthen institutional and professional competence through “centers of excellence”

How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Perú?

Activities to be developed under the proposed Regional Adaptation Project do present a very good example of synergies between adaptation and development projects. Although the proposed adaptation project does not include an agriculture research component, it is clear that farmers confronted with the impacts of rapid glacier retreat will have to adjust their production practices and products to future water availability. Research into drought resistant species and new species suitable to future conditions is needed. The proposed adaptation project will provide the experience required to define priorities and will promote an environment for acceptance of new varieties.

- Peru-National Rural Water Supply, Sanitation and Health Project

This World Bank US\$ 50 million project aims at:(a) implementing demand-responsive and sustainable basic water and/or sanitation services for approximately 1.5 million people in rural communities through the construction and/or rehabilitation of water points, piped systems, and sanitation facilities;(b) strengthening local communities' capacity to manage services, by (i) supporting an effective community participation process during the entire project cycle; (ii) introducing sound financial and economic principles to value water and sanitation services; and (iii) forming and training community-based water committees (JASSs).

How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Perú?

The National Rural Water Supply, Sanitation and Health Project started in 2002 and works within communities that are sensitized to express their need and build consensus on their priorities on water supply and sanitation. Also these communities receive training to manage their water services. Information from the pilot adaptation activities will be used to further strengthen community management abilities, and introduce new concepts to better cope with the impacts of rapid glacier retreat in communal economic and social activities under the National Rural Water Supply project.

- Bolivia Community-Based Land Distribution Project

The objective of this World Bank US\$ 17 million Project is to establish a decentralized beneficiary driven mechanism that allows organized landless or poor farmers to acquire suitable agricultural lands and implement investment subprojects that would increase their income. It is estimated that this project would benefit between 1,500 and 3,000 poor rural families.

How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Bolivia?

In the Bolivian Plateau, the adaptation project 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. The data from these activities will be direct benefit to actions under implementation by the land distribution project in the common area of influence of both initiatives. The Adaptation project will add the climate change perspective, and the concepts of adaptive management to the Community-based Land Distribution Project.

17. The proposed project has three components which are consistent with the project objectives:

Project Components/Outcomes	Co-financing (\$)	GEF (\$)	Total (\$)
1. Modeling of future climate and identification of vulnerable investment programs	4,850,000	400,000	5,250,000
2. Implementation of pilot adaptation measures	14,100,000	6,000,000	20,100,000
3. Monitoring of glacier retreat and associated impacts in the region	1,900,000	0	1,900,000
4. Project management budget/cost*	900,000	500,000	1,400,000
Total project costs	21,750,000	6,900,000	28,650,000

Component 1: Detailed Design of Key Selected Adaptation Measures (GEF contribution US\$0.4 million; total cost US\$5.25 million)

18. 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:

19. **Sub-component 1.1 – Design of Glaciarized Basin Impacts Map:** This sub-component 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 glaciarized basins. The basins were selected through a set of agreed criteria and in consultation with key stakeholders during project preparation. These criteria and consultation process is described in Annex 1 of the GEF Project Brief.

20. **Sub-component 1.2 – Detailed Design of Specific Adaptation Measures:** The sub-component will overlay the impacts map designed under sub-component 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 mechanisms to generate data (e.g., on costs) to feed into the overall M&E system of the project developed under component 3.

21. **Sub-component 1.3 – Public outreach and dissemination of information:** 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; (iii) raise international awareness on the economic and social costs of tropical glacier retreat.

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

Component 2: Implementation of Pilot Adaptation Measures (GEF contribution US\$6.0 million; total cost US\$20.10 million)

23. The objective of this component is the implementation of pilot adaptation projects in selected communities and sectors highly vulnerable to the effects of glacier retreat. The following pilot adaptation interventions for each country are under formulation and will be appraised prior to CEO endorsement.

- **ECUADOR**

- (i) **Adaptation to the impacts of glacier retreat in the water supply plan for Quito** (US\$ 2,000,000). The objective of this is to incorporate the impact of retreat of the Antizana glacier in the medium term (2010-2040) planning for water supply for the city of Quito. This is a period during which substantial glacier retreat is anticipated. The activity will support: (i) strengthening of existing water infrastructure (water supply pipes and water storage capacity) sufficient to maintain same level of water service with reduced glacier runoff contributions, (ii) speed up of the investments in development of new water sources to internalize water yield reduction and loss of water regulation caused by glacier retreat (through the inclusion of additional creeks in the water supply system to the city of Quito and the use of underground reservoirs); (iii) undertake demand management program to reduce water leaks in the distribution system to Quito to adapt to anticipated reduced water availability per capita.

- (ii) **Integrated Basin Management Plan in the wetlands of the Antisana Plateau to compensate for reduction of water regulation and water availability caused by glacier retreat** (US\$ 1,000,000). The objective is to: (i) compensate for the decrease in water regulation of the Antizana catchment through the construction of water storage capacity and measures to increase water holding capacity in mountain wetlands; and (ii) minimize the potential negative effects on highly vulnerable local communities in the area, which in most cases live in extreme poverty conditions. The main activities include the development and adoption of a community base Catchment Management Plan including: (i) a revised land zoning (incorporating land forms, ecosystems and vegetations formations) that incorporate the concerns of reduced glacier runoffs, increased evaporation and generalized warming of mountain habitats; (ii) design and adoption of adapted land use practices that take into account anticipated climate changes in the Plateau; and (iii) design and implementation of a fire prevention/management plan and a reforestation program with native species to secure water retention and regulation lost through rapid glacier retreat and generalized warming.

- **BOLIVIA**

- (i) **Implementation of a Management Plan for the potable water supply systems in areas affected by the disappearance or reduction of glacier runoffs in the region of La Paz and El Alto** (US\$2,300,000). This activity seeks to include provisions that compensate for the retreat of the Chacaltaya glacier through: (i) study and design of government-planned reservoirs in the urban areas near the cities of La Paz and El Alto; and (ii) construction water supply system that incorporates loss of water regulation caused by glacier retreat, through the addition of water storage capacity (tanks and ponds), in the rural areas of Pucarani and Cohoni.

- (ii) **Integrated Pilot Catchment Management Plan in the Bolivian Plateau** (US\$1,700,000). This 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. Specific activities include: (i) build and operate small ponds in selected places where water scarcity induced by glacier retreat is projected to stress local economical activities; (ii) implement a reforestation and re-vegetation to decrease erosion rates, and promote infiltration; (iii) apply water conservation practices (drip irrigation and mulching, closed water tanks) for agricultural and livestock activities; (iv) implement a Water Management Plan with the help of local communities to make an efficient use of reduced water resources in their daily domestic activities (water recycling and adoption of rainfall collection tanks and spouts).

- **PERU**

- (i) **Implementation of a water Management Plan aimed to: (i) improve water use practices in the agricultural and livestock sectors and (ii) improve water storage infrastructure at selected basin's head waters to address negative effects caused by temporary increase in runoff (US\$ 5,500,000).** The activity seeks to improve water availability and its use for agricultural and livestock through the implementation of a Water Management Plan to (i) improve water use practices (systems for irrigation, improvement in efficiency of water use to compensate reduction in water regulation induced by glacier retreat ; (ii) improve infrastructure for water storage in selected areas to prevent negative impacts due to overflows caused by temporary increase in runoff caused by accelerated glacier melting; and (iii) implement 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.
- (ii) **Implementation of an Agricultural Production Plan that compensates for reduction of water availability to the agricultural sector as a result of rapid glacier retreat (US\$ 1,480,000).** This pilot will implement a Plan for the Diversification of agricultural production which will aim to improve competitiveness, food security, reduction of agricultural production losses and implementation of 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 purchase of seeds and inputs to promote drought resistant cultivars in the areas of Shullcas and Santa Teresa sub-basins; (iii) promote changes in agricultural exports to adapt to anticipated conditions and addressing 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 in the application of adapted agricultural practices; (v) develop a program for technology transfer to sustain adapted agricultural practices in the Mantaro Valley.
- (iii) **Implementation of an Integral Water Management Plan that incorporates reductions in glacier run off contributions in Huancayo (US\$ 600,000).** **Objectives:** To improve the availability of water for human consumption by rationalizing the use of water and research on alternative sources of water supply. The following activities are contemplated: (i) implement improvements as required of the drinking water supply infrastructure (storage tanks and reservoirs and rain collection systems); (ii).implement a strategy for the planning of the use of drinking water and agricultural water; (iii) develop a Program with local communities in the rationalization and efficient use of water for human consumption (adoption of water saving practices and tools).

24. Key outcome of this component is the incorporation of glacier retreat impacts in the water, energy and agricultural sector policies and implications in the areas of intervention.

Component 3: Monitoring of glacier retreat in the region. (No GEF contribution; total cost US\$1.9 million)

25. The project would support, primarily with assistance from a Climate Change Implementation Grant and 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 policy and interventions. The program will be largely supported through a CCIG grant (no GEF contribution) as well as contributions from the Japanese Space Agency, NOAA and IRD. The monitoring program has two sub-components:

26. **Sub-component 3.1:** Design and set up of field stations for monitoring of 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.

27. **Sub-component 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.

28. A key outcome of this component includes the design of a sustainable glaciers' monitoring network in the Andean region that could produce information for local institutions and policy makers.

Component 4: Project Management. (GEF contribution US\$0.5 million; total cost US\$1.4 million)

29. This component will support the overall technical coordination of Project Activities (including the implementation of a technical monitoring system) as well as the administrative and financial management of the Project. It will include goods; consultancy services; travel; and operating costs undertaken by the Project Management. Specifically this component will finance the project coordinator, the procurement specialist, other required personnel for the project management, and the project external audits. Incremental GEF co-financing will be used for goods; consultancy services; travel; and operating costs.

b) **KEY INDICATORS, ASSUMPTIONS, AND RISKS (FROM LOGFRAME)**

30. Key indicators related to the project objectives are:

- Integration of glacier retreat impacts into local, regional, and country level planning, as measured by actions taken during the planning process to ensure such integration.
- Government institutions of Peru, Ecuador, and Bolivia will have the capability to document and disseminate information on the process and the impacts of rapid tropical glacier retreat in the Andes, as measured by technical reports and published papers.
- A sustainable glacier observation and monitoring network, as measured by continuity of records of previous 12 months and allocation of budget for its mid-term operations after the end of project.
- Increase in the global and regional awareness on the catastrophic impacts of rapid tropical glacier retreat as measured through mentions in written media of mass circulation.

31. Key risks and mitigation measures are:

Risk	Mitigation	Rating
Overarching macroeconomic/fiscal constraints remain a key risk in the region.	Project resources will be committed by executing agencies by time of appraisal. External resources will be committed by partners by time of appraisal.	Moderate
Given the long-term nature of adaptation measures, there is a risk that future administrations may not support the activities under the project.	Sustainability mechanisms and local ownership are criteria for the selection of adaptation measures and pilot sites. Local implementation arrangements will be considered for all measures. Pilot Project will be selected based on the local benefits it generates. Sustainability is enhanced if beneficiaries operate the Projects although. This is not always possible. Increased availability of information on climate change will facilitate integration of these issues in local strategic priorities.	High
Mainstreaming of climate change issues remains a concern given the multitude of challenges that the region is facing.	Incorporation of climate change perspective in the water supply, agriculture, and power development plans in affected regions is part of the project. Given the relevance and high visibility of glacier retreat in the region, policy makers are unlikely to ignore the issue.	Moderate
Allocation of national counterpart resources may delay implementation.	Allocation of counterpart resources will be made prior to appraisal for the first year of project operation.	Moderate
Financial constraints may limit sustainability of adaptation measures.	Long-term cofinancing arrangements will be undertaken. Cost-benefit and financial analysis will provide information on the adaptation measures' viability and long-term benefits. Beneficiaries will be encouraged to manage and generate the pilot projects.	Moderate
Regional character may increase transaction costs and create difficulties for project management and implementation.	The governments of Bolivia, Ecuador, and Peru have committed to efficient coordination and administration. The executing agency will be empowered to coordinate across boundaries.	High

Overall risk assessment: **Moderate**.

2. COUNTRY OWNERSHIP

a) COUNTRY ELIGIBILITY

32. Each of the participating countries is a party to the UNFCCC, and has signed the Kyoto Protocol. National Communications coincide in their priorities to identify global climate change impacts that will affect sustainable economic development. Moreover, NC1s encourage the development of adaptation plans, policies, and actions to respond to anticipated climate variability and extremes.¹

¹ Bolivia signed the United Nations Framework Convention on Climate Change (UNFCCC) during the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro in 1992, and ratified the agreement in November 2004. It also produced its First National Communication (NC1) in 2000. Bolivia also structured its National Inter-institutional Committee of Climate Change in 1999.

Ecuador signed the Convention in 1992 and ratified on 23 February 1993. It has developed and adopted Guidelines for Climate Change Policy (1999). The establishment of the National Climate Committee (CNC), by executive decree in June 1999, was a clear signal of the importance of climate change for the country. Ecuador's First National Communication (NC1, 2000) was developed, under the responsibility of the GEF-UNDP ECU/99/G31 Climate Change Project, and with the supervision and support of the Ministry of the Environment, on behalf of the CNC.

Peru ratified the agreement May 24, 1993. Peru produced its First National Communication on March 2, 2001, and established its National Commission on Climate Change-NCCC (involving 13 public and non public institutions) to fulfill the commitments of the Climate Change Convention (UNFCCC). This NCCC (lead by the National Environmental Council-CONAM) proposed the National Strategy on Climate Change which was approved by Supreme Decree on 2003. CONAM directs the PROCLIM project (Peruvian Climate Change and Air Quality Program) which is responsible for implementing part of the NECC.

b) COUNTRY DRIVENNESS

33. The proposed project is consistent with the priorities of participating countries' National Communications.

34. The regional nature of the project is consistent with an ecosystem approach to a problem that is common and unique to the tropical Andes that each of these countries share. Furthermore, the regional approach will allow the development of adaptation activities under different conditions (variations) in the cultural and socio-economic milieu of the different countries, increasing its global knowledge value, while taking advantage of economies of scale.

35. The countries have obtained technical assistance and inter-agency coordination support from participating member agencies, the Andean Community of Nations, the GEF, the Government of Switzerland, and other agencies and potential cofinanciers. The proposed Project has the support of the respective Ministries of the Environment, along with the GEF and UNFCCC Focal Points. This proposal is consistent with the respective National Development Plans and Strategies of the respective participating countries. The project links with US\$194 in World Bank investments that will benefit from the implementation of activities under the project.

36. Country Drivenness is also illustrated through the region's efforts to strengthen the knowledge of the consequences of glacier retreat and the desire to share information on this unique climate change challenge, and associated concerns and adaptive requirements of each member country, and to effectively provide collaborative coordination to this pioneering effort.

3. PROGRAM AND POLICY CONFORMITY

a) FIT TO GEF FOCAL AREA STRATEGIC OBJECTIVES AND OPERATIONAL PROGRAM

37. The SCCF eligibility criteria include that the project should: a) address the adverse impacts of climate change; b) serve as a catalyst to leverage additional resources from bilateral and other multilateral sources; c) be country-driven, cost-effectively and integrated into national sustainable development and poverty-reduction strategies; and d) include technology transfer and its associated capacity building activities. Eligible activities to be funded by SCCF include, *inter alia*: a) water resources management; b) land management; c) agriculture; d) health; e) infrastructure development; f) fragile ecosystems (including mountain ecosystems); and g) integrated coastal zone management.

38. The proposed project is consistent with the objective of SCCF and contributes to its programming principles, in particular:

- In assisting the participating countries to understand potential impacts of climate change in their sectoral policies and programs, and to devise adaptation measures;
- In assisting the participating countries to implement pilot adaptation investments in the management of water resources and land, in agriculture and health sectors, and management of fragile mountain ecosystems; and
- In assisting the participating countries acquire valuable lessons and knowledge, and share them with other countries in the region and in other parts of the world.

b) SUSTAINABILITY (INCLUDING FINANCIAL SUSTAINABILITY)

39. The sustainability of project impacts can be measured in four distinct manners:

- Integration of climate change retreat impacts in governments' planned and ongoing investment activities: The project will add on to these government activities by incorporating the consequences of rapid glacier retreat in planning, designing and implementing development plans, making these plans more sustainable. However, unless quick action is taken by resource intensive societies, glacier melt will only accelerate imposing a heavy burden in the development options of these areas.

- Integration of the issue of glacier retreat in regional and local policies: Adaptation measures implemented under this project will provide lessons that can be incorporated into regional and municipal government policies (water and energy use, for example) and into poverty alleviation policies and strategies.
- Built monitoring and technical capacity: The proposed project will support in implementing a monitoring network to measure the gradual process of glacier retreat in the region. The monitoring network will be equipped with state of the art equipment and field stations. The technical capacity of institutions involved in monitoring the climate change induced impacts, in general, and on glacier retreat, in particular, will be strengthened to enable better long-term planning for further adaptation policy and interventions.
- Provision of tools and demonstrative pilots that can be replicated within the country, region and world: The proposed project is a first of its kind in overlaying, in a pilot basis, the climate change induced impacts on the hydrological cycle of glacier basins. Lessons from the project interventions will be widely disseminated in other parts and sectors of these countries, region and the world.

c) REPLICABILITY

40. The implementation of adaptation pilots will be used to disseminate expertise and know-how. Project outcomes will provide substantive lessons observed and learned regarding climate impact and adaptive practices. The outcome of activities in the glacierized basins will be of direct relevance in other regions of the world subject to the impacts caused by glacier retreat. The development of specific adaptation measures to face the impacts of glacier retreat, under this project is a “first of kind”, that will inform on the cost and benefits of adaptation alternatives.

41. **Dissemination of results**. The results of this and other adaptation projects under implementation in the region will be the focus on the "First International Seminar of Adaptation Practices", which is scheduled to be held in Bogota, next November, with wide participation of policy and decision makers in the region. Additional events are planned for later in the project cycle. Results from the work undertaken will be published in peer reviewed journals. As adaptation measures are successfully implemented, the results will be shared widely amongst practitioners in the region

d) STAKEHOLDER INVOLVEMENT

42. Participating countries have identified, in their National Communications to the UNFCCC, numerous regions, sectors, and populations that are at increased risk from the impacts of climate change, including glacier melt and other changes in the water cycle in mountain areas and downstream watersheds. Project beneficiaries include marginal indigenous *campesinos* and peri-urban populations in areas adjacent to, or dependent on glacial melt flows, and heavily reliant on surface and downstream water for their agricultural subsistence, and potable water supplies. Isolated communities without adequate access to public health facilities will likely suffer increased morbidity from climate-induced water (dysentery, giardia) and vector-borne pathogens (malaria, dengue, lyme disease). Populations and industry that are heavily reliant on glacier-fed outflows for hydro generation and therefore vulnerable to extreme hydrological discharge or drought-induced water loss are also a focus.

43. A Social Assessment is being carried out which will provide detailed information about specific type of communities and farmers that will benefit from project interventions and mechanisms to involve all the major stakeholders in the project activities. Stakeholder participation is the key for the success of project impacts and is an integral part of the project. Consultations have been carried out in each participating countries where all the major stakeholder groups have participated in design of project. The design of adaptation measures and location of interventions will be considered in a consultative process taking into account the eligibility criteria developed during project preparation.

44. As part of the formulation efforts, a consultation and participation process has been undertaken in the region, in the area of influence of the project. The results of the consultation process will be documented in the PAD and executive summary

e) **MONITORING AND EVALUATION**

45. The CAN is responsible for overall monitoring and evaluation. The National Coordinating Units (NCU) will be responsible for monitoring and evaluation of the project at country level. A detailed monitoring and evaluation system and guidelines will be further developed in the project's operational manual which will be produced prior to effectiveness. The NCU will submit to the Bank biannual project progress reports demonstrating project development and financial and physical performance indicators. The Bank will conduct supervision missions to jointly review progress made with regard to objectives and performance indicators. Regular monitoring of project activities will be the responsibility of the NCU, which will prepare semiannual reports on implementation progress. Monitoring is key both for local purposes as well as for the documentation of global benefits. The project will have a complete Project Monitoring and evaluation system.

46. Mid Term Review (MTR): A MTR will be conducted no later than three years after the first disbursement. The external review will focus on: (i) progress in achieving project outcomes; (ii) institutional arrangements for project implementation; (iii) operational manual for payments; and (iv) review of both the project implementation plan and general project operational manual. In preparation for the midterm review (MTR), the Steering Committee, together with the local implementing agencies, will prepare a working book containing the following information: (i) executive summary of the overall project status; (ii) up-to-date description of the overall components' development and indicators; and (iii) detailed description of the status of the proposed adaptation pilots by catchments.

4. **FINANCING** (for all tables, expand or narrow table lines as necessary)

a) **PROJECT COSTS**

Project Components/Outcomes	Co-financing (\$)	GEF (\$)	Total (\$)
1. Modeling of future climate and identification of vulnerable investment programs	4,850,000	400,000	5,250,000
2. Implementation of pilot adaptation measures	14,100,000	6,000,000	20,100,000
3. Monitoring of glacier retreat and associated impacts in the region	1,900,000	0	1,900,000
4. Project management budget/cost*	900,000	500,000	1,400,000
Total project costs	21,750,000	6,900,000	28,650,000

* This item is an aggregate cost of project management; breakdown of this aggregate amount should be presented in the table b) below.

b) **PROJECT MANAGEMENT BUDGET/COST²**

Component	Estimated staffweeks	GEF(\$)	Other sources (\$)	Project total (\$)
Locally recruited personnel*	1500	420,000	380,000	800,000
Internationally recruited consultants*				
Office facilities, equipment, vehicles and communications**		35,000	165,000	200,000
Travel		35,000	165,000	200,000
Miscellaneous***		10,000	190,000	200,000
Total		500,000	900,000	1,400,000

* Local and international consultants in this table are those who are hired for functions related to the management of project. For those consultants who are hired to do a special task, they would be referred to as

² For all consultants hired to manage project or provide technical assistance, please attach a description in terms of their staff weeks, roles and functions in the project, and their position titles in the organization, such as project officer, supervisor, assistants or secretaries.

consultants providing technical assistance. For these consultants, please provide details of their services in c) below. **Office facilities, equipment, vehicles and communications budget will cover incremental costs associated with expenses such as acquisition of office supplies and goods for project implementation (e.g., computer equipment and/or software, communication, etc.). ***Miscellaneous budget will cover costs for evaluation and financial audits.

C) CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	Estimated staffweeks	GEF(\$)	Other sources (\$)	Project total (\$)
Personnel				
Local consultants	170	200,000	310,000	510,000
International consultants	40	100,000	300,000	400,000
Total	210	300,000	610,000	910,000

d) CO-FINANCING SOURCES³ (expand the table line items as necessary)

Co-financing Sources				
Name of co-financier (source)	Classification	Type	Amount (\$)	Status*
Participating Governments (Bolivia, Ecuador, Peru)	National Government	in cash/kind	7,200,000	Financial commitment in Project Aide Memoires
Andean Community of Nations	Regional Agency	in kind	250,000	Financial commitment in Project Aide Memoires
Climate Change Implementation Grant	Japanese Trust Fund	in cash	900,000	commitment confirmed
Switzerland	Bilateral Donor	in cash	5,500,000	commitment expressed
United States National Agency for Oceanic and Atmospheric Administration (NOAA)	Bilateral Donor	in cash	300,000	commitment expressed
MRI	Bilateral Donor	in cash/kind	1,000,000	commitment expressed
Empresa de Acueducto de Quito	Water utility	in cash/kind	4,700,000	commitment expressed
Other Donors	Others	in cash/kind	1,900,000	commitment expressed
Sub-total co-financing			21,750,000	

* Reflect the status of discussion with co-financiers. If there are any letters with expressions of interest or commitment, please attach them.

5. INSTITUTIONAL COORDINATION AND SUPPORT

a) CORE COMMITMENTS AND LINKAGES

47. The last full Country Assistance Strategy (CAS) for Perú was published in December 20, 2002. Recently, a Country partnership Strategy (CPS)⁴ for Peru has been drafted which recognizes the country's vulnerability to both climate change and climate variability and the challenge posed to the Country by glacier retreat, which will impact the country's water supply, agricultural, health, and tourism sectors. This project contributes to the CPS' strategic focus on protection and conservation of strategic ecosystems, increasing their adaptive capacity with regard to GCC impacts. Adaptation activities are designed to strengthen local adaptive capacity, reducing risks and contributing to the adoption of sustainable practices within current programs. The CAS for Ecuador and Bolivia highlight the vulnerability of water resources to changing environmental conditions.

48. The World Bank has been involved in climate change mitigation and adaptation projects in the region, funded through the GEF and other sources, including the Colombia Integrated National Adaptation Project (INAP), which includes an activity in the central mountain range of the Colombian

³ Refer to the paper on Cofinancing, GEF/C.206/Rev. 1

⁴ Country Partnership Strategy for the Republic of Peru, FY07-FY11

Andes. The Bank has also been managing different carbon funds of about US\$1.6 billion. Carbon financed projects that are of relevance include the Colombia Amoyá Environmental Services Project which supports adaptation measures in mountain habitats.

49. The project would also coordinate activities with the TF-funded project “Strategies for Adaptation to the Environmental and Socioeconomic Impacts of El Niño for Rural Communities in Ecuador and Peru,” which is currently aimed at identifying key vulnerabilities and specific capacity-building measures. El Niño events have become more frequent since 1976 with some devastating effects in particular on the economies of Ecuador and Peru and proposed SCCF-funded adaptation activities in Ecuador (see below).

b) CONSULTATION, COORDINATION AND COLLABORATION BETWEEN IAS, AND IAS AND ExAs, IF APPROPRIATE.

50. The proposed project will seek synergies with other projects in these countries being prepared and/or implemented by other GEF agencies and bilateral donors. The proposed project will be coordinated with the Ecuador Water Management and Development and Integration of Climate Adaptation Governance Instruments in Host Government and Practitioner Protocols project. In particular, efforts will be undertaken to ensure full coordination with a proposed national project in Ecuador for the SSCF, dealing with water impacts. The three major outcomes envisioned for this national project are: improved public policy and governance structures for effective water management, increased adaptive water management practices through capacity development and flexible financing mechanisms, and strengthened information and knowledge management on climate risks. Both projects—the Ecuador national project and the Andean regional project—have been designed in close collaboration to ensure that there will be no overlap but rather substantial complementarity. Both projects are expected to be submitted for consideration to the same council meeting.

51. The Ecuador project focuses strongly on water management adaptive governance instruments, and steers away from operational community pilots related to hydrology, thus providing a strong complementarity with regional project activities in the country. The project aims at strong coordination with this activity, involving implementing agencies through an informal coordination committee to ensure that the region’s overall adaptive capacity is strengthened through complementary measures.

52. Key differences between the two initiatives in Ecuador are:

- The regional project focuses on the response to glacier retreat, the national project focuses on governance in the water sector.
- The regional project focuses on high mountain ecosystems and water supply, the national project focuses on agriculture and power generation. The national project focuses on coastal areas.
- In the regional project the water utility of the city of Quito plays a key role. The main stakeholder for the national project is Hidropaute (power utility) in the Paute river basin.

53. Key synergies are:

- Both projects will make use of similar tools to simulate future climate, with the regional project having access to the Earth Simulator and thus in a position to contribute to the analysis under the national project.
- Both projects will be led by the Ministry of Environment.
- Information generated by both initiatives will be shared.

54. Complementarity with Perú Second National Communication. While the second national communication analyzes the vulnerabilities of Peru to the impacts of climate change, the Regional Andes Adaptation Project seeks to demonstrate practically how to reduce a key vulnerability, to rapid glacier retreat, and will support specific measures to adapt to these changes. The experience with the

implementation of adaptation measures will inform the overall process of adaptation to rapid glacier retreat throughout Peru, illustrating costs and benefits.

55. In the area of glacier retreat the communication is expected to contribute with (i) analysis of current glacier hydrology, including an update of previous glacier inventories, glacier variations, and record of glacier melt hazards and disasters; (ii) estimation of the availability of water resources due to glacier melt at the national level up to 2050; and (iii) evaluation of adaptation strategies in the management of hydro resources in the basins with a glacier component under climate change conditions. These outputs will guide the selection process of priority adaptation measures and will strengthen their design. Additionally, the glacier monitoring effort under the regional project will benefit from the analysis under the communication.

56. Furthermore, the proposed project will be implemented in cooperation with several partnership arrangements:

- **Meteorological Research Institute (MRI) of Japan and Japan Frontier Research Institute (JAMSTEC).** Under an agreement reached with both institutions, support will be provided to CAN. Specifically, MRI and JAMSTEC will provide data from the Earth Simulator for use in the development of local climate scenarios and the selection of adaptation measures, training, and scientific exchanges.
- **Japanese Space Agency (JAXA-RESTEC).** JAXA-RESTEC will provide assistance to the project under the terms of a MOU agreement and as a contractor under the CC-IG grant. The support will be geared to glacier monitoring activities.
- **National Agency for Oceanic and Atmospheric Administration (NOAA).** NOAA will support activities under the monitoring component. Specifically, NOAA, under an agreement with the implementation agencies, will complement the resources provides for the installation and operation of field stations designed to complement the remote sensing monitoring of tropical glaciers.
- **Consortia of Glaciology Institutes.** A consortia composed of the Innsbruck Glaciology Institute (Austria), Institut pour le Recherche sur le Développement (France), the Global Monitoring Service, and the University of Massachusetts will provide technical assistance and capacity building, targeting the monitoring of tropical glaciers in the region.
- **Global Glacier Monitoring Service.** The service, based in Bern, Switzerland, will assist with the dissemination of information obtained through the project.

C) PROJECT IMPLEMENTATION ARRANGEMENT

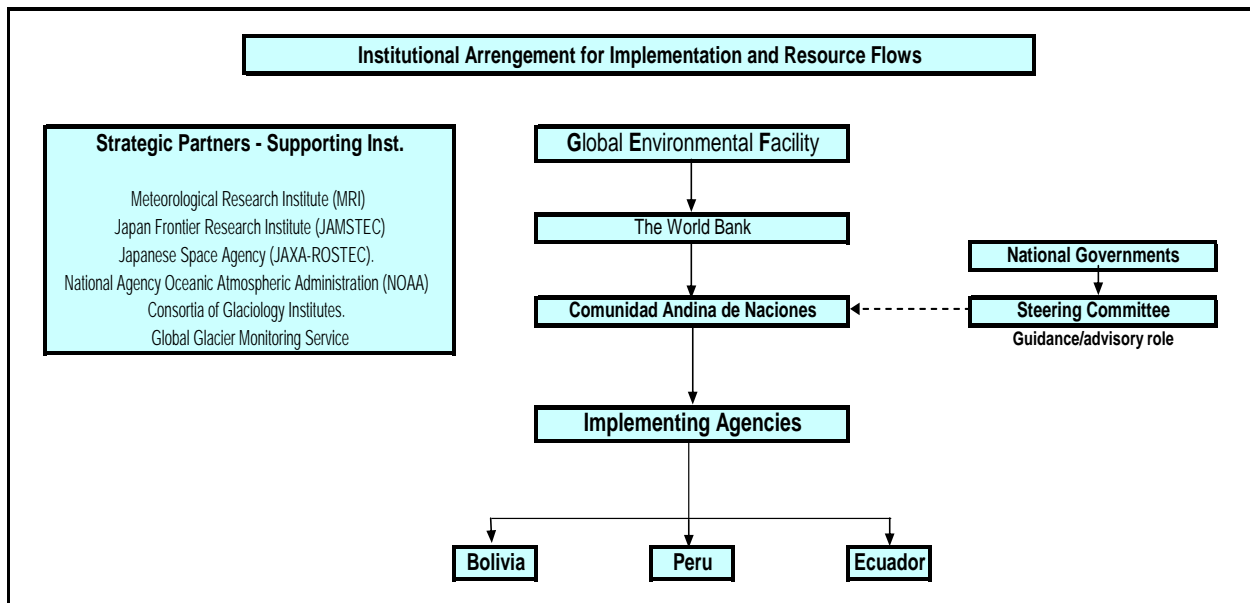
57. **General implementation arrangements (to be confirmed at appraisal):** The GEF grant beneficiaries (the Beneficiary) will be the Governments of Bolivia, Ecuador, and Peru. The grant recipient (the Recipient) will be CAN (Andean Community of Nations) for the benefit of the Beneficiary. The project will be executed by CAN. The administrative and financial management of the project will also be carried out by CAN. CAN will be in charge of the overall technical coordination of project activities.

58. **Technical implementation arrangements:**

- **Steering Committee.** The main responsibility of the Steering Committee involving representatives from the three governments and sector agencies will be to assure the attainment of the projects objectives and targets. The SC will also provide guidance on the implementation of the project and take high level decision regarding the project's development, technical difficulties and management issues. The SC will approve the Annual Operating Plans (AOP) of the project.

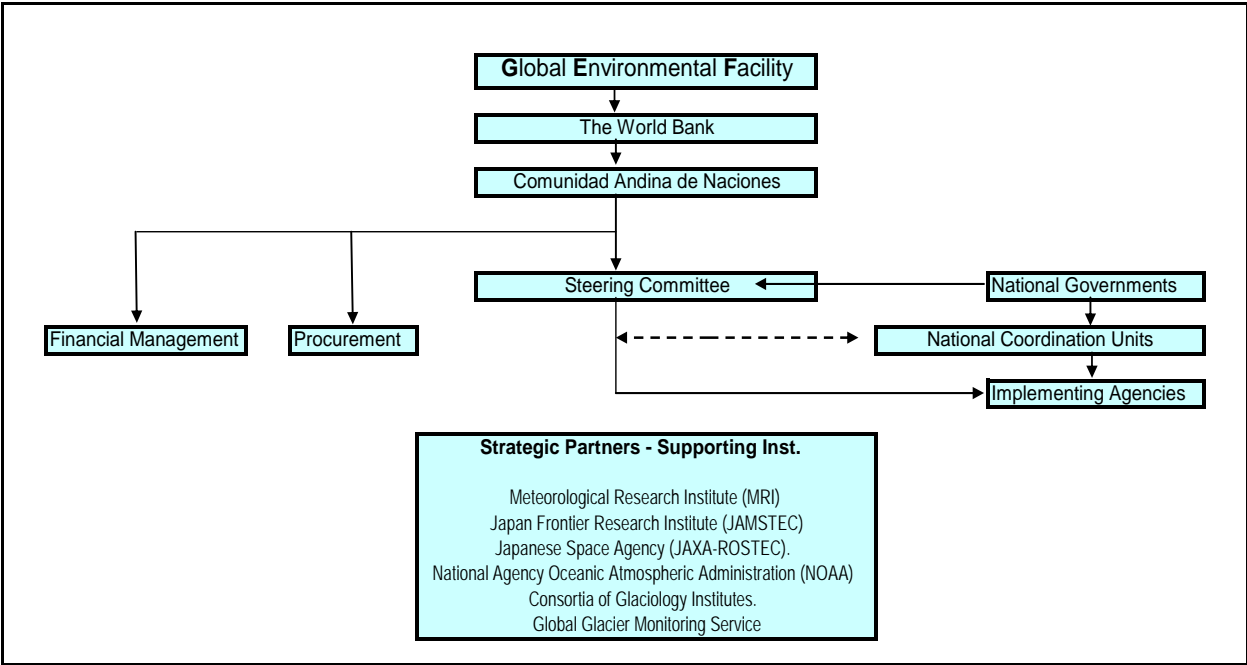
- The **National Coordination Units (NCU)** will be in charge of the operational coordination of the project activities in each participating country. The NCU will finalize the POA⁵, assess the overall project progress. The NCU will ensure the financial, conceptual and methodological coherence among all activities and the integrity of the project. This will also include the provision of feed back to the component coordinators of the executing agencies.
- **CAN** will carry out the administrative and financial management of the project.

59. **The administrative and financial management** of the project will be undertaken through CAN as the recipient of the GEF grant. CAN will enter into subsidiary agreements with regional implementation agencies. The following chart shows the project’s institutional arrangements for implementation and flow of funds. There will be a steering committee created and directed by the national governments of the participating countries, which will maintain a continuous relationship with CAN and will play an advisory role during project implementation.



60. The following chart shows the working structure for the project’s technical implementation. CAN will coordinate operational and logistical activities on a continuous basis with the steering committee (SC), the financial management team, and the procurement team during project implementation. The SC will provide technical and institutional guidance to the project as required and will assure that the project is being implemented in accordance with the project development goals and activities as expressed in the Grant Agreement. For this purpose it will have the direct coordination of the national governments, which will be also in continuous communication with the National Coordination Units (GEF focal points). These focal points will maintain a flow of information to the project and will play a coordinating role with both the SC and the local implementing agencies.

⁵ The POA will include statement of specific objectives for the year, a description of the activities, expected outputs, monitoring indicators, detailed estimated budgets, a procurement plan, indicating the sources of financing in the budget.



ANNEX A: ADDITIONALITY ANALYSIS

Overview

1. The **development objective** of the proposed project is to implement adaptation measures to meet the anticipated impacts from the catastrophic glacier retreat induced by climate change. This will be achieved by: a) identifying ongoing or planned government interventions with outcomes highly vulnerable to rapid glacier retreat and assessing measures and policy options to adapt to the anticipated effects; b) implementing regional and strategic adaptation pilots to address key climate impacts on their economies; and c) supporting continuing observation and assessment of glacier retreat and the associated impacts in the region. Priority will be given to pilots from vulnerable highland glacial-dependent watersheds, other associated ecosystems, and regions of mutual interest to participating member countries, where the combined impacts on global commons and the prospects for local sustainable development are the highest.

Sector Issues Addressed by the Project

2. Runoff from tropical glaciers plays a critical role in the water regulation function (storing water during the cold months and releasing it during the warm months), and its reduction would have lasting and pervasive implications for water supply in the Andes. The runoff will be more concentrated in the rainy season due to the loss of water regulation function from glacier retreat, leaving the dry season even drier. In the medium term, water availability is expected to decrease due to glacier melting which is a significant portion of the final watershed runoff, even if glaciers represent only a small fraction of the total watershed.⁶ Estimates for the Antisana glacier, near Quito, show a potential reduction of up to 50 percent in its water yield.

3. Increased number of large precipitation events: A regional trend has been observed, supported by GCM, indicating an increase in the number of precipitation events above some thresholds. The possible implication of this observation is added stress to ecosystems, because erosion is closely related to extreme precipitation events, and drought conditions may develop as the period between precipitation events increase. Crops, native vegetation, and fauna in general will have to adapt to these new conditions.

4. Temperature increases would be more pronounced at high elevations, fostering increased evapotranspiration, changes (possibly decreases in) crop yields and increased risks of pest infestation.

5. With glaciers and *páramos* continuing to shrink at an alarming rate, the hydrological cycles across the Andean region will be permanently compromised without some sort of adaptive coping and risk management mechanisms for biodiversity, land degradation, and economic activities. These climate-induced changes would mean a dramatic reduction in biodiversity and increased ecosystem deterioration, significant degradation in agriculture productivity and food security, risk to human health, and potential damage to public and community utility infrastructure.

6. The project addresses the vulnerability of highland communities and economic activity (water and power supply) to the impacts induced by rapid glacier retreat. The project also addresses the need for better information on glacier evolution. The project contributes to mainstreaming of glacier retreat concerns into water, power, and agricultural development plans in affected regions.

7. The vulnerability of water supply to Andean cities will be addressed through the implementation of a pilot measure to counteract the anticipated loss of water regulation and water supply to the city of

⁶ Vergara, et al. 2006. "The Economic Impacts of Rapid Glacier Retreat in the Andes."

Quito, caused by the retreat of the Antisana glacier. If successful, this measure will provide invaluable information for the development of water supply strategies for cities throughout the region, affected not only by rapid glacier retreat but also by the warming of other mountain ecosystems, such as moorlands.

8. The vulnerability of power systems in the Andes that depend on water runoffs from glaciated basins will be addressed through the implementation of a pilot measure that would counteract the seasonal loss in water flows caused by the retreat of glaciers in the Urubamba–Vilcanota valley.

Project Areas

Ecuador: Papallacta, Jeringa, Quijos, and Antisana Rivers

9. The project locations are the microcatchments of the Papallacta, Jeringa, and Quijos Rivers which belong to the Coca River sub-basin and the Antisana River which belongs to the Jatunyacu River sub-basin. In these areas, livestock, fisheries, and tourism activities are the main economic activities, especially in areas adjacent to and within the zone's principal town, Papallacta. The current uses of waters from the sub-basins are: 1) drinking water for the city of Quito which is inhabited by two million people; 2) hydroelectricity generated in various existing projects; 3) drinking water for other small towns located in the area, and 4) agriculture, fisheries, and tourism in a smaller proportion. The water resources produced in these sub-basins are of immense importance at local, provincial, and regional levels, because they account for over 60 percent of the total amount provided by the Metropolitan Drinking Water and Sewerage Company of the city of Quito (EMAAP-Q) to the over 2 million people living in the city and its surrounding areas.

Peru: Urubamba–Vilcanota and Mantaro Basins

10. The main use of water in the Mantaro basin is for drinking water for the 431,000 inhabitants of the city of Huancayo, capital of the Junín Region, for irrigation of 2,000 hectares, and for two fish farms and small hydroelectric plants. There has been a conflict between water uses for agricultural purposes and drinking water, especially in the drier season, due mainly to the increase of irrigated areas in recent years as well as the growing population of the city of Huancayo. Low water flows in summer are anticipated and already occurring as a result of warmer temperatures.

Bolivia: La Paz and El Alto microcatchments

11. The La Paz and El Alto microcatchments encompass the municipalities of La Paz, El Alto, Palca, and Mecapaca. The entire population of these areas is about 1,515,000 inhabitants (18 percent of Bolivia's total population), of whom 95 percent live in the city of La Paz and El Alto. Fifty percent of those inhabitants are considered poor and 30 percent live in extreme poverty. The annual rate of population growth for the period between 1992 and 2001 was 1.67, with the greatest growth in the municipality of Mecapaca (2.25 percent). The city of La Paz, which is one of Bolivia's most important population centers, had a service coverage of 91.59 percent for the provision of drinking and cooking water, and 95.35 percent for electricity in homes as of 2001. In the municipalities of Palca and Mecapaca, the coverage of water service is nearly 50 percent, and 45 percent of homes are supplied with electricity. In addition to drinking water, water is used for agriculture and livestock.

12. Due to changing climate, regional water supplies will not be the same for the areas impacted by accelerated glacier melting, placing millions of already economically and environmentally stressed ecosystems and inhabitants at further risk of inadequate potable water. Furthermore, climate-induced glacial melt will likely precipitate the migration of human populations and mega-faunal animals affected by extreme events. Thus, an average change in the distribution of water, hydrological, and agricultural resources will precipitate hydrological stressors that will likely cause a sharp rise in intraregional and country-scale inequities, and a possible risk of political instability and conflicts.

13. Semiarid mountainous ecosystems in the region are highly vulnerable to disruption of local hydrological patterns, placing subsistence agriculture and consequently rural livelihoods at risk.

Anticipated dramatic fluctuations in the hydrological cycle will exacerbate already stressed ecosystems and reduce the biodiversity and productivity of highland agricultural lands because of unreliable water supply. Furthermore, poor land use practices exacerbate already compromised and destabilized watersheds, root retention structures, and ecosystems. Much of the current research suggests yield decreases in the Andean highlands as a consequence of effects on the water cycle and higher soil surface temperatures if no adaptation options are considered. The adaptive limitations of less-developed subregions will likely increase the disparity in food production and food security in rural highlands. It is also important to consider that much of the lowland basins strongly depend on the tributary streams coming from the mountain regions; therefore, impacts will also be felt downstream.

14. The region relies on hydropower to cover most of its power requirements, and many rivers that are used to generate hydroelectricity are glacier- or mountain lake-fed. Indeed, most power generation in Peru (80 percent) and Ecuador (50 percent) is met through hydropower. Reduction in water flows will reduce the potential for power generation and directly induce a carbonization of the power sector (countries returning to thermal power plants to make up for reduced hydropower potential), thus increasing these system's greenhouse gas emissions. Recent studies in Ecuador suggest that during the low-water period, the Paute Project (Paute River basin) would only provide between 43 and 45 percent of average power capacity, which represents a deficit of about 27 percent compared to energy production under normal conditions.

Baseline Scenario

15. The proposed Regional Andes Adaptation Project baseline is represented by a scenario in which the adoption of specific measures to address the impacts caused by glacier retreat will not take place. This is due to critical but progressive needs which compete with immediate economic development requirements. It is unlikely that similar adaptation project design and development funding would be made available under a business-as-usual scenario, in which other multiple local and regional challenges demand all available technical and financial resources. Without SCCF involvement, a regional approach, i.e., one that supports climate change adaptation activities which generate benefits by alleviating barriers to development caused by the effects of climate change and which may be primarily local benefits, seems very unlikely. Moreover, SCCF resources will have a strong leveraging effect that will help generate additional financial resources.

16. The following projects have been identified as the baseline scenario in the three participating countries:

Ecuador: Rural and Small Towns Water Supply and Sanitation Project II (PRAGUAS)

17. This innovative US\$ 48 million World Bank operation addresses the main shortcomings identified for the WSS sector in Ecuador. The second phase seeks to promote better service in 25 intermediate towns by strengthening and empowering local authorities to delegate WSS services to autonomous operators. The selected approach will improve water service provision, but will do so by concentrating efforts in the short to medium term.

18. How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Ecuador?

19. The proposed Adaptation pilot will focus in the area of Antizana glacier, including rural communities and will explore, within the scope of existing good practices and government programs, options to cope with the consequences of rapid glacier retreat. Emphasis will be given to adaptive planning (planning based on climate projections) as well as on water conflict resolution alternatives, as it is expected that in the future water scarcity has the potential to trigger social and economic tensions.

Lessons learned would be replicated in other towns sited in glacierized basins that could be sponsored through the baseline project.

Peru: Agricultural Research and Extension APL Phase 2

20. This US\$ 69 million World Bank project will contribute to the expansion, strengthening, and institutional development of the rural agricultural technology and innovation system so it is pluralistic, decentralized, demand driven, and led by the private sector. It will advance a decentralized market for professional services for agricultural innovation. It will strengthen producer organizations as clients of quality services, and improve entrepreneurial capacity of private service providers. It will also strengthen agricultural research and technological development for innovation in strategic areas of national importance, and to strengthen institutional and professional competence through “centers of excellence”.

21. How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Perú?

22. Activities to be developed under the proposed Regional Adaptation Project do present a very good example of synergies between adaptation and development projects. Although the proposed adaptation project does not include an agriculture research component, it is clear that farmers confronted with the impacts of rapid glacier retreat will have to adjust their production practices and products to future water availability. Research into drought resistant species and new species suitable to future conditions is needed. The proposed SCCF project will provide the guidance required to define priorities and will create the appropriate environment for readily acceptance of new varieties.

Peru-National Rural Water Supply, Sanitation and Health Project

23. This World Bank US\$ 50 million project aims to increase the sustainable use of new and rehabilitated water supply and sanitation facilities in rural areas and small towns while improving hygiene practices. More specific objectives:(a) implementing demand-responsive and sustainable basic water and/or sanitation services for approximately 1.5 million people in rural communities through the construction and/or rehabilitation of water points, piped systems, and sanitation facilities;(b) strengthening local communities' capacity to manage services, by (i) supporting an effective community participation process during the entire project cycle; (ii) introducing sound financial and economic principles to value water and sanitation services; and (iii) forming and training community-based water committees (JASSs).

24. How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Perú?

25. The National Rural Water Supply, Sanitation and Health Project started in 2002 and its implementation is satisfactory to date. The proposed Regional Adaptation Project will build upon the results of this project to superimpose the climate change issues. The proposed Integrated Water Management Plan will work within communities that are sensitized to express their need and build consensus on their priorities. Also these communities would have had training to manage their water services. The Adaptation pilot seeks to integrate climate change consideration in their decision making process, further strengthen their community management abilities, and introduce new concepts to better cope with the impacts of rapid glacier retreat in their economic and social activities.

Bolivia Community-Based Land Distribution Project

26. The objective of this World Bank US\$ 17 million Project is to establish a decentralized beneficiary driven mechanism that allows organized landless or poor farmers to acquire suitable agricultural lands and implement investment subprojects which puts them on a sustainable, higher-income pathway. It is estimated that this project would benefit between 1,500 and 3,000 poor rural families.

27. How do activities under the Regional Andes Adaptation Project add to the baseline scenario in Bolivia?

28. The Regional Andes Adaptation Project will collaborate closely with the implementation of the Bank funded project In particular the Integrated Pilot Catchment Management Plan in the Bolivian Plateau. (US\$1,600,000) 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. Both project seek to promote sustainability, the Regional Andes Adaptation project will incorporate the climate change perspective, and the concepts of adaptive management into the Community-based Land Distribution Project.

Additional Activities

29. The project seeks to finance the costs of analytical work and specific investment pilots that are necessitated by climate change and specifically by the warming of the higher catchments, glacial melt, and subsequent changes in the amount and seasonality of river flows. These components of the work would not be needed in the absence of climate change. The analytical work will be integrated into ongoing national planning processes such as the Peruvian Program on Climate Change (PROCLIM) and Ecuador's Water Management and Development and Integration of Climate Adaptation Governance Instruments Project which are funded through other sources.

30. The project seeks the funding of US\$6.9 million from the SCCF to finance one-third of the US\$28.65 million project cost. The SCCF financing has served as a catalyst to leverage additional resources from other financiers. The project would be cofinanced by (i) the Republics of Peru, Ecuador and Bolivia (US\$7.2 million), (ii) the Swiss Development Corporation (SWF 5 million, US\$5.5 million equivalent), (iii) a Climate Change Implementation Grant (US\$0.9 million); (iv) NOAA (US\$0.3 million), (v) the Meteorological Research Institute of Japan (US\$1.0 million), (vi) EMAAP-Quito, the water utility serving Quito (US\$4.7 million), (vii) The Andean Community of Nations (US\$0.25 m) and other donors (US\$1.9 million, to be confirmed) for a total of US\$28.65 million. The SCCF requires that most of its resources be used toward the implementation of adaptation measures. Co-financing resources provide complementary funding.

31. The project would address the additional activities required to achieve climate-resilient sustainable development imposed on vulnerable countries in Andes by the impacts of climate change. The project would provide an enabling environment for regional efforts to address the ravages attributed to climate variability and extremes in Pacific-based highland and coastal-dependent watersheds and human settlements. It would help address primarily local impacts as well as downstream impacts on water supply, agriculture, and energy generation, which are of common interest and importance to the sustainable development of the three countries.

32. City planners, engineers, and city officials have never before confronted the problem of planning the expansion of water supply (among other uses of water resources) under the conditions of uncertainty that climate change implies. The challenge is how best to incorporate the threats of climate change if planning and operating water supply systems are at the core of this adaptation project. The following general categories of interventions are being considered:

- Strengthening existing infrastructure to maintain the same level of service. This category of possible interventions includes: (i) adjustments to existing infrastructure, such as larger intake structures, increased reservoirs, and improved storage facilities; and (ii) changes in system operations to increase the usability of the water resources collected, i.e., the adoption of new operating strategies to maximize the volume of water actually delivered to consumers.

- Speeding up the development of new water sources to cope with (i) demand growth, and (ii) water yield reduction. Under this category of interventions city planners and engineers seek to implement identified expansion plans sooner than initially thought. This option is reflected in the cost analysis presented in Annex 9. Clearly, such a situation will have important implications for the finances of the water utility and for consumers.
- Implementing demand management options to reduce per capita water consumption/usage. Better use could be made of the water supplied to the consumer. All users and all sectors could make efforts to reduce water wastage, and public officials have the responsibility to guide actions and programs to achieve a “voluntary” reduction in water consumption. Public outreach programs, adoption of new standards for water fixtures, new operating policies, and economic signals are part of the arsenal of tools available to planners and city managers.

33. Climate change will compound the difficulties of promoting well-being from agricultural practices in the small and impoverished communities of the Andean highlands. Although the project will concentrate on improving the expected impacts of climate change, a broader perspective will be maintained to ensure that other barriers and market failures are incorporated in the analysis and in the interventions sought. The project will complement programs and projects already being considered by the national and local authorities.

34. The general categories of possible interventions are:

- Strengthening and complementing existing infrastructure. If climate change affects water availability at a particular site, one solution is to increase the infrastructure, if feasible, to compensate for the loss of water yield. Specific actions may include increasing diversion structures, building or increasing reservoir capacity, improving—through investment in civil works—the efficiency of the existing water systems, improving farm water delivery systems, etc.
- Providing additional infrastructure (more ponds and reservoirs, additional irrigation schemes). Infrastructure could be complemented and/or expanded. More creeks could be diverted and reservoirs built; pumping stations and transbasin systems may be considered.
- Enhancing the sustainable management of available resources. Water resources management may be adjusted to better incorporate scarcity values, improve maintenance, and increase the production of high-value crops. District -evel integrated water management should be pursued, and new crop practices should be introduced at farm level.
- Developing new options: new crops or crop varieties, new agricultural practices attuned to climate variability and climate change, and exploration of other land uses. In the medium term it should be expected that agricultural practices will be subjected to sweeping changes. New crop varieties should be developed to adapt to the expected future climate, practices will need to be modified, and in general strategic decisions will need to be made in order to guide agricultural change toward a new and more sustainable paradigm.

35. The proposed project specifically aims to carry out the following activities:

- Implementing pilot adaptation activities to address vulnerabilities to rapid glacier retreat, including:
 - Partial substitution of the loss of water regulation caused by the effects of the Antisana glacier’s retreat on the water supply for the city of Quito in Ecuador.

- Reduced vulnerability to loss of glacier runoffs with regard to the ability to generate power in the Urubamba–Vilcanota Basin.
- Adaptation program designed and incorporated in regional development plans for the area of the Altiplano in Bolivia, taking into account the loss of glacier surface and glacier runoff in the region.
- Incorporation of glacier retreat impacts on development plans in the following glaciated basins:
 - Bolivia: La Paz River microcatchment and El Alto microcatchment
 - Ecuador: Microcatchments receiving a direct water contribution from the Antisana glacier. These are: the Papallacta, Jeringa, Quijos, and Antisana Rivers.
 - Peru: Mantaro and Cusco Basins.
- Strengthening capacity to produce and disseminate relevant information on the process and the impacts of warming and rapid tropical glacier retreat in the Andes.
- Designing and operating a glacier observation and monitoring network combining six field stations and remote sensing through use of the Advanced Land Observation Satellite of Japan.

36. This project would produce significant local benefits in the development sectors of agriculture, water, and energy which are being pushed further under changing climate conditions. These benefits include partial substitution of the loss of water supply from glacier runoffs, the communities' preparedness and management with regard to the impacts of glacier retreat, and improved capacity of the glacier observation and monitoring network.

37. The proposed project follows the guidance defined by the UNFCCC for the SCCF. It will seek the implementation of adaptation activities to address the adverse impacts of climate change. It will also complement traditional government interventions in the area of water resources management by explicitly including the impacts of warmer temperatures and glacial melt into planning processes with emphasis on water supply and irrigation in highland areas, including mountain ecosystems. Moreover, the proposed project will serve as a catalyst to leverage additional resources from bilateral and other multilateral sources. The activities to be funded under the proposed project are country-driven, cost-effective, and integrated into national priorities as expressed in the National Communications. While the assessment of future climate scenario impacts on key ecosystems has been conducted under the UNDP National Communications for Peru, the project will focus on filling the gap in assessments for the three countries, thus achieving the same analytical basis for all countries.

ANNEX B: PROJECT LOGICAL FRAMEWORK

Results Framework

PDO	Project Outcome Indicators	Use of Project Outcome Information
<p>To assist participating governments to adopt measures to meet the anticipated consequences of the catastrophic glacier retreat induced by climate change.</p>	<p>Integration of glacier retreat impacts into local, regional, and country level planning, as measured by actions taken for such integration.</p> <p>Government institutions of Peru, Ecuador, and Bolivia will have the capability to document and disseminate information on the process and the impacts of rapid tropical glacier retreat in the Andes, as measured by technical reports and papers for publication.</p> <p>A sustainable glacier observation and monitoring network, as measured by continuity of records of previous 12 months and allocation of budget for its mid-term operations after the end of project.</p> <p>At least 30 policy makers from local, regional, national planning institutions surveyed indicate an increase in their awareness and knowledge on the impacts of rapid tropical glacier retreat.</p>	<p>The outcomes will be the basis for replication in other areas of Andean countries and for medium term adaptation measures planning for in those countries.</p>
Intermediate Outcomes	Intermediate Outcome Indicators	Use of Intermediate Outcome Monitoring
<p>Component 1: Detailed design of strategic adaptation measures</p>	<p>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 glacierized basins, as measured by impact map developed.</p> <p>At least 6 sets of adaptation measures designed for the selected basins.</p>	<p>The map will be the basis of designing adaptation measures for the selected basins.</p> <p>The adaptation measures will be the basis for the pilots implemented in Component 2.</p>

	At least 10 dissemination notes to reach and raise awareness of local impacts of climate change.	
Component 2: Implementation of pilot adaptation measures	<p>Amount of water supply to be compensated / improved through the pilots in the selected microcatchments in the Antisana Plateau and for Quito City, as consequence of gradual glacier retreat up until 2015.</p> <p>Scope (ha, tons) of agricultural production to be compensated/improved through the pilots in, the selected microcatchments in the Mantaro, Cusco Basins, Peru.</p> <p>Amount of water supply to be compensated/improved through the pilots in the La Paz and El Alto microcatchments in the Altiplano, Bolivia</p>	The outcomes will be used for cost benefit analysis of pilot measures.
Component 3: Monitoring of glacier retreat and associated impacts in the region	<p>Six of glacier monitoring stations are established and capable of monitoring glacier evolution, weather and hydrological conditions in the glacier basin on a sustainable basis, as measured by continuity of records and budget.</p> <p>Increased capacity, i.e., resolution, coverage, and frequency of provision of high precision remote sensing data, of the national institutes of meteorological sciences of the participating countries to monitor gradual process of glacier retreat and associated ecosystems in the region</p>	The outcomes will be used for better long-term planning for further adaptation policy and interventions

Arrangements for results monitoring

Institutional issues:

1. Monitoring and evaluation of project outcomes/results (both intermediate and end-of-project) will be coordinated by the project staff in the Andean Community of Nations (CAN). The CAN project manager will be responsible for monitoring project performance with the assistance of the national coordination units.
2. The project will be guided by semiannual learning reviews of project results to coincide with Bank supervision missions on which basis CAN and the Bank will identify specific measures to: (i) address any areas of implementation weakness, and (ii) adapt project design to ensure that objectives are met. These measures for improvement will be reflected in CAN's semiannual learning reports and its proposal for the forthcoming year's Annual Implementation Plan including project budget.
3. CAN will monitor financial and procurement management for the project. Financial information on inputs, outputs, budgeting, treasury, accounting, and audits will be monitored. The latter activity will be performed by an externally hired consultant. A budget specially allocated for this purpose was considered during the project design stage. The project will send to the Bank quarterly financial management and procurement reports. Monitoring and processing of procurement for services, goods, works, and subprojects will be carried out by CAN's project staff. The annual planning processes will be monitored with specific indicators on planning performance defined in the Results Framework. The project's physical implementation will be monitored based on the specific outputs and monitoring indicators for project components as defined in the Results Framework. Information from the monitoring system will be analyzed by project management and disseminated according to the project's communication strategy to appropriate stakeholders. The project will provide the Bank with quarterly progress reports and an update on legal covenants compliance every six months.
4. The monitoring and evaluation process will function as a mechanism for assessing project impacts and as a day-to-day management tool. A baseline study will be carried out at inception, and follow-up evaluations at both midterm and project closing. Site-specific baseline studies will be performed before work begins in the pilot areas; baseline studies will be shared with local NGOs and other national institutions. The National Focal Points will collaborate in the process, assuring a free flow of information to project stakeholders. Specific project implementation monitoring data will be provided in agreed-upon report formats, included in the operational manual, and will be required for the twice-yearly supervision missions. CAN, with the help of the Steering Committee, will develop the project monitoring system that will record planning, physical implementation, performance of local technical assistance and development objective indicators from the project's Results Framework.

Data collection

5. National activities will be reported to CAN project management. CAN will be responsible for compiling data and reporting to the World Bank. Data used for regional modeling and post-downscaling activities under Subcomponent 1.2 comes from statistical reports developed by local institutions.

Semiannual evaluations

6. Semiannual discussions are planned to coincide with supervision missions to identify and discuss lessons learned during project implementation with project stakeholders and beneficiaries. Project staff will submit semiannual reports on lessons learned and plans for incorporating those lessons into future activities.

Midterm Evaluation

7. The Bank's supervision team, together with a team of external reviewers and key stakeholders, will conduct a midterm evaluation of project execution. It will be conducted no later than three years after the first disbursement. The external review will focus on: (i) progress in achieving project outcomes, (ii) institutional arrangements for project implementation, (iii) operational manual for payments, (iv) review of both the project implementation plan and general project operational manual. In preparation for the midterm review (MTR), the Steering Committee, together with the local implementing agencies, will prepare a working book containing the following information: (i) executive summary of the overall project status, (ii) up-to-date description of the overall components' development and indicators; and (iii) detailed description of the status of the proposed adaptation pilots by catchments.

Final Evaluation

8. A final evaluation will be conducted in the last semester of project execution. The key objectives of the final evaluation will be to: (i) assess attainment of the project's expected results, (ii) use the results to design a strategy for replication in future projects, and (iii) design a strategy for mainstreaming future adaptation activities in the participating countries.

Arrangements for results monitoring

Project Outcome Indicators	Baseline	Target Values					Data Collection and Reporting		
		YR1	YR2	YR3	YR4	YR5	Frequency and Reports	Data Collection Instruments	Responsibility for Data Collection
Integration of glacier retreat impacts into local, regional, and country level planning, as measured in concrete actions taken for such integration.	0	0 (To be measured at EOP)	0 (To be measured at EOP)	0 (To be measured at EOP)	0 (To be measured at EOP)	At least 6 concrete actions at different levels of planning	Completion Report	Final Evaluation	National Coordinators
Government institutions of Peru, Ecuador, and Bolivia will have the capability to document and disseminate information on the process and the impacts of rapid tropical glacier retreat in the Andes, as measured in technical reports and papers for publication.	0	0	0	0	0	5 technical report, 3 journals	Completion Report	Final Evaluation	National Coordinators
A sustainable glacier observation and monitoring, as measured in continuity of records of previous 12 months and allocation of budget for its mid-term operations after the end of project.	Record: None Budget: N/A	Record: 0 Budget: N/A	Record: 0 Budget: N/A	Record: 50% Budget: N/A	Record: 95% Budget: N/A	Record: 97% Budget: 100% at least for the following 2 years.	Annual Report	Annual Review	National Coordinators
At least 30 policy makers from local, regional, national planning institutions increased their awareness and knowledge on the impacts of rapid tropical glacier retreat.	0	0 (To be measured at EOP)	0 (To be measured at EOP)	0 (To be measured at EOP)	0 (To be measured at EOP)	At least 30	Completion Report	Survey	National Coordinators

Intermediate Outcome Indicators									
Component 1: Identification, selection, and formulation of adaptation measures									
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 glacierized basins, as measured by impact map developed.	No map	Draft impact map created	Final impact map completed	-	-	-	Annual Report	Annual Review	National Coordinators
Sets of adaptation measures designed for the selected basins.	0	0	At least 2 sets of strategic adaptation measures	At least 4 sets of strategic adaptation measures	At least 5 sets of strategic adaptation measures	At least 6 sets of strategic adaptation measures	Annual Report	Annual Review	National Coordinators
At least 10 dissemination notes to reach and raise awareness of local impacts of climate change.	0	6	7	8	9	10	Annual Report	Annual Review	National Coordinators
Component 2: Implementation of pilot adaptation measures.									
Amount of water supply to be compensated/improved through the pilots in the selected microcatchments in the Antisana Plateau and for Quito City.	0	0	0	TBD (as a result of PDF-B)		TBD (as a result of PDF-B)	Annual Report	Annual Review	National Coordinators
Scope (# ha, # tons) of agricultural production to be compensated/improved through the pilots in, the selected microcatchments in the Mantaro, Cusco Basins, Peru.	0	0	0	200,000 ha		400,000 ha	Annual Report	Annual Review	National Coordinators

Amount of water supply to be compensated/improved through the pilots in the La Paz and El Alto microcatchments in the Altiplano, Bolivia	0	0	0	TBD (as a result of PDF-B)		TBD (as a result of PDF-B)	Annual Report	Annual Review	CAN
Component 3: Monitoring of glacier retreat and associated impacts in the region.									
6 of glacier monitoring stations that are established and capable of monitoring glacier evolution, weather and hydrological conditions in the glacier basin on a sustainable basis.	0	0	0	6 (Bolivia, Ecuador, and Peru)		6 (Bolivia, Ecuador, and Peru) And 2 additional as part of network (Colombia)	Annual Report	Annual Review	CAN
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 gradual process of glacier retreat and associated ecosystems in the region	Quality: 20 x 20 km resolution Coverage: 1 basin Frequency: N/A	Quality: less than 10 x 10 km resolution Coverage: 3 basins Frequency: Annually	Quality: less than 5 x 5 km resolution, basin basis Coverage: 6 basins Frequency: Semiannually			Quality: less than 5 x 5 km resolution, basin basis Coverage: 6 basins Frequency: Quarterly	Semiannual Report	Semiannual Review	CAN

ANNEX C: RESPONSE TO PROJECT REVIEWS

a) Convention Secretariat comments and IA/ExA response

N/A

b) STAP expert review and IA/ExA response

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Recommendations

However, the following are comments and suggestions that may help to focus and strengthen the project proposal:

1. The project, though very deserving, is somewhat ambitious, given the tasks identified, the limited budget from GEF (US \$ 6.9 million) and the local skills capacity for such an undertaking. One also has the impression that the approach taken is a piece-meal one, given the costs and the urgency of the problem. However, the project proposal can be strengthened by giving a greater priority to the pressing infrastructure upgrades that are required to address future water resources availability following rapid glacier retreat under climate change

Response: The problem is huge and growing. There is an urgent need to illustrate in a few well selected basins the potential adaptation strategies. On these basins, the project will invest close to US\$30 million at a very local scale. Allocated resources are judged sufficient to initiate the process of adaptation at these locations. The document does not claim that the problem will be solved with this one intervention. Although the GEF grant is for US\$ 6.9 million, the entire project costs are estimated in US\$28 million. Nevertheless, these adaptation funds are not enough to cope with the impacts of climate change reducing the scope of the project a selected pilots. We have taken attention to the fragmentation indicated by the reviewer, and have concentrated resources on more strategic interventions. Although the countries have made detailed analysis of possible interventions, the final determination of the pilot adaptation interventions has been postpone giving recent elected governments the time to define priorities and defined investments in their portfolio for climate change adaptation.

The overriding concern is the consequences of rapid glacier retreat. They differ in different basins so that not a single response is valid every where. Thus, tailored responses are required.

2. The document contains a number of broad and sweeping statements relating to rapid glacier retreat, automatically ascribing it to climate change without providing sufficient proof or evidence. For instance, the document claims that GCM project lower precipitation for the Andean region covering Bolivia, Ecuador and Peru, unlike the results of the IPCC TAR. This may very well be the case since different GCMs using different climate forcings give contradictory results. Also, it would have been judicious to include sample stations data on temperature and precipitation (including the fraction as snowfall) for the study area. Also, the tone of the document assumes that GHG climate change and its impacts are inevitable, which may well be the case, but caution must be exercised in such assumptions because of the high uncertainty, deriving from the level of GHG forcing, spatial issues and climate models imperfections. Furthermore, the project, supposedly, attempts to undertake

monitoring of glacier retreat in the future and less effort is focused on glacier mass balance modeling using future climate scenarios which are critical in the design of the planned infrastructure works for the future. Besides, Governments are more and more being asked to integrate climate change issues into Environmental Impacts Assessments.

Response: *There is no doubt that rapid glacier retreat as experienced during the last quarter of the last century is directly linked to warming of the troposphere. Additional work done recently shows that mountain habitats are warming faster than lower altitudes. There is in fact overwhelming evidence of the direct effect of global warming on the catastrophic decline of tropical glaciers worldwide. There is scientific consensus on this point and it should not be debated.*

During project preparation we have obtained data confirming the climate trends announced by the GCM. Also the recent publication of the Fourth Assessment Report, by the IPCC, reiterates the anthropogenic origin of global warming. The conclusions are now clear, even with outmost efforts climate change will continue as Earth seeks a new thermal equilibrium to the high concentration of GHG in the atmosphere. This equilibrium will be reached, it is estimated, in centuries, much more time than the expected life for many of the Andean glaciers. In the new version of the project document we have included a state of the art account of the understanding of tropical glacier retreat.

3. The sectors that are targeted as the focus of the study, namely water resources, hydropower generation, biodiversity, agriculture, drainage and flood protection and lowland infrastructure and peoples are critical for the well-being of Bolivia, Ecuador and Peru. However, the document does not provide adequate information in terms of institutions and capacity for undertaking the engineering and impacts studies in these sectors and there is a lack of details relating the precise methodologies that are to be used to undertake the assessments of rapid glacier retreat in the Tropical Andes. Also, although there are some identified timelines and targets, one gets the impression that the planning of the project would evolve as it progresses.

Response: *Engineering capabilities are not lacking in the Andean countries, although due consideration is given to the need for international expertise. The reviewer's comment of the adaptive nature of planning is correct. It is considered a project's strength to have the flexibility to adjust interventions as new information becomes available and knowledge is increased. The project will be implemented by the Andean Community of Nations an international institution, in cooperation with local and regional agencies in the targeted basins and in cooperation with the Ministries of environment and offices of climate change.*

4. The document provides details of budget allocations for the 3 activity components, namely *Identification, Selection and Formulation of Adaptation Measures, Implementation of Pilot Adaptation Measures and Monitoring of Glacier Retreat and Associated Impacts in the Region* for the GEF project proposal. However, there is no mention of guarantees to sustain the project beyond the 5-year timeline and this is a concern.

Response: *The reviewer poses a very important consideration; long term sustainability. This will depend on the specific pilots selected. If the criteria is to select (during the implementation of component 1) pilots with high local benefits, as it is expected, then the expected benefits of the intervention should maintain the community and the government interest on its sustainability. This*

sustainability consideration will be incorporated in the criteria for the final selection of pilot interventions.

Also, the problem is increasing with time and the measures are being developed with regional and local agencies facing a growing crisis with time. There are strong incentives to continue this work in the long term. The GEF project needs to be seen as the necessary first step of a continuum of actions forced by the growing impacts of climate change.

5. It would appear from the project proposal to the GEF, that a good part of the research and funding will be handled by foreign consultants, since the tasks call for highly specialized expertise and equipment in mapping and glacier/hydrological modeling. This raises the issue of capacity building and in-house expertise. Besides, once foreign consultants are done with a project follow-up and local ownership become issues.

Response: *This is not true. The local glaciology and engineering capabilities are being fully deployed for implementation of the project. Local institutions are managing the design and implementation of all activities. Where needed, critical inputs from overseas institutions are being used but most of the activities are implemented locally by local institutions. The project has a large component on training and technology transfer. With additional resources from grants local scientists and development practitioners will continue to be trained in the use of data from new satellites and from global circulation models, including the art of downscaling. Local scientists have been involved, and will continue involved, in glacier retreat monitoring. Commitments are been sought for meteorological agencies to secure station maintenance and data collection for at least a period of 10 years.*

6. The identification of critical risks and possible controversial aspects (native land claims) are to be commended. However, it is stated that there are no controversial aspects related to the project. This statement is very strong and must be justified, especially in view of the fact that major native settlements are located within or in the vicinity of the project area. Also, the fact that social and environmental impacts of the project are considered is also highly commendable.

Response: *All safeguards have been closely studied and defined for the type of interventions sought. In this regard there are not controversial issues to report. The project proponents are working with local communities and their leaders to assure ownership of the pilot projects. This is a criterion for project final selection. No political, social or environmental controversial issues have been identified.*

7. There is also the issue of supervision and control of the project. The executing agency is CONAM, an affiliate of the Peruvian government. Also the geographic size and populations of the three participating countries vary. This provides the potential for disagreements in terms of budget allocations and adaptation measures implemented.

Response: *This has changed. The implementing agency is CAN which represents all three participating governments. Local activities will be implemented by local agencies. The implementing agency has been selected by consensus among the participating countries, and a well design and worded agreement has been signed defining rights and responsibilities, as well as conflict resolution procedures.*

8. There a number of syntax and grammatical errors that needs to be corrected to improve the quality of the project proposal. Furthermore the document is too long and replete with repletion of information presented.

Response: *The project document has been edited to improve the reading quality of the document.*

9. There are a number of abbreviations and acronyms that are mentioned in the project document that are not defined (CONAM for instance). It is recommended that a list of Abbreviations and Acronyms be inserted in the project proposal.

Response: *A table with abbreviations and acronyms will be inserted in the final document.*

10. The project document has a few incomprehensible and incomplete sections (Table 2, p 64 and Maps, p 81), which should be addressed in order to ensure a complete and comprehensive evaluation of the proposal.

Response: *The project document has been edited to improve the reading quality of the document.*

In spite of the above observations and comments, The Implementation of Adaptation Measures to Rapid Glacier Retreat in the Andes Project fits into the criteria of projects eligible for GEF funding for adaptation activities through the Special Climate Change Fund. Besides, the project addresses a number of very pressing and critical issues relating to climate change impacts and adaptation for water resources management, hydropower generation and flood and drainage control, Tropical Mountain biodiversity and agriculture, tourism and health and livelihoods of people and the sustainable development of Bolivia, Ecuador and Peru.

Though the project, in its present form needs some improvements, it is well-founded and justified and therefore GEF funding is highly recommended.

Bhawan Singh

c) GEF Secretariat and other Agencies' comments and IA/ExA response

N/A