

World Bank Climate Change Program in Peru

October 31, 2008

1. Context: Peru and Climate Change

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 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 Fourth Assessment Report updates the knowledge on anticipated climate changes, including warmer temperatures, alterations of the hydrological cycle, drier soils, changes in weather extremes, rising sea levels, and 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.

Recent research shows that climate change will be more pronounced in high-elevation mountain ranges (Bradley et al. 2006). While much attention has been paid to climate change in the Polar Regions, those mountains that extend into the troposphere have been warming faster than adjacent lowlands. Thus, heavily populated, high-elevation 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 significant repercussions on ecosystem integrity and the welfare of local populations.

Peru is particularly vulnerable to climate change. During the last decades important changes in precipitation and increases in temperature have been observed in Peru. As a consequence of temperature increases, the trend in glacier retreat is accelerating. The observed trend in change of precipitation patterns is unprecedented. While significant increases in precipitation were observed in northwest Peru, a declining trend in precipitation was observed in southern Peru. As a result of temperature increase, glaciers in Latin America have receded dramatically in the past decades, and many of them have disappeared completely. One of the most affected sub-region are the Peruvian Andes. Peru incurred a 22% reduction in total glacier area over the last 35 years, leading to a reduction of 12% in freshwater supply for the coastal zone where approx. 60% of the country's population live. The estimated water loss amounts to almost 7,000 Mm³ (Vásquez, 2004; Mark and Seltzer, 2003). Deglaciation is even more acute in the small ranges of the Andes where up to 80% of glacier surface has been lost over the last 30 years leading to a loss of 188 Mm³ in water reserves during the last 50 years. (NC-Perú, 2001). The IPCC Fourth Assessment Report states with high confidence that Andean inter-tropical glaciers are very likely to disappear over the next decades. Acute water scarcity is projected between 2015 and 2025 very probably impacting the availability of water supply for 60% of the Peru's population (Vásquez, 2004). Water stress and persistent rainfall anomalies due to El Niño and La Niña phenomena contribute to water supply insecurities, which also affect hydropower generation.

Peru relies on its mountain water basins for the provision of water for urban supply, agriculture and power. While Peru accounts for about 4% of the world's annual renewable water resource (World Bank, 2006), a great part of the resource is located east of the Andes, where population density and agricultural production is relatively lower (Ministry of Agriculture, 2006). In contrast, the large part of the population and economic activity that are located along the Pacific coastal plains (where the land is

typically drier) and western slopes of the Andes are very dependent on runoff from the cordilleras (Ministry of Agriculture, 2006). There are also relatively densely populated areas in the central and eastern highlands where important parts of the agricultural and mining activities take place. Important power plants are located in these areas including Mantaro, the largest with around 1,000MW. Most plants depend on the Mantaro and the Urubamba River Basins, located in the central-southern sector of the Andes Cordillera of Peru. These basins have a glacier component and produce over 50% of the electricity in the country. In addition, these basins are also located near agriculture producing valleys that provide food for the city of Lima and have hence an important socioeconomic relevance. Of the electric power produced in Peru in 2006, 71.6% was hydroelectric (Peru has around 6,100 megawatts of installed power capacity). **Thus, climate change is expected to affect the surface hydrology of Peru as a result of changes in environmental conditions possibly affecting net runoffs from mountain wetlands, rivers and glaciers and precipitation patterns.**

Impact on Mountain Wetlands. High mountain ecosystems, including *páramos* (unique wetlands of the Northern Andes) and snowcapped terrain, are among the environments most sensitive to climate change. These ecosystems have unique endemic flora and provide numerous and valuable environmental goods and services. Although understanding of glacier retreat and its consequences has significantly increased, the consequences of climate change in the functioning of *páramos* require additional work. Data recently made available (Ruíz et al. 2007) suggest that climate impacts have already altered the circulation patterns responsible for producing and moving water vapor to the region. These striking changes have probably contributed to the disappearance of high altitude water bodies, as well as to the increased occurrence of natural and man-induced mountain fires. Thus understanding the *páramos*' function and response to climate change has important implications for Peru.

The expected increase in sea-level rise is very likely going to affect coastal areas. In the future, adverse impacts are projected for the coastal morphology in Peru. Global losses in eight coastal regions in Peru are estimated at US\$1,000 million (NC-Perú, 2001). Sea-level rise and increase in sea surface temperature are also very likely to affect spawning areas and fish catches of anchovy as well as the location of fish stocks in the south-east Pacific in general, which in turn adversely affects Peru's economy.

Regarding **agriculture**, the El Niño phenomenon on the one hand shortens the cotton and mango growing cycles on the northern coast of Peru because of increases in temperature (Torres et al., 2001). On the other hand, several fungal diseases in maize, potato, wheat and beans are observed during El Niño events due to higher rainfall and humidity in other parts of Peru (Torres et al., 2001). In drier areas of Latin America, such as the Peruvian coast, climate change is likely to lead to salinization and desertification of agricultural lands. It is projected that by 2050, desertification and salinization will affect 50% of agricultural lands in Latin America and the Caribbean zone (FAO, 2004a).

With regard to **climate change and health effects in Peru** some models project a substantial increase in the number of people at risk of dengue due to changes in the geographical limits of transmission (Hales et al., 2002). Some models project changes in the spatial distribution (dispersion) of the cutaneous leishmaniasis vector for Peru and other countries (Aparicio, 2000; Peterson and Shaw, 2003), as well as the monthly distribution of dengue vector (Peterson et al., 2005). Recent studies warn of a wider vector distribution of Chagas' disease in Peru (Cáceres et al., 2002).

Peru's GHG footprint. Excluding emissions from land-use change and forestry, Peru emits a relatively moderate portion of total greenhouse gases (68.7 MtCO_{2e} or about 0.19% in 2000), ranking it on place 58 amongst all countries in the world and on place six in Latin America. This figure is equivalent to about 2.6 tCO_{2e} per capita. The assessment changes when including land use-change related emissions. In this case, Peru emits 256 MtCO_{2e} or 9.9 tCO_{2e} per capita. Peru is the second largest emitter from land-use

change in LAC. Still, Peru's contribution to the World's total emissions is relatively small (0.19% or rank 58 excluding land use change, 0.59% or rank 33 including land-use change). The carbon intensity of the Peruvian economy is 209.3 tCO_{2e} per million US\$ of GDP. The main sources of Peru's GHG emissions are the following: land-use change and forestry (73%), agriculture (13%), energy (11%), waste management (2%), and industrial processes (1%).

GHG Emissions by Sector in 2000
CO₂, CH₄, N₂O, PFCs, HFCs, SF₆ (includes land use change)

Peru	MtCO ₂		%	
Energy	28.1		11	
Electricity & Heat		4.7		1.8
Manufacturing & Construction		7.8		3.1
Transportation		9.1		3.6
Other Fuel Combustion		6.1		2.4
Fugitive Emissions		0.3		0.1
Industrial Processes	2.3		0.9	
Agriculture	33.1		12.9	
Land-Use Change & Forestry	187.2		73	
Waste	5.7		2.2	
Total	256.4		100	

GHG Emissions by Sector in 2004
CO₂ (excludes land use change)

Peru	MtCO ₂		%	
Energy		29.3		92.8
Electricity & Heat	6.6		21	
Manufacturing & Construction	8.5		26.9	
Transportation	10.1		31.9	
Other Fuel Combustion	3.7		11.7	
Fugitive Emissions	0.4		1.3	
Industrial Processes		2.3		7.2
Total		31.6		

Citation: Climate Analysis Indicators Tool (CAIT) Version 5.0.
(Washington, DC: World Resources Institute, 2008).

2. Peru is addressing the challenge

Peru's National Climate Change strategy

In 2003 Peru formulated its National Climate Change Strategy. The objective of the strategy is to promote and develop policies, measures and projects that will increase the adaptation capacity of the country to climate change thus making it less vulnerable. It also proposes measures for the management of GHG emissions, better forest management for increased carbon sequestration and distribution of knowledge and information about climate change for a better awareness and preparedness of Peru's population.

A **National Strategy Study for the Clean Development Mechanism** was formulated in July 2003. This Strategy is intended to evaluate Peru's role in the CDM identify the potential for investment in GHG abatement projects as well as financing options for such projects and develop national policies aimed at participating in the CDM.

Peru in the UNFCCC

Like most developing countries, Peru has submitted one national communication to the United Nations Framework Convention on Climate Change (UNFCCC) in June 2001. The Communication established Peru's National GHG Inventory, and it proposed policies and measures to be taken that would have a mitigating impact on climate change. Furthermore, it gives an overview of adaptation measures and financial and technological limitations to confront climate change. A Second National Communication is currently prepared and scheduled for publication in 2009.

3. Current World Bank Assistance Framework

The World Bank's climate change-related activities in Peru are in line with Peru's National Climate Change Strategy, its National Strategy study for the Clean Development Mechanism and Peru's National Communication to the UNFCCC. The Bank's engagement in Peru is furthermore guided by the Climate Change Strategy for LAC which aims to (i) support low carbon economic growth, in particular for the energy and transport sectors and promote avoidance of deforestation; (ii) support the process of adaptation, focused on key vulnerabilities as identified under the national communications process to the UNFCCC; and (iii) support the linkages between knowledge and capacity building and decision making. In addition, the climate change-related work is aligned with the Country Partnership Strategy (CPS) for Peru, approved by the Board in December 2006. The CPS recognizes Peru's vulnerability to both climate change and climate variability and the challenge posed to the country by glacier retreat, which ultimately will impact the country's water supply, agricultural, health, and tourism sectors.¹

The paragraphs below briefly outline the Bank's various activities in accordance with the Bank's strategy. An overview is given in Annex 1. The Bank currently maintains 17 (18) activities addressing climate change in Peru. The activities break down into adaptation, mitigation and sequestration. They take the form of IBRD loans, GEF grants, carbon finance emission reduction purchase agreements, CF-Assist grants for capacity building, ESW, TFESSD and knowledge products. They are the result of many years of discussion with a wide range of Peruvian stakeholders.

Ongoing World Bank activities in climate change include the following:

The adaptation pilots focus on the implications of climate change for the water, agricultural and energy sectors in Peru:

1. P098248 –Adaptation to the Impact of Rapid Glacier Retreat in the Tropical Andes (GEF: USD 7.5 million) - The project aims to strengthen the resilience of local ecosystems and economies to the impacts of glacier retreat in the Tropical Andes, through the implementation of specific pilot adaptation activities that illustrate the costs and benefits of adaptation. The specific objectives of the project, in support of this broad objective, are: (i) the effective integration of the implications of glacier retreat into the regional and local planning in glacierized basins; (ii) the inclusion of glacier retreat impacts in local, sector development projects; and (iii) generation of data on glacier dynamics. The General Secretariat of the Andean Community (SGCAN) acts as counterpart and on behalf of the governments of Bolivia, Ecuador, and Peru. The project directly contributes to the CPS' strategic focus on protection and conservation of strategic ecosystems, increasing their adaptive capacity with regard to climate change impacts. Complementarity with Peru's Second National Communication (under development) is ensured. While the second national communication to the UNFCCC analyzes Peru's vulnerabilities to the impacts of climate change, the Regional Andes Adaptation Project seeks to demonstrate practically how to reduce a key vulnerability, namely to rapid glacier retreat. The project is supporting specific measures to adapt to these changes. The experiences will inform the overall process of adaptation to rapid glacier retreat throughout Peru, illustrating costs and benefits.

¹ Country Partnership Strategy for the Republic of Peru, FY07-FY11

Pilots supported under this project in Peru include:

Pilot 1: Implementation of a Water Management Plan aimed at: (i) improving water use practices in the agricultural and livestock sectors, and (ii) improving water storage infrastructure at selected basins' headwaters to address negative effects caused by temporary increase in runoff;

Pilot 2: Implementation of an Agricultural Production Plan that compensates for reduction of water availability to the agricultural sector as a result of rapid glacier retreat;

Pilot 3: Implementation of an Integrated Water Management Plan that incorporates reductions in glacier runoff contributions in Huancayo;

The *analytical work* on climate change focuses on assessing the impacts of Climate Change on Peru's hydrology and hydropower potential, and on agriculture; it also focuses on disseminating lessons from adaptation pilots; on analyzing the social implications of climate change; and on providing an economic assessment of REDD in Peru.

2. P110305 - Assessment of Climate Impact on Peru's hydrology. Development of a methodology (ESMAP: USD 0.3 million) - The project development objective is to demonstrate a methodology to assess climate impacts on Peru's hydrology (e.g., rapid mountain warming, with the consequent changes in glaciers and mountain wetlands, and change in rainfall patterns). This project is linked to the "Adaptation to the Impact of rapid Glacier Retreat in the Tropical Andes". The task will also closely link and inform the Bank-funded, TA task "Overcoming Barrier to Hydropower Investment in Peru". In addition, the project will liaise with the Bank funded, TA: "Risk Analysis of Amazon Dieback" as it relates to findings regarding impacts on rainfall in the Andes. In addition the project will draw from the Sierra Irrigation Subsector Project and the Water Resources Management Modernization Project. The study is conducted by the Bank in coordination with CONAM, the Ministry of Mines and Energy of Peru and ElectroPeru. Local partners will include SENAMHI (hydrological data generation) and IRH (responsible for water resources management nationwide). Finally the activity would also benefit current strategic planning at the Government level for long term positioning of renewable energy resources in the power generation mix. The task will be developed in partnership with SEI and the Institute de Recherché pour le Développement, which has long been involved in glacier research in the area. The existing partnerships with the Meteorological Research Institute for use of Earth Simulator data and with the Japanese Space Agency will be deployed for purposes of this task, providing data on projected climatic conditions and glacier dynamic information respectively.

3. P109969 - Overcoming Barriers to Hydropower Investment in Peru (ESW / LCSSD's Climate Change and Clean Energy Initiative: USD 0.2 million) - This study would: (a) determine the recent impact of climate change on existing and future possible hydroelectric facilities ; (b) evaluate the hydrological data available, its adequacy for project development, and propose measures to improve data availability and accessibility; (c) review the pre-feasibility studies and feasibility studies already prepared and assess the economic and financial feasibility under current conditions; (d) investigate and propose solutions to problems relating to obtaining water concessions; (e) investigate barriers to mobilizing long-term financing and the possible justification for public financing of such projects; and (f) assess the viability of a financial intermediary facility to be established partially with public funds. Peru's MEM considers technical assistance in this area to be their number one priority for the sector. This study would provide critical TA to the MEM and would lay the groundwork for a possible investment loan to partially fund the hydroelectric financing facility. ESMAP funding also likely, pending ESMAP clearance

4. Potential impact and possible adaptation measures with emphasis on irrigation agriculture along the pacific (FAO – WB). The objective of this project is to assess the impacts of CC on water

resources and to identify possible adaptation options with emphasis on irrigation agriculture located on the pacific side of Peru.

5. P109730 - Climate Change and Agricultural Vulnerability across mega-environments in Latin America (ESW: USD 0.3 million) - The proposed work intends to identify feasible adaptation responses to climate change impacts on agriculture in specific production environments in LAC. The study develops and tests a methodology for prioritizing responses within the context of uncertainty. The project identifies three types of mega-environments, i.e. diverse agricultural production systems with different response capacities to weather variations: drought prone areas (e.g. Mexico), altiplano systems (e.g. Peru and Bolivia), and favorable high-potential areas or "bread baskets" (e.g. Uruguay). The project considers the different dimensions of vulnerability: agricultural productivity, livelihoods of rural households (poverty aspects), natural resources and environmental quality. This framework will enable an assessment of the impact of climate change on different production environments and their beneficiaries and to identify suitable adaptation strategies for each mega-environment. Adaptation strategies through research and extension systems, as well as through water management (irrigation systems) and other investment activities will be considered. Implications for additional investments in agricultural development, as well as for complementary strategies, will be outlined, which may influence future Bank operations. Moreover, adaptation to climate change fits the third pillar of CEIF (Clean Energy Investment Framework) strategy of the Bank and the development community. The process will be through partnerships with local institutions to enable local capacity building (in Mexico with INIFAP, COFUPRO and Universidad de Sonora; in Uruguay with INIA; in Peru with INIA). Duration of the ESW - 2 years (FY08, FY09)

6. P104668 - Stocktaking on climate change and agriculture in LAC (KP - USD 0.1 million) - The work comprises gathering relevant information on climate change aspects in agriculture, such as national communications, strategies, programs, studies. The focus is also on identifying the main actors and relevant institutions that are responsible for climate change related aspects in agriculture. This information is synthesized by country - in the form of *Country Notes*- for the majority of the countries in LAC. Several country notes have already been developed - Mexico, Uruguay, Peru, Bolivia, Chile, Argentina, Brazil and the Central American countries, with the remainder of the country notes to be completed by the end of December 2008. This country-specific information provides a useful baseline for climate change related activities in each country - it highlights gaps in data availability and local research capacity, enables comparisons across countries in their pursuit of climate change policies and implementation, identifies suitable local partners, indicates potential areas of engagement for LCSAR. Duration of activity - 1 calendar year (2008).

7. TF092566 - Dissemination and adoption of lessons from pilot adaptation projects to the Bank's regional portfolio (TFESSD: USD 0.5 million) - The development objective of this TFESSD-funded project is to support the dissemination and adoption of adaptation policies into the wider Bank portfolio in the region, based on the data and experience generated by the adaptation projects under implementation and with a focus on vulnerable ecosystems (high mountains and coastal), vulnerable sectors (water resources, irrigation) and vulnerable populations (coastal residents, urban). This would support data sharing, extract lessons learned from the portfolio of pilot adaptation activities, disseminate the information, and use it to promote climate-proofing policies and operations.

8. TF092388 - Increasing Community Resilience to the Social Impacts of Climate Change in LAC (TFESSD: USD XX million) - This project will contribute to the understanding of the diverse types of social impacts of climate change among poor and vulnerable rural communities in the LAC region, identifying the transmission channels that bring about those impacts and the strategies that local communities have developed to cope with those changes. As a result of this analysis, the project seeks to

better inform the design of climate change adaptation strategies at the local and national levels, increase the social resilience to climate change of vulnerable communities by strengthening their capacity to: (i) use existing resources to improve their resilience as they change their production systems; (ii) resolve conflicts over use of resources and, (iii) identify and advocate policy alternatives that enhance their adaptation capacity.

9. TF092387 - Supporting Area Based Development Initiatives to enhance adaptive capacity and maintain resilience of local actors and institutions to Climate Change (product line: USD 0.5 million) - The primary objective of the proposed activity is to better understand the interface between territorial development and climate change adaptation in selected countries in Francophone West Africa (Senegal, Burkina Faso and Niger) and Latin America (Peru, Mexico and Dominican Republic) by (1) *developing and applying a methodology to identify operational recommendations* on how to strengthen local adaptive capacity and resilience to climate change related risks through decentralized and area-based approaches;(2) and, *creating a community of practice* in country and at the regional levels for area based development and climate change adaptation. It is expected that the assessment will help in identifying windows of opportunity to advance the climate change and area based development agenda in these countries, and make operational recommendations for the Bank, government and civil society. The regional research partner for this study in Latin America is RIMISP (Centro Latinoamericano para el Desarrollo Rural) and in Peru the field work will be carried out by GRADE (Grupo de Análisis para el Desarrollo). The study will work in collaboration with Stocktaking on Climate Change and Agriculture (P104668) and Peru Irrigation Subsector and Water Resources Management Modernization Project (P104760) in the Mantaro Valley. First results from the household surveys and focus group discussions are expected by August 2009.

10. P112517 and P112654 – Social Dimensions of Climate Change (TFESSD: USD XX million) – Coordination of Peruvian case studies between two TFESSD regional initiatives studying the Social Dimensions of Climate Change in LCR: (i) “*Area Based Development and Climate Change*”, and (ii) “*Good Governance, Equitable Adaptation & Building Coalitions*”. Both studies will contribute to future analyses of social vulnerability under different social, economic and institutional circumstances by examining the role of local institutions and communities in climate change adaptation. The objective of **P112517** "Area Based Development and Climate Change Adaptation" is to better understand the interface between territorial development and climate change adaptation by (1) developing and applying a methodology to identify operational recommendations on how to strengthen local adaptive capacity and resilience to climate change related risks through decentralized and area-based approaches; and (2) creating a community of practice in country and at the regional levels for area based development and climate change adaptation. The objective of the **P112654** “Good Governance, Equitable Adaptation & Building Coalition” is to develop a framework for improving governance and institutional support for adaptation strategies, reducing exclusion in these strategies, and building advocacy coalitions and participatory mechanisms to respond to the impacts of climate change in rural communities.

These two studies will closely coordinate and develop complementary field studies (including household surveys and focus group discussions), starting with a launching workshop in February 2009. From an operational standpoint, both projects will contribute to identifying options for improving poor and vulnerable rural communities’ coping capacities by focusing attention directly on the underlying determinants of successful adaptation and constructive participation at the local level. The fieldwork will be carried out in collaboration with Stocktaking on Climate Change and Agriculture (P104668) and Peru Irrigation Subsector and Water Resources Management Modernization Project (P104760) in the Mantaro Valley. The first results from the household surveys and focus group discussions are expected by August 2009 and will be disseminated to the local and national stakeholders to foster a community of practice on the topic.

11. P101481 - Economics of Reducing Emissions from Deforestation and Forest Degradation (ESW: USD XX million). The objective of the study is to assess the economic and ecological costs of reducing emissions from deforestation and forest degradation along the Interoceanic highway through: (i) estimation of opportunity costs associated with forest maintenance on lands with high agricultural potential; (ii) modeling of carbon stock changes associated with land cover trends; and (iii) practical assessments of the costs and benefits of policy proposals under discussion. The proposed study is expected to assess the costs of alternative land uses particularly in the Amazonian forests of Peru along the Interoceanic highway and to propose incentive mechanisms that the Government of Peru could pursue to reduce emissions from deforestation and forest degradation while developing its R-Plan under the Bank's Forest Carbon Partnership Facility (FCPF).

The mitigation portfolio focuses on supporting Peru's hydro-potential and on assisting Peru in identifying new CDM projects, in strengthening its capacity in that regard and in reducing transaction costs. In addition, the Bank's support for Peru under the FCPF is part of the mitigation portfolio.

12. P110920 - CDM Project Portfolio Consolidation Project (CF Assist: USD XX million)- The aim of this project is to consolidate the execution of the CDM project portfolio previously selected and to identify new CDM potential projects. *Specifics Objectives:* (i) To reduce the access cost of the Carbon Market by providing advice to project developers on the CDM project cycle, likewise strengthen capacities of CDM-related knowledge of national actors and stakeholders through dissemination of technical publications, guidelines and websites. (ii) To strengthen the institutional capacity of FONAM and other relevant actors of the private and public sector in the promotion, identification and preparation of new projects in potential areas of intervention, like, biofuels, and renewable energy, wastewater treatment and gas recovery in oil industry, which can be eligible for the CDM, ensuring sustainable development in CDM project formulation and execution through, improving local stakeholder consultation. (iii) To support project developers in presenting adequate financial analyses, to use the carbon finance as a tool to get financing, facilitate the approach with national and international financial institutions, and develop financial tools to support the decision making of project developers, national consultants, CERs buyers, and financial institutions. (iv) To update and promote the national CDM project portfolio and strengthen the image of Peru as an attractive place for investment and the development of CDM projects

13. P092834 – Santa Rosa Hydro Carbon Finance Project (Carbon Finance: USD XX million) - The 4.1 MW Santa Rosa Hydroelectric Project, which uses the existing irrigation infrastructure as its source of water flow, is a milestone for Peru as it is the first small-scale CDM project to be developed in that country. The project is a bundle of small run-of-river hydropower plants located in the Santa Rosa Irrigation area of Sayán District. The project will help the national grid reduce the use of thermal plants and will displace expensive heavy fuel-diesel, coal, and gas-fired generation. The CDCF will purchase 88,000 tCO_{2e} from the project with an option to purchase an additional 62,000 tons. In Peru, the options for hydropower are limited because most of the best locations for hydroelectric plants have been granted to private firms. Thermal plants, meanwhile, offer better investment opportunities because they face fewer restrictions and can be located almost everywhere. Additionally, hydroelectric plants require more than double the investment capital, and the construction period is one or two years more than for a thermal plant. Providing a revenue flow through carbon finance will help level that playing field.

14. P081954 - Poechos Hydropower Project (product line: USD XX million) - The project development objective is to provide a new venue for investment in projects in the Peruvian power sector contributing to global greenhouse gas Certified Emission Reductions (CERs); initially through development of a privately developed small hydropower project totaling 15.4 MW of capacity, and additional small hydro and other projects to be determined.

15. P068250 - Participatory Management of Protected Areas (GEF: USD XX million) - The project's development objectives are: (i) to ensure biodiversity conservation by increasing the involvement of civil society institutions and the private sector in planning and sustainable management of at least five protected areas (PAs) of the Peruvian System of Natural Protected Areas (SINANPE), and one PA to be created during project implementation; and (ii) to obtain sustainability for the financing of recurrent costs in SINANPE.

16. P095424 - Strengthening Biodiversity Conservation through the National Protected Areas product line: USD XX million - The goal of the proposed project is to enhance Peru's biodiversity conservation through increasing the area of key ecosystems under protection and strengthening the capacity for strategic analysis and management under a decentralized management framework. This would be accomplished by supporting the establishment and management of regional, local and private PAs near or adjacent to critical PAs from the SINANPE, allowing for the creation of conservation mosaics and/or corridors². Different tested and innovative approaches to biodiversity conservation — including those of past GEF projects — would be applied in this project with the active participation of regional, local and private stakeholders. This will be accomplished through a collaborative effort among national and sub-national (i.e. regional, local and/or private) actors, local authorities, civil society organizations, the private sector, and bilateral organizations to consolidate a National Program for Protected Areas (PAs) as outlined in the Law for Natural Protected Areas. To achieve its goal, the project will: (i) support institutional strengthening at the central, sub-national and local levels to coordinate and effectively manage the Peruvian System of Protected Areas within the decentralized framework; (ii) establish alliances, incentive systems, coordination mechanisms and an integrated strategy that would allow participatory management of PAs by national, sub-national and local authorities with the support and active participation of the private sector, civil society and local communities; (iii) promote and establish mutually beneficial relationships between sub-national authorities and local communities in PA management; and (iv) promote the sustainability of the Peruvian System of local and sub-national PAs (the SPANP) through the establishment of an endowment fund for financing recurrent costs. This goal would significantly strengthen the fulfillment of the CBD-COP7 Plan of Work for Protected Areas and the achievements of priority actions included in the National System of Protected Areas' (SINANPE) updated National System Plan of Protected Areas.

17. LINK TO CC ? P090110/P090116 - Rural Electrification (GEF/IBRD: USD XX million). The objective of the proposed project would be to increase access to efficient and sustainable electricity services in rural areas of Peru. The proposed project would achieve this by: (a) investment in sub-projects to supply electricity services to about 160,000 currently unserved rural households, businesses and public facilities, such as schools and health clinics (serving about 800,000 people), using both conventional grid extension and renewable energy sources; (b) demonstration of key elements of a framework for electricity provision in rural areas of Peru that would attract investment from private and public sector electricity providers, as well as national, regional and local governments; and (c) implementation of a pilot program to increase productive uses of electricity that would increase opportunities for income generation in rural areas.

18. PXXXXXX – Support for Peru under the FCPF – (FCPF: USD up to 3.5 million) – The objective of the project is to support Peru's activities as a member country of the FCPF. Since October 2007 Peru is one of the countries selected into the FCPF. After an official participation agreement has been signed (Peru to sign first, then CD), the Bank is LIKELY? going to support Peru's activities in the next phase, which is the preparation of the so-called Readiness Plan (or R-Plan, in short). Besides the fact

² "Ecological corridors" refers to the areas of rich biodiversity between established protected areas and newly established private, local and/or regional PAs.

that the Bank would support key entities, as defined by Peru, in the preparation of the R-Plan document and the related consultation and outreach activities, the proposed project directly links to P101481 – “Economics of Reducing Emissions from Deforestation and Forest Degradation”. Key findings of the latter study assessing the economic and ecological costs of reducing emissions from deforestation and forest degradation will directly inform the readiness efforts of Peru under the FCPF.

Looking ahead:

The key priority for Peru is adaptation in the sense of adjusting the economy, in particular the power, water and agriculture sectors to the anticipated changes in water runoffs and water regulation caused by climate change in the Andes. These changes have the potential to make power and water supply much more expensive (Vergara et al. 2007). Likewise, changes in the ENSO signal may have effects on water circulation patterns, affecting Peru as well as on the productivity of fisheries. Critical actions are required to assess the likelihood of these potential impacts.

On the issue of glacier retreat, the projects already under implementation will provide data on the benefits and costs of adaptation measures. However, the size of the pilots is quite limited and the projects should be significantly expanded, based on the lessons learned and covering most of the Peruvian Andes. The data on hydrology produced by the ESMAP-funded study would also be instrumental in preparing for a much larger intervention.

In addition, Peru is the second largest emitter from land-use change in LAC. Pressures from the Inter-oceanic highway as well as other large-scale infrastructure projects in the Peruvian Amazon are likely to further impact the stability of primary forests leading to even higher emissions from land-use change in the future. A major effort needs to be launched to thoroughly address the different root causes of deforestation drives and implement activities to reduce and revert land use change affecting the Amazon basin. This is also considered a priority.

Peru's Second National Communication to the UNFCCC

In the area of glacier retreat the second communication is expected to contribute to: (i) an analysis of current glacier hydrology, including an update of previous glacier inventories, glacier variations, and records of glacier melt hazards and disasters; (ii) estimates of the availability of water resources due to glacier melt at the national level up to 2050; and (iii) an evaluation of adaptation strategies in the management of hydro resources in 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. In addition, the glacier monitoring effort under the regional project will benefit from the analysis under the communication.

Table 1 Overview of World Bank Climate Change Activities in Peru (draft)

Unit	Number	Name	Product Line	Adapt./ Mitigat./ Seques.	TTL	Stage/ Type	Appr. Date	Clos. Date	Total Cost	Commit. Amount (total)	Total ERPA Value	Disburs.	Status
1	LCSEN	P098248	Adaptation to the Impact of Rapid Glacier Retreat in the Tropical Andes (GEF: USD 7.5)	GEF – SCCF (7.49) & PHRD (0.86)	ADP	Vergara	SPN	05/27/2008	09/30/201	32.72	8.55	N/A	Active
2	LCSEN	P110305	Assessment of Climate Impact on Peru's hydrology. Development of a methodology (ESMAP: USD 0.3 million)	TA	ADP	Vergara			286	216	N/A		Active
3		P109969	Overcoming Barriers to Hydropower Investment in Peru (ESW, USD 0.2 million)	ESW	MIT	Bogach							
4		???	Potential impact and possible adaptation measures with emphasis on irrigation agriculture along the pacific (FAO – WB)										
5	LCSAR	P109730	Climate Change and Agricultural Vulnerability across mega-environments in Latin America (ESW)	ESW	ADP	Janssen					N/A		Active
6	LCSAR	P104668	Stocktaking on climate change and agriculture in LAC	ESW		Edmeades			70				Closed ?
7	LCSEN	TF092566	Dissemination and adoption of lessons from pilot adaptation projects to the Bank's regional portfolio (TFESSD)	TFESSD	ADP	Vergara, Cestfi							Active
8	LCSSO	TF092388	Increasing Community Resilience to the Social Impacts of Climate Change in LAC (TFESSD)	TFESSD	ADP	Gaciña Marió, Verner							Active
9	SDV	TF092387	Supporting Area Based Development Initiatives to enhance adaptive capacity and maintain resilience of local actors and institutions to Climate Change	TFESSD	ADP	Perrin							Active
10		P112517 and P112654	Social Dimensions of Climate Change consisting of projects: "Area Based Development and Climate Change" and "Good Governance, Equitable	TFESSD									

Unit	Number	Name	Product Line	Adapt./ Mitigat./ Seques.	TTL	Stage/ Type	Appr. Date	Clos. Date	Total Cost	Commit. Amount (total)	Total ERPA Value	Disburs.	Status
		Adaptation & Building Coalitions"											
11	LCSEN	Economics of Reducing Emissions from Deforestation and Forest Degradation	ESW	MIT	Bosquet								
12		CDM Project Portfolio Consolidation Project - CF Assist	CF Assist	MIT	Poveda								
13		Santa Rosa Hydro Carbon Finance Project	Carbon Finance	MIT	Bogach								
14		Peechos Hydropower Project	Carbon Finance	MIT	Bogach								
15		- Participatory Management of Protected Areas (GEF)	GEF		Poveda								
16		Strengthening Biodiversity Conservation through the National Protected Areas.	GEF		Poveda								
17		Rural Electrification (GEF/IBRD).	GEF/IBRD	MIT	Bogach								
18	???	Support for Peru under the FCPF	FCPF										

Table 2 Summary of Peru's National Inventory of Greenhouse Gases (in Gg)

Categoriéis of Sources and Sinks	CO₂	CH₄	N₂O	CO₂ Equivalent
I. Total energy	30,656.75	53.80	0.86	32,053.09
Fuel combustion	20,770.53	45.40	0.86	21,990.53
Conversion and transformation industry	4,237.12	0.40	0.06	4,264.12
Industry (ISIC)	2,851.57	0.70	0.11	2,900.37
Domestic/commercial	2,271.15	41.40	0.56	3,314.15
Public	729.64	0.10	0.01	734.84
Transportation	7,921.89	1.10	0.08	7,969.79
Agriculture and livestock/agroindustrial	240.33	1.40	0.02	275.93
Fishing	1,682.08	0.20	0.01	1,689.38
Metal mining	836.75	0.10	0.01	841.95
Fugitive emission (extraction, transmission and transportation)	0.00	7.78	0.00	163.38
Mineral coal		0.86		18.06
Oil and natural gas		6.92		145.32
Industrial processes	9,886.22	0.62	0.00	9,899.18
Mineral products	1,989.11			1,989.11
Chemical industry	25.63	0.62		38.59
Metal production	7,871.48			7,871.48
II. Total Non-Energy	37,196.80	757.81	44.04	66,763.21
Agriculture	0.00	471.46	41.64	22,809.06
Enteric fermentation		364.67		7,658.07
Manure management		11.16	1.96	841.96
Rice cultivation		55.28		1,160.88
Prescribed burning of savanna		36.40	0.45	903.90
Field burning of agriculture residues		3.95	0.10	113.95
Use of agriculture soils			39.13	12,130.30
Change of land use and forestry	37,196.80	173.77	1.20	41,217.97
Change in forest and other woody biomass stocks	-4,122.40			-4,122.40
Forests and grasslands conversion	82,487.50	173.77	1.20	86,508.67
Abandonment of managed lands	-37,345.00			-37,345.00
CO ₂ Emissions and removals from soil	-3,823.30			-3,823.30
Wastes	0.00	112.58	1.20	2,736.18
Solid waste disposal on land		95.93		2,014.53
Human faeces			1.20	372.00
Other		16.65		349.65
III. Total National Greenhouse Gases Emissions and Capture	67,853.55	811.61	44.90	98,816.30

Source: Comunicacion Nacional del Peru a la Convencion de Naciones Unidas sobre Cambio Climatico. 2001.