PERU

Country Note on Climate Change Aspects in Agriculture

This Country Note briefly summarizes information relevant to both climate change and agriculture in Peru, with focus on policy developments (including action plans and programs) and institutional make-up.

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Contribution of agriculture (without LUCF) to the economy and to emissions in LAC countries

(size of bubble in MTCO2 of LUCF emissions; axes cross at LAC average)

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(size of bubble in MTCO2 of LUCF emissions; axes cross at LAC average)

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Percent of GHG emissions in CO2 equivalent, by sector (2000)

Source: World Resources Institute

Note: The Second National Communication identifies a significant reduction in LUCF emissions and an increase in emissions from agriculture.

Land use (2005)

Source: World Development Indicators

Vulnerability Indicators

Note: Employment in agriculture (% of total employment)*; Rainfed cropland (% of total cropland)*; Gini*; Water usage in agriculture (% of total annual fresh water withdrawals)*; Uninsured cropland (% of total cultivated land area)**; Soil degradation (% of total land)***; Risk of extreme weather events (index; annual average 1997-2006)****

Sources: *World Development Indicators 2007, 2000-2007 average; **IADB, IICA, 2002/2003 figures; ***FAO AGL 2005; ****Germanwatch

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Note: In the first bubble graph, the total emissions for Uruguay do not account for the positive effects of LUCF (i.e. afforestation efforts). If they are considered, agriculture represents 222% of total emissions. Because of afforestation efforts in Uruguay and Chile, land use change and forestry (LUCF) is not a net contributor to emissions; hence the countries do not appear in the second bubble graph, but are considered in the calculation of the average in the vertical axis.

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1 http://www.fao.org/landandwater/agll/glaoed/glaoedmaps.jsp?country=PER&search=Display+map+%21
Summary

Like most developing countries, Peru has submitted only one national communication to the United Nations Framework Convention on Climate Change (UNFCCC), with the second one under preparation. Land use change and forestry are the largest contributors to GHG emissions in the country. The emission reduction potential of the agricultural (including land use change and forestry) sector is large, though not yet sufficiently explored. Peru currently counts with 1 CDM project in the agricultural sector, and 1 CDM reforestation project. Reducing vulnerability to climate change and, in particular, to water scarcity due to variations in precipitation and glacier retreats is of increasing importance in the agricultural sector, coupled with more sustainable land management practices.

Working definitions

Agriculture is defined as a managed system of crops, livestock, soil management, forest resources (productive use, goods & services) and water resources (irrigation), including land use and land use change. Climate change encompasses both mitigation and adaptation activities within the agricultural sector. On the mitigation side, the focus is on the potential to reduce greenhouse gas emissions by the different sub-sectors. On the adaptation side, the focus is on the potential to build resilience to climate and to increase the adaptive capacity through sustainable management of agriculture and other complementary factors (e.g. financial instruments). There is no specific time frame used in the country notes. An effort was made to collect the most recent available information on country indicators and policy matters.
The baseline map provides a visual characterization of Peru's agricultural potential given current environmental constraints and their regional distribution. Around 17% of Peru's land is used for agriculture (14% for pasture and 3% for cultivation), with forestry occupying 53% of the land in the country (WDI, 2005).

Baseline map: Current Major Environmental Constraints related to Agricultural Potential

1.1. Country Projections
According to studies prior to the Second National Communication, the following future impacts from climate change related events can be expected in Peru by 2050:

a) **increase in temperature** – summer temperature increase of 1.3°C; relative summer humidity decreases of 6%; an increases in the number of days with frost during the summer, as well as rising surface temperature of ocean water on the Peruvian coast of around 3-4°C above the current level,

b) **reduction in precipitation** – precipitation decreases in the Northern, Central and Southern part of the country of 10%, 19% and 14% respectively,

c) **rising sea level** – this can lead to flooding of the low areas, erosion, penetration of salt water and increase damage from heavy sea,
d) **increased frequency of weather events** – increased frequency of the *El Niño* South Oscillation (ENSO).

In recent years (between 2003 and 2007), extreme temperatures and floods have had the highest human and economic impact in Peru, with losses for the period 1997-2006 averaging at 0.11% of GDP - 5 million people (around 18% of the country’s population) have been affected by extreme temperatures (3 events) and 0.5 million people (around 2% of the country’s population) have been affected by floods (1 event)\(^2\). The annual cost of natural disasters during the period 2000-2004 was around $325 million. The occurrence of disasters showed an increasing trend over the years: flooding increased by more than 60% from the period 1970-1980 to 1990-2000, huaycos (mudflows) by almost 400% for the same period\(^3\).

### 1.2. Agriculture related impacts

The most common effects from the *El Niño* phenomenon (1997-1998) in the Andean region were increasing droughts and levels of precipitation, both causing a reduction in crop yields and leading to higher occurrence of diseases. A study performed in the Cañete Valley\(^4\) situated 140km South of Lima showed that an increase in temperature led to a 45% increase in the occurrence of plagues for the period 1996-1997 and a 34% increase for the period 1996-1998. This led to a decrease in crop yield of 57% for the period 1996-1998. The yield loss for the most important crops was as follows: 56% for potatoes, 50% for cotton and 46% for corn. The total damage due to the *El Niño* effect was concentrated in the agricultural sector and it was worth US$ 613 million\(^5\).

Peru has submitted only one **National Communication to the United Nations Framework Convention on Climate Change** (UNFCCC)\(^6\) in June 2001. The Communication established the National GHG Inventory, as well as it proposed measures to be taken in the agricultural sector (including land use and land use change and forestry) that will have an impact on climate change. Furthermore, it gives a description of the programs and policies with an impact on climate change, an overview of climate change adaptation measures and financial and technological limitations to confront climate change. A **Second National Communication** is in the works and scheduled to be published in 2009.

Despite its high methane emissions from the agriculture sector, Peru has a small impact on the global climate in terms of total greenhouse gas emissions. Because of it small contribution to global emissions, Peru is not included in the **Climate Change Performance Index 2008**\(^7\) of 56 countries responsible for more than 90 percent of global energy related CO\(_2\). Compared to other countries in the region such as Argentina, Brazil, Mexico and Venezuela, Peru has an overall small contribution of GHG emissions to the atmosphere of less than 0.3% of overall emissions\(^8\).

### 2. National Climate Change Plans, Strategies and Programs

In 2003 Peru formulated its **National Climate Change Strategy**\(^9\) (ENCC, Spanish acronym). The objective of the strategy is to promote and develop policies, measures and projects that

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\(^2\) [http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php](http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php)


\(^4\) [http://www.revistafuturos.info](http://www.revistafuturos.info)


\(^6\) [http://www.cambioclimatico.gob.pe/estrategia-nacional-de-cambio-climatico-encc/](http://www.cambioclimatico.gob.pe/estrategia-nacional-de-cambio-climatico-encc/)


\(^8\) [http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php](http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php)

will increase the adaptation capacity of the country to climate change thus making it less vulnerable. It also proposes measures for a more rational management of GHG emissions, better management of forests for increased carbon sequestration and distribution of knowledge and information about climate change for a better preparation of the population. The National Climate Change Strategy has been updated throughout 2009.

In July 2003, Peru formulated its National Strategy Study for the Clean Development Mechanism in Peru\(^\text{10}\) (NSS, Spanish acronym). This Strategy is intended to evaluate Peru’s role in the Clean Development Mechanism, identify the potential for investment in greenhouse gas abatement projects as well as financing options for such projects and develop national policies aimed at participating in the CDM. The Strategy was carried out by CONAM together with a team of national and international consultants and today is implemented by the Ministry of the Environment (MINAM).

### 2.2. Agricultural Sector Initiatives

In April 2009, the National Water Authority (ANA, Spanish acronym) formulated the National Policy and Strategy for Water Resources in Peru\(^\text{11}\) (PENRHP, Spanish acronym). This objective of the strategy is the rational and sustainable use of water and the protection and preservation of water resources. For this purpose, a Multisectoral Technical Commission was formed, constituted by 14 members from various ministries, to work on defining the framework within which it must interact with the public and private sectors in managing water resources using integrated management interventions, properly institutionalized mechanisms, coherent and coordinated management in the context of regionalization and decentralization process.

The National Environment Council\(^\text{12}\) (CONAM, Spanish acronym) was the national environment authority created in October 1995 and was also the Designated National Authority (DNA) on climate change to the United Nations Framework on Climate Change (UNFCCC) in Peru.

In May 2008 Peru announced the inception of its first Ministry of the Environment\(^\text{13}\) (MINAM, Spanish acronym) which assumed the responsibilities previously held by CONAM and has among its mandates the coordination of the national climate change strategy and adaptation and mitigation measures related to it. The Ministry of the Environment is constituted by the Vice Ministry of Environmental Management and the Vice Ministry of Strategic Development of Natural Resources that is the DNA on climate change to the United Nations Framework on Climate Change (UNFCCC) in Peru.

The National Environment Fund\(^\text{14}\) (FONAM, Spanish acronym) is a non-profit institution of public and social interest funded with the objective of promoting public and private investment for the development of environmental projects in Peru. FONAM is the organization responsible for promoting the Clean Development Mechanism in the country. Its task involves promoting and registering potential CDM projects on the CDM National Project Portfolio. It provides technical support to project developers throughout the CDM project cycle, with the aim to facilitate the application procedure for national projects.

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\(^{11}\) http://gestionsostenibledelagua.wordpress.com/blog/politica-y-estrategia-nacional-de-los-recursos-hidricos-en-el-peru

\(^{12}\) www.conam.gob.pe

\(^{13}\) http://www.minam.gob.pe/

\(^{14}\) www.fonamperu.org
The National Weather and Water Service\textsuperscript{15} (SENAMHI, Spanish acronym) is an institution that provides climate and data information, including agroclimatological description and accumulated hydrological year and river discharges data since 1969. It is also the entity that has produced numerous vulnerability studies in the country, including ENSO, natural disaster warning, climate change, regional and national precipitation, droughts and their impacts\textsuperscript{16}. Since May 2008, with the inception of MINAM, SENAMHI is an institution that belongs to this Ministry.

The National Institute of Civil Defense\textsuperscript{17} (INDECI, Spanish acronym) focuses its attention on response to natural disasters and develops prevention actions for vulnerability reduction through the existence of a National Plan for Prevention and Attention to Disasters\textsuperscript{18} (PNPAD, Spanish acronym).

### 3.1. Inter-Sectoral Coordination

MINAM is the National Environmental Authority governing the National Environmental Management System that drives the process of inter-sectoral coordination with the Central Government, Regional and Local Governments and the process of strategy development and coordination of policies and goals to promote sustainable development.

The National Commission on Climate Change was created in 2001 and it is made up by twenty members from the public and private sector who work on issues of adaptation and mitigation and its goal is to coordinate with the different sectors the fulfillment of the obligations to the UNFCCC.

The National Capacities Strengthening Program for Climate Change Impact and Air Pollution Management\textsuperscript{19} (PROCLIM, Spanish acronym) was an activity program coordinated by CONAM. The objective of the program was to contribute to poverty reduction by integrating the concepts of climate change and air quality in sustainable development policies of the country. PROCLIM has a multi-institutional and multidisciplinary nature and counts with the participation of different governmental and non-governmental sectors. The subject components of this program among others are vulnerability and adaptation, as well as inventories and mitigation, for which many outcomes have been used in developing the Second National Communication.

The National Science, Technology and Technological Innovation Council\textsuperscript{20} (CONCYTEC, Spanish acronym) is a government institution composed of scientists from the academic sector, national research institutes, private enterprises and the civil society that organizes programs and seminars on climate change, vulnerability, adaptation and mitigation measures among others.

### 3.2. Agricultural Sector Institutions

The Ministry of Agriculture\textsuperscript{21} (MINAG, Spanish acronym) is responsible for the formulation of policies related to agriculture, livestock and natural resources (including water and forestry), as well as it oversees climate change related programs through its different institutions in the sector. The National Water Authority (ANA, Spanish acronym), created in March 2008, is under the authority of the Ministry of Agriculture and it is responsible for the integrated and sustainable management of water resources.

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\textsuperscript{15} http://www.senamhi.gob.pe/
\textsuperscript{16} http://unfccc.int/files/adaptation/adverse_effects_and_response_measures_art_48/application/pdf/200609_background_latin_american_wkshp.pdf
\textsuperscript{17} www.indeci.gob.pe
\textsuperscript{18} http://www.indeci.gob.pe/planes_proy_prig/pdfs/plan_nacional_preven_15ene04.pdf
\textsuperscript{19} www.conam.gob.pe/proclim
\textsuperscript{20} www.concytec.gob.pe
\textsuperscript{21} www.minag.gob.pe
The National Water Authority (ANA, Spanish acronym), created in March 2008, is under the authority of the Ministry of Agriculture and it is responsible for the integrated and sustainable management of water resources at the national level and the Local Authority of Water (ALA, Spanish acronym) at the regional level are responsible for the administration of water resources and water use, especially in agriculture.

The National Institute for Agrarian Innovation (INIA, Spanish acronym) is responsible for agricultural research and technology development, extension and capacity building in the agricultural sector. The focus of research and extension are crops, livestock, forestry resources and genetic material.

The Agricultural-Rural Production Development Program (AGRORURAL, Spanish acronym) is the institution in charge of elaborating, promoting, coordinating and supervising the programs and projects linked to reforestation and climate change, soil management and management of watersheds as part of the sustainable management of natural resources. The Irrigation Subsectoral Program (PSI, Spanish acronym) focuses on the efficient and sustainable use of irrigation water, working with 64 user groups on the coastal side of the country.

The National Consultative Council for Forestry Policy (CONAFOR, Spanish acronym), the Supervising Organism for Timber Forestry Resources (OSINFOR, Spanish acronym) are two agencies created under the Forestry Law to provide guidance in relation to policies and feedback on development plans and other sectoral issues, as well as they are in charge of supervising forest concessions for timber production.

The Viceministry of Fisheries under the authority of the Ministry of Production (PRODUCE, Spanish acronym) is responsible for the formulation and execution of policies related to extraction, transformation and fishing activities overseeing the rational exploitation of natural resources and the preservation of the environment.

3.3. Fostering Capacity to Deal with Climate Change

Emission inventory: To date, Peru counts with one National GHG Inventory with 1994 as its base year. The inventory includes information on emissions from agriculture, land use change and forestry, providing disaggregated information by type of emission and type of agricultural resource. Peru has also recently created the National GHG Inventory with 2000 as its base year.

Studies related to climate change and agriculture: SENAMHI and CONAM have produced several regional vulnerability and adaptation studies (mentioned in greater detail in Section 5 below). Among some of the studies are: a) Future Climate Scenarios and Availability of Water Resources in the Rio Santa Basin (Escenarios Climáticos Futuros y Disponibilidad del Recurso Hídrico en la Cuenca del Río Santa): using various climate scenarios the general conclusion of these studies is that there is a tendency for a temperature increase in Peru with an increase of precipitations which will lead to increased storms in the Central and Southern part of the country as well as a continued retreat of glaciers in the Cordillera Blanca resulting in a reduction of water resources for population use and for agriculture in the studied areas;
b) Current and future vulnerability to climate change and adaptation methods for the Rio Mantaro Basin (Vulnerabilidad Actual y Futura Ante el Cambio Climático y Medidas de Adaptación en la Cuenca del Río Mantaro): it presents the current vulnerability problems due to poverty as well as future ones posed by the decrease in precipitations and it proposes adaptation measures for the area; c) Local evaluation and adaptation strategy to climate change in the Rio Piura Basin (Evaluación Local Integrada y Estrategia de Adaptación al Cambio Climático en la Cuenca del Río Piura): it proposes adaptation measures for this area and proposes the incorporation of the variable “climate change” in future planning and regional development projects; d) Study of Vulnerability of Water Resources in the Highlands (Estudio de Vulnerabilidad de Recursos Hidricos de Alta Montaña): this is a research study performed in 1997 and 1998 by CONAM that analyzed the impact of climate change on four glaciers of Peru. The final conclusion was a drastic reduction of the four studied glaciers for the last 15 years and a disappearance of glaciers covering a smaller surface during the present decade.

There are several recent World Bank publications that focus on climate change issues in the Latin America region and on Mexico, in particular: 1) a flagship document for Latin America and the Caribbean titled “Low carbon, High Growth: Latin American Responses to Climate Change”\(^\text{29}\), encompassing information on climate change impacts in the region, on the potential contribution to mitigation efforts as well as a listing of future low carbon and high growth policies; 2) a paper titled “Transitioning to Climate Resilient development Perspectives from Communities in Peru” comparing scientific data in expected \(\text{El Niño}\) and \(\text{La Niña}\) impacts on the climate in Northern Peru with community perspectives and adaptation measures collected from rural communities in Puno and Piura; 3) a methodology for designing participatory adaptation Action Plans in agriculture (through bottom up prioritization of response options), which was applied in the Altiplano of Peru (Mantaro Valley, State of Junín), among other regions (Mexico and Uruguay).

According to the First National Communication, the land used for agriculture represents only 6% of the total surface area of Peru (7,600,000ha) due to the low natural land fertility and water scarcity in the coastal area and in the highlands. Agriculture accounts for 23% of GHG emissions in the country, forests and land use change for 42%. According to the 2000 National GHG Inventory, the main source of emissions are forests and grasslands conversion (110,060 Gg CO\(_2\) Eq.) while the main sink is the change in forest and other wood biomass stocks (53,541 Gg CO\(_2\) Eq.). Agriculture is responsible for 21% and forests and land use change for 47% of GHG emissions in Peru.

The most important crops (sugarcane, cotton, rice) are grown on the coast, employing mechanized irrigation methods, while agriculture in the highlands is mostly traditional and rainfed, thus making it more vulnerable to weather related events. Soil erosion is a very serious problem in Peru given that only 3.3%of the entire country’s area is cultivated with annual and perennial crops. The most severe soil erosion problems are found in the highlands with 72% of the total land being affected. The causes for this are deforestation, overgrazing and inadequate crop growing practices. Soil erosion represents 65% of the total cost of agricultural land degradation and soil salinity around 35% in terms of crop yield reductions associated with these damages\(^\text{30}\).


4.1. Action frameworks

4.1.1. Forestry and Land Use Change

The natural forest cover of Peru represents 35.5% of its territory. This places Peru 8th in the world in terms of forest coverage and 2nd only to Brazil in Latin America. Forests are distributed unevenly across the country with 99.4% of them being located in the Eastern part of the country. Deforestation is a big problem in the country with the coastal region having almost entirely depleted its forest cover of mangroves and dry sub-humid forests. In the Andean highlands, some 300,000 ha of natural forests remain.

In the First National Communication, forestry is identified as having the highest potential of carbon capture. The total carbon sequestration from forest plantations, forests allocated for industrial use and area under perennial crops amounted to 13,906 Gg CO₂ in 1994.

- Forests destined for industrial use accounted for 55.14% of the total carbon sequestration (7,669 Gg CO₂)
- Plantation forests accounted for 27.09% (3,767 Gg CO₂) of total carbon sequestration
- Areas under perennial crops accounted for 17.77% (2,470.6 Gg CO₂)
- Of the total area of secondary forests (not natural), 76% are considered abandoned lands. The remaining 24% are cropland, pastureland and abandoned lands or land in the process of erosion. The total carbon capture from secondary forests amounts to 37,345 Gg CO₂.
- The impact of migratory agriculture on soils indicates a carbon capture of 3,823 Gg CO₂.

The annual average deforestation rate for the period 1990-2000 is estimated at 149,632 ha, according to the Map of the Peruvian Amazon Deforestation. The Peruvian Amazon is the region with the largest increase in deforestation and within this the Amazonas department registers the highest deforestation increase for the period 1990-2000 of 23.78%. Illegal logging is a primary cause of deforestation in Peru. Other causes are slash-and-burn agriculture, fuel wood extraction and overgrazing in the Sierra, large-scale agriculture, clearance of forests for coca cultivation and cattle ranching in the Amazon.

Annual reforestation showed an increasing trend from 1990 to 1997 after which a sharp decrease can be noticed from 109,885 ha in 1997 to 43,128 ha in 2000 (the equivalent of a 60% decrease). An estimated 10,500,000 ha of forest lands are suitable for reforestation: 5% on the coast (500,000 ha), 71% (7,500,000 ha) in the mountain area and 24% (2,500,000 ha) in the Amazonian jungle area. Of the total area fit for reforestation, only 7% has been reforested in the coastal area, 5% in the mountain area and 0.01% in the jungle area.

Some mitigation measures include the following:

- Creation in 2003 of the Forestry Development Promotion Fund (FONDEBOSQUE, Spanish acronym), a public-private organization destined to promote the development of forestry plantations.
- Plantation development
- Payments for environmental services

31 About 80 percent of remaining forest area in Peru is located in three departments to the east of the mountain chains with about 50 percent in Loreto. These departments represent 43 percent of Peru’s total land area and have less than 5 percent of the country’s total population. (World Bank, 2007)
33 Jorge O. Elgegren, Deforestation in Peru
35 http://www.inei.gob.pe/
36 Forest Peru in figures (INRENA, 1999) as cited in CONAM, 2003
37 www.fondebosque.org.pe
Projects on afforestation and reforestation

Furthermore, The First National Communication identifies the following mitigation actions to be undertaken in the forestry sector:

- Forestation with exotic species which would have as additional benefits the development of the forest and paper industry, protection of soil and water and the improvement of the microclimate (estimated carbon capture of 9.9 MtCO₂ for the period 2000-2020)
- Forestation with native species which would have as additional benefits the conservation of biodiversity, wood supply for the local communities, protection of soil and water (estimated carbon capture of 4.3 MtCO₂ for the period 2000-2020)
- Forest management which would have as additional benefit the protection of the forest industry (estimated carbon capture of 2.4 MtCO₂ for the period 2000-2020)

In addition, during the development of the Second National Communication some mitigation activities in the forestry sector have been identified:

- Bi-national program for conservation and participatory management of tropical forests of the Chinchipe Basin
- Forestation activities in regions Madre de Dios and San Martín (FONDEBOSQUE 2008-2009)
- Reforestation activities in region Madre de Dios by the Research Institute of the Peruvian Amazon (IIAP, Spanish acronym).
- National Reforestation Plan by the Ministry of Agriculture: in the first phase 40 million seedlings have been planted
- Keeping Together Program by the Ministry of the Environment, has the goal of preserving at least 5 years around 10.5 million hectares of Amazonian forests located on lands belonging to indigenous communities

Peru was selected into the World Bank’s Forest Carbon Partnership Facility (FCPF) Readiness Mechanism. The FCPF aims to assist Peru in its efforts to reduce emissions from deforestation and forest degradation (REDD).

### 4.1.2. Livestock

Farming activities are the ones responsible for the highest emissions of methane. Enteric fermentation was responsible for 51% (495.7 Gg CH₄) of all methane emissions in 2000 and for 86% of methane emissions from the agricultural sector, according to the National GHG Inventory with 2000 as its base year. These emissions are generated during the digestion process of the herbivores and they depend on the age, type, weight and quality and quantity of food the animals receive. Only 2.76% of the total methane emissions were generated from animal manure (16 Gg CH₄).

### 4.2. Carbon Trading and Agriculture

Under the Clean Development Mechanism (CDM), developed (also referred to as Annex I) countries can implement project activities that reduce emissions in developing (non-Annex

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38 www.iiap.org.pe
I) countries. Though the CDM is expected to generate investment in developing countries, especially from the private sector, and promote the transfer of environmentally-friendly technologies in that direction, the global share of agricultural sector projects (including afforestation and reforestation) is very small (5.71% of total registered projects globally as of December 2009)\(^40\) and the potential is country-specific. Latin America, as a region, currently holds the largest share of registered agricultural projects globally, 61% (75 projects).

As of December 2009, there are only 21 registered projects in Peru. Currently, there is 1 registered CDM project in agriculture in Peru (on the reduction of methane emissions from livestock) and 1 CDM reforestation project\(^41\). The country portfolio of CDM projects (in different stages of approval) represents an investment of over US$6 billion with a large potential for reducing GHG emissions, estimated at 15,000 Gg CO\(_2\) equivalent per year. Of the 21 registered projects, 6 are already receiving benefits from certified emission reductions (CERs), reason why Point Carbon\(^42\) places Peru within the 6 most attractive countries for this market.

The key vulnerability areas for Peru are in the agricultural sector, coastal zones, water resources and fisheries. The adaptation capacity to climate change of Peru is constrained by the scarcity of financial, human and technological resources.

5. Impact of Climate Change on Agriculture - Adaptation Measures

5.1. Action frameworks

5.1.1. Land Management

The El Niño phenomenon had a strong effect on crop yields in the country. Temperature rises led to the following decreases in yields in selected crops for the period 1996-1997: 55.5% yield loss in potatoes, 43% in sweet potatoes, 50% in cotton and 97% in peaches. In addition the rise in precipitation led to an increase occurrence of plagues. Soil conservation methods are to be applied as a primary measure to avoid soil erosion with positive effects on crop productivity. A study showed that by applying soil conservation measures such as terraces, the crop yield increased as follows: 13% for potato, 20% for maize and 10% for barley\(^43\).

Approximately 15% of irrigated areas show low degree of land degradation, 7% moderate and 18% serious. The total compromised areas amounts to 307,000 hectares\(^44\). The main causes for these occurrences are low irrigation efficiency, cultivation of water intensive crops, lack of underwater exploitation and lack of maintenance of existing drainage systems.

Around 79% of sugarcane output in Peru is from plantations along the North coast. To achieve production at such a scale as to replace all the fossil fuel used in the country would require 200,000 additional hectares of sugarcane. This would require an extension of the agricultural frontier, replacement of established crops and more water, as sugarcane is a water-intensive crop. Peru is currently not a producer of ethanol but estimates for the future show that if it were, the total cost would be $1.02/gallon or $0.27/liter\(^45\).

Several institutions in the country are involved in R&D related to the improvement of productive processes. Among them are: a) The Peruvian Association of Sugar and Biofuel Producers\(^46\) (APPAB, Spanish acronym) is a private institution that conducts research in

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\(^40\) http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html
\(^41\) http://cdm.unfccc.int/Projects/projssearch.html
\(^42\) http://www.pointcarbon.com/
\(^43\) The World Bank, *Environmental Sustainability: A Key to Poverty Reduction in Peru, Country Environmental Analysis*, June 2007
\(^44\) http://pacificosur.rirh.net/ADVF/documentos/ENGRHaprobado120105.pdf
\(^46\) http://appab.org/
areas such as sugarcane production and biofuels and performs studies on the production of ethanol; b) **The National Agrarian University La Molina**⁴⁷ (UNALM, Spanish acronym): its Renewable Research Laboratory (LER) performs research on non-conventional energies and their use as nonpolluting alternatives, especially for the rural sector; as well as, c) **INIA**.

### 5.1.2. Water Use

Rapid shrinkage of glaciers in the Andean countries, for example in Bolivia, Chile, Ecuador and Peru, could lead to droughts which would affect people and the biodiversity of the region. An observed increase in run-off has only been temporary. It cannot last very long without increasing precipitation. The melting of glaciers will cause water shortage for millions of people in the region. This is the main vulnerability in the Andean region⁴⁸.

The three regions of Peru have a very unequal distribution of water resources and irrigation infrastructure. The Pacific region accounts for 70% of the population; it is characterized by its aridity and has only 1.8% of the water resources in the country. The Altiplano region accounts for only 26% of the population and it has 97.7% of the water resources in the country⁴⁹. The most populated costal area of Peru accounts for 68% of the country’s irrigation infrastructure. The highlands and the Amazon region (the third region of the country) rely much more on rain as a source of water and thus are less equipped with irrigation infrastructure: 26% and 6% respectively. Of the total cultivated area, only 27.7% is equipped for irrigation, representing 1.7 m hectares. Of this area, only 70% of the territory is actually irrigated (1.2 m hectares). 85% of the irrigated surface is done by surface irrigation (1.1 m hectares), 9% by sprinkler irrigation (0.12 m hectares) and the remaining 6% by localized irrigation (0.07 m hectares)⁵⁰.

Agriculture accounts for over 86% of the water usage in the country, yet 65% of this water is lost due to reliance on inefficient irrigation system⁵¹. This inefficiency is mainly due to leaky distribution systems and the wide use of unimproved gravity and flooding irrigation methods.

Adaptation measures in the water sector include the **Waru Waru Project** implemented in 1991 in the Peruvian Altiplano. This is a cultivation and irrigation system used in flood prone areas aimed at bringing into production abandoned flood prone land from the Altiplano by employing ancient irrigation and drainage techniques. This system achieves higher productivity levels than traditional cropping methods (the increase is of 50% to 100% for potatoes and other Andean tubers), controls soil salinity in poorly drained soils and reduces damage caused by drought and frost⁵². Currently more than 120 communities have incorporated Waru Waru into their production system, covering an area of 1600 ha of reclaimed land.

The **El Niño** phenomenon in Peru resulted in the reduction of catches of the most predominant commercial species, thus affecting the small fishing communities the strongest. According to the **National System of Civil Defense (SINDECI, Spanish acronym)** the fishing sector was the most affected one of the economy in 1998. During the period 1970-1983 and the year 1998, fish catches in Peru fell by 80% and 45% respectively, representing on average a reduction of 10% and 5% of global fish catches due to ENSO related events⁵³.

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⁴⁷ [http://www.lamolina.edu.pe/portada/](http://www.lamolina.edu.pe/portada/)
⁴⁹ [http://pacificosur.rirh.net/ADVF/documentos/ENGRHaprobado120105.pdf](http://pacificosur.rirh.net/ADVF/documentos/ENGRHaprobado120105.pdf)
⁵³ Comunidad Andina, **El Cambio Clímático no tiene Fronteras. Impacto del Cambio Climático en la Comunidad Andina**, Lima, Perú (2008)
The **Design and implementation of adaptation measures to address glacial melt in the central Andes** is a project to be funded through the SCCF and to be implemented by the World Bank. It is planned to support: (i) institutional analysis, legal and regulatory assessments, a stakeholder analysis and consultation process, and public awareness for the implementation of adaptation measures; and (ii) design and implementation of pilot adaptation projects in selected communities, and key economic sectors where vulnerability is greatest and the region's interest is the highest\(^54\).

### 5.2. Social Aspects and Interventions

Many people in rural areas derive their livelihoods from agriculture and can be disproportionately affected by changes in climate. The Gini index of inequality for Peru is 52, with about 30% of the population living on less than $2 a day\(^55\).

According to the **Third National Agrarian Census of 1994**, peasant communities encompassing almost 9% of the total population are owners of almost 40% of agricultural lands of the country (14 million ha)\(^56\). Of the total Peruvian population of 28 million, in 2005 more than 50% lived in poverty conditions of which approximately 17% lived in extreme poverty (5.6 million). The likelihood of being poor is higher among indigenous communities, by 11%. There is a 58% labor earning gap between indigenous and non-indigenous people in 2004 which shows the high level of marginalization of the former\(^57\). Sharp regional differences exist in Peru reflected in earning capabilities and life expectancy. People living in Lima can expect to live 20 years longer than those born in the southern highlands and they can earn 30 times as much as poor farmers. Nearly nine out of ten rural poor people are in the arid Andean highlands and most of them are indigenous people producing basic food crops at subsistence level which makes them more vulnerable to climate change effects\(^58\).

Some of the adaptation strategies identified for rural poor in the Andean highlands in Peru are in-kind and cash food crops, improved cattle, off-farm income and forages, the former two maximizing households income and thus making them less vulnerable to future shocks and the latter three being more available to higher income households\(^59\).

The farming communities (comunidades campesinas) controlling 39.8% of agricultural land in the country\(^60\) have both an institutional and legal significance in the agricultural sector that is relevant to climate change adaptation. The institutional stems from the strong decision-making power these communities have in the rural areas on various issues such as agriculture and their proven ability on mobilizing resources for the improvement of the rural area (building roads, schools etc.). The legal one comes from the fact that these communities are significant holders of the title of land.

Further adaptation initiatives are:

- **Climate Risk and Adaptation of Poor Rural Communities in Peru**\(^61\), a project developed by **Technologies to Challenge Poverty**\(^62\) (ITDG, Spanish acronym) in seven rural zones.
aimed to increase the capacity of rural communities to preserve their livelihoods while undergoing climate changes.

- Market Strengthening and Livelihood Diversification in the Southern Highlands of Peru, a project run by the International Fund for Agricultural Development (IFAD) that focuses on the development of markets for local goods and services as well as on transferring management responsibility and public funds to their community organizations.

- National Compensation and Social Development Fund (FONCODES, Spanish Acronym), created to channel funds to the poor communities for projects such as roads, schools, etc.

- The project: Las Prácticas y Políticas de Desarrollo Local frente a los Riesgos de Desastres: Identificación de Experiencias Significativas en los Países de la Subregión Andina: one of 12 projects implemented by NGOs or municipalities that address community vulnerability and preparedness to climate change in Peru.

- Policy Strategies for Sustainable Development in Latin-America and the Caribbean: Prevention and Reduction of the Danger posed by Natural Disasters: this project covers four countries (Argentina, Colombia, Peru and Chile) and it seeks to improve the public system's prevention and mitigation mechanisms by promoting community wide participation in the prevention of natural hazards and reduction of vulnerability.

Peru created a cash transfer program in April 2005 titled Programa Juntos (National Program for Direct Assistance to the Poorest Population) whose objective is to fight against chronic infantile malnutrition and extreme poverty in the rural sector covering 14 departments. This program is for a period of four years only after which the recipients will be evaluated in order to see if they surpassed the vulnerability stage that qualified them for it.

5.3. Insurance Instruments

According to an IADB study on agricultural insurance in Peru, there are 15 private insurance companies offering single peril insurance products to producers covering fire, excess/lack of rain and hail for the following crops: mango, lemon, asparagus, rice, sugar cane, grape, citric fruits, cotton and olives.

In June 2003 the government of Peru formed an Agricultural Insurance Commission (CNSA, Spanish acronym) comprised of various stakeholder groups whose mission is to study the feasibility of introducing and expanding agricultural insurance so as to permit diversification into more profitable but riskier crops, provide income stabilization for farmers and improve farmer access to formal credit.

The Government of Peru has instruments (programs) in place that directly support the agriculture sector in managing climate risks. All of them require public sector budgetary resources to operate:

a) The Technical Committee for the Development of Agricultural Insurance (CTDSA, Spanish acronym) created by AIC whose objective among others is to design the...
appropriate research case studies on climatic risks necessary for the implementation of an agricultural insurance program

b) The **Agricultural Insurance Development Unit** (UDESA, Spanish acronym) created by **MINAG** to begin implementation and create conditions for developing the agricultural insurance market

c) The **Agricultural Insurance Fund**: the government, through **COFIDE** (Financial Development Corporation), has set up a fund to finance agricultural insurance mechanisms. This fund has been in operation for one year and has subsidized catastrophic insurance policies for at least 5 departments. These department-level insurance policies have been offered by private insurers and are based on an area-yield contract with loss-verification based on sampling. The fund has Soles$ 40million (US $15million).

a) **Agrobanco**: public agriculture development bank with a key interest in agricultural insurance

**NGOs**: a) **COPEME**70 (Consortio de Organizaciones Privadas de Promoción al Desarrollo de la Micro y Pequeña Empresa): it is the national association of microfinance institutions; b) **GRADE**71 (Grupo de Análisis para el Desarrollo): a think-tank that has worked on Studies relating to the development of the agricultural insurance market; c) **APESEG** (Asociación Peruana de Empresas de Seguros): is the national association of insurance companies of Peru.

**Donors**: a) The World Bank has provided technical assistance to MINAG for the development of parametric insurance instruments. It has done feasibility studies for index based climate insurance instruments as well as training and sensibilisation materials for farmers; b) The Inter-American Development Bank (IADB): it has been in contact with COPEME and USAID regarding the development of an index-based instrument based on ENSO; c) FADQ (Financiere agricole du Quebec): has signed an agreement with MINAG in providing technical assistance for developing an agricultural insurance scheme; d) USAID has been supporting a pilot program for two index-based insurance instruments: one based on ENSO for covering micro-finance institutions agriculture portfolios; and an area-yield instrument for the Peruvian coastal zones.

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70 www.copeme.org.pe
71 www.grade.org.pe
About Country Notes on Climate Change Aspects in Agriculture...

The *Country Notes* are a series of country briefs on climate change and agriculture for 19 countries in Latin America and the Caribbean region, with focus on policy developments (action plans and programs), institutional make-up, specific adaptation and mitigation strategies, as well as social aspects and insurance mechanisms to address risk in the sector. The *Country Notes* provide a snapshot of key vulnerability indicators and establish a baseline of knowledge on climate change and agriculture in each country. The *Country Notes* are the beginning of a process of information gathering on climate change and agriculture. The *Country Notes* are “live” documents and are periodically updated.

Feedback

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