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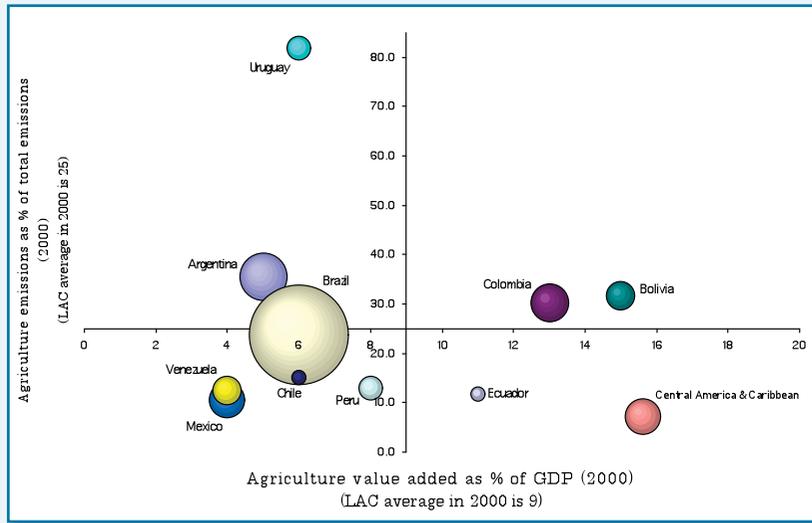
# PARAGUAY

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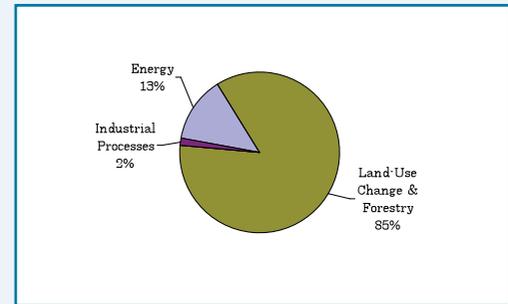
### Country Note on Climate Change Aspects in Agriculture

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

Contribution of agriculture (without LUCF) to the economy and to emissions in LAC countries (size of bubble in MTCO<sub>2</sub> of LUCF emissions; axes cross at LAC average)

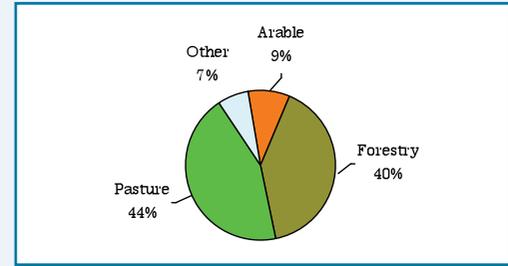


Percent of GHG emissions in CO<sub>2</sub> equivalent, by sector (2000)



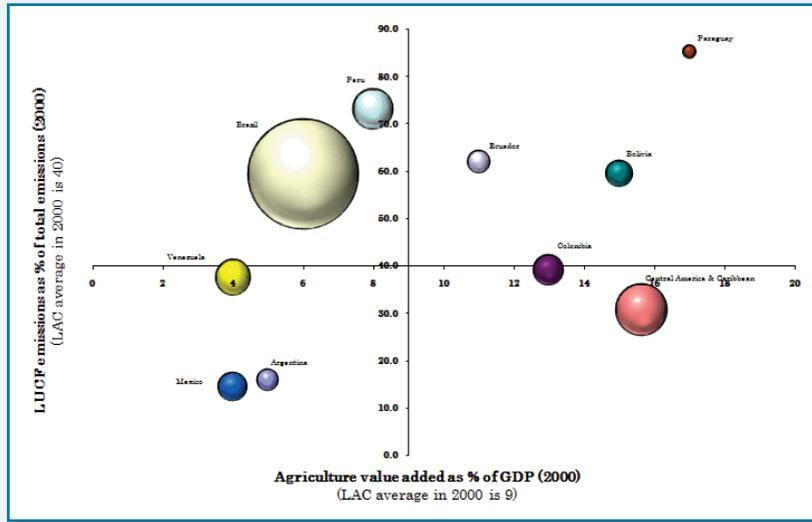
Source: World Resources Institute <http://cait.wri.org>

Land use (2005)

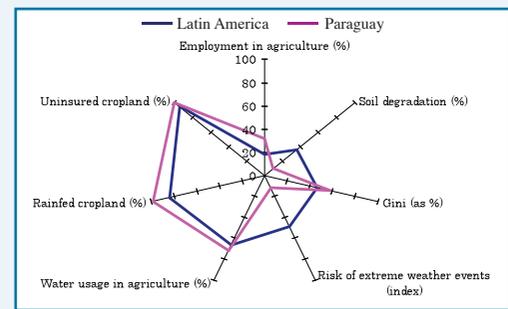


Source: World Development Indicators

Contribution of agriculture to the economy and of LUCF to emissions in LAC countries (size of bubble in MTCO<sub>2</sub> of LUCF emissions; axes cross at LAC average)



Vulnerability Indicators



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.

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<sup>1</sup>; \*\*\*\*Germanwatch

<sup>1</sup> <http://www.fao.org/landandwater/agll/glasod/glasodmaps.jsp?country=PRY&search=Display+map+%21>

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## Summary

Like most countries in Latin America, Paraguay has submitted one national communication to the United Nations Framework Convention on Climate Change (UNFCCC) with a second one under preparation. Land use change and forestry are the largest contributors to GHG emissions in the country. The emission reduction potential is large and several reforestation programs have been initiated. Paraguay is among the few countries in Latin America without a single CDM project, and carbon trading opportunities can be explored. Agriculture is highly vulnerable to climate variability, this coupled with problems of land degradation in the country. A greater emphasis on developing and applying adequate insurance mechanisms can be placed for better management of public resources in light of natural disasters in the agriculture sector.

## 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 green house 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.

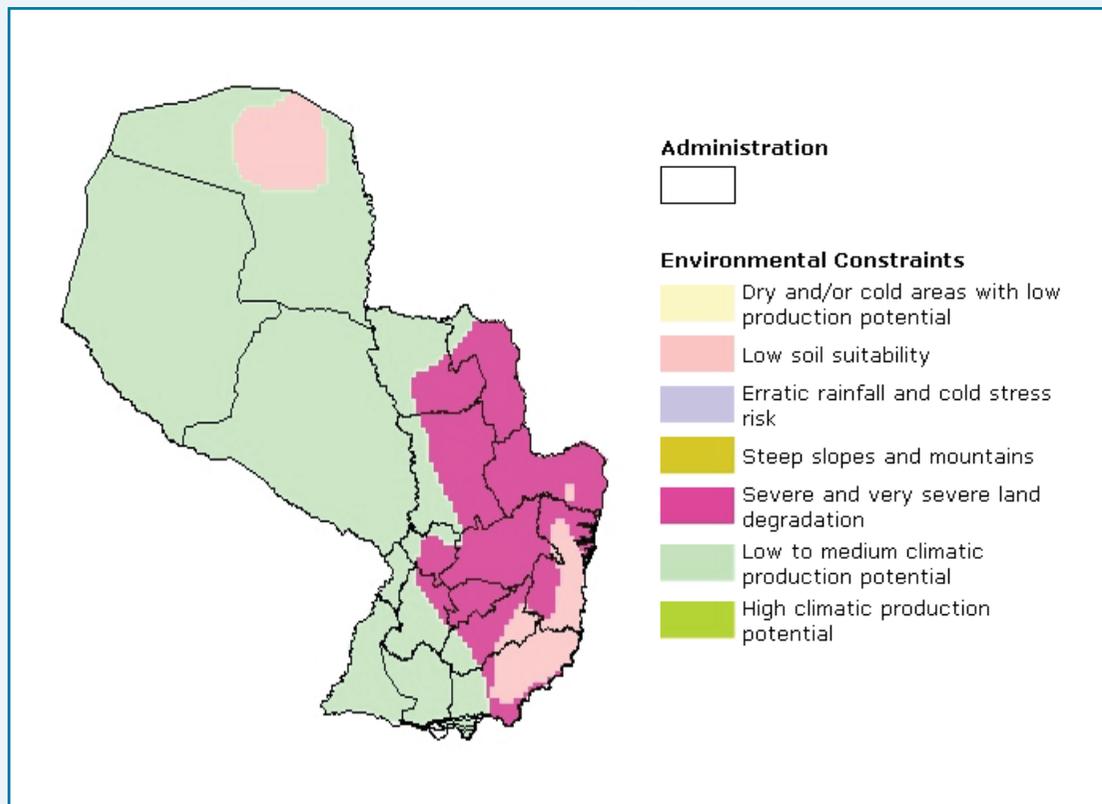
### Acknowledgments:

This *Country Note* was produced by a World Bank team of specialists (in agriculture, forestry, social development, risk and knowledge management) from the Latin America and the Caribbean region and other units of the World Bank. The team is very grateful for all the comments and suggestions received from the focal points on climate change and agriculture in many of the countries.

## 1. The Climate Context

The baseline map provides a visual characterization of Paraguay's agricultural potential given current environmental constraints and their regional distribution. Around 53% of Paraguay's land is used for agriculture (44% for pasture and 9% for cultivation), with forestry occupying 40% of the land in the country (WDI, 2005).

**Baseline map: Current Major Environmental Constraints related to Agricultural Potential**



**Source:** FAO **Note:** For more maps on Paraguay and agricultural resources, go to <http://www.fao.org/countryprofiles/Maps/PRY/04/ec/index.html>

### 1.1. Country Projections

According to the First National Communication and to climate scenarios using general circulation models, the following climate changes with relevance for the agricultural sector are to be expected in Paraguay by 2010, 2030, 2050 and 2100:

- a) **increases in temperature** – it is probable that the annual average temperature will increase between 0.4°C by 2010 to 1.3°C by 2100, depending on the region, under the optimistic scenario; between 0.5°C by 2010 and 3.3°C by 2100, depending on the region, under the intermediate scenario; and between 0.7°C by 2010 and 6.2°C by 2100 depending on the region, under the pessimistic scenario.
- b) **changes in the precipitation regime** – the optimistic scenario shows a probable increase in precipitations between 0.1-1.1% by 2010 to 0.-3.4% by 2100, depending on the region, with only region III( south-west) showing a decrease in precipitations between 0.1% by 2010 to 0.2% by 2100; under the pessimistic scenario, the precipitations would decrease between 1.2-4.9% by 2010 to between 8.3-34.2% by 2100 in all four regions of the country.

In recent years (between 2002 and 2008), wildfires, droughts and storms have had the highest human and economic impact in Paraguay with economic losses for the period 1997-2006 totaling 0.02% of GDP – 125,000

people have been affected by wildfires (1 event) with the cost of damages reaching US\$ 30 million, 52,990 people have been affected by droughts (1 event) and 12,830 people have been affected by storms (2 events)<sup>2</sup>.

## 1.2. Agriculture-Related Impacts

Paraguay suffered widespread fires in the north-east and western regions in September 2007, due to lack of rainfall, high temperatures and strong winds, coupled with the traditional practice of burning pasture and grassland. This resulted in the destruction of about one million hectares of forest, pasture and crops. In addition, it is estimated that around 200,000 people have been directly affected by this disaster. The department suffering the highest losses was the department of San Pedro, where almost half the population (about 4,000 families) lost their production, especially maize and orange, putting at risk their food security<sup>3</sup>.

Like most countries in the region, Paraguay has submitted only one **National Communication**<sup>4</sup> to the **United Nations Framework Convention on Climate Change**<sup>5</sup> (UNFCCC), laying out the actions that the government has already taken and the analytical basis for its policy response to climate change and its commitment to take future actions within an official international framework. The Communication established the First National GHG Inventory with 1994 as its base year; it includes an analysis of options of mitigation measures, as well as general guidelines on the national strategy to be adopted for the implementation of the climate change convention and a vulnerability evaluation and adaptation options for the agricultural sector.

The **Second National Communication**<sup>6</sup> is currently being developed and it contains, among other, the proposal for a National Mitigation Program, which includes initiatives to reduce GHG emissions through various programs, including through carbon sequestration and substitution programs for the forestry sector.

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

The **National Climate Change Program**<sup>7</sup> (PNCC, Spanish acronym) was created in October 2001 and has as a mission the evaluation and implementation of actions linked to the obligations assumed by Paraguay to the UNFCCC.

A **National Action Plan on Climate Change**<sup>8</sup> is currently being developed. Its mission will be to analyze the priority sectors, such as the forestry and agricultural sector, with the objective to identify and propose general measures aimed at reducing the impact of climate variability and to the mitigation and adaptation of the adverse effects created by this variability. It will serve as a guide for the elaboration of the future national Climate Change Strategy.

## 2.2. Agricultural Sector Initiatives

The **Ministry of Environment**<sup>9</sup> (SEAM, Spanish acronym) created in July 2000, is the national authority on the environment in Paraguay. It oversees Paraguay's commitments to the UNFCCC and other climate change related actions and is the Designated National Authority (DNA) on climate change in Paraguay. It is also the hosting entity for the National Climate Change Program.

Climate data information can be obtained from the **National Meteorological Center**<sup>10</sup>, which is under the **National Directorate for Civil Aeronautics (DINAC, Spanish acronym)**<sup>11</sup>.

## 3.1. Inter-Sectoral Coordination

The National Climate Change Commission<sup>12</sup> (CNCC, Spanish acronym) is part of the structure of the National Climate Change Program and it consist of several lines of ministries, among which are the Ministry of Agriculture and Livestock and the Ministry of Environment, as well as of private institutions, civil society and the education sector. It was created in response to the need for an adequate inter-institutional coordination on the issue of climate change and for the development of an integrated national response to global change issues.

## 2. The Policy Context

## 3. The Institutional Context

<sup>2</sup> [http://www.emdat.be/Database/CountryProfile/countryprofile.php?disgroup=natural&country=pry&period=1999\\$2008](http://www.emdat.be/Database/CountryProfile/countryprofile.php?disgroup=natural&country=pry&period=1999$2008)

<sup>3</sup> <http://www.reliefweb.int/rw/rwb.nsf/db900SID/EGUA-78GN9G?OpenDocument>

<sup>4</sup> <http://unfccc.int/resource/docs/natc/pry1sum.pdf>

<sup>5</sup> [www.unfccc.int](http://www.unfccc.int)

<sup>6</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

<sup>7</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

<sup>8</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

<sup>9</sup> [www.seam.gov.py](http://www.seam.gov.py)

<sup>10</sup> <http://www.meteorologia.gov.py/db1.html>

<sup>11</sup> <http://www.dinac.gov.py/>

<sup>12</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

The **Paraguayan Office of Joint Implementation** was created in December 1999 and is the administrative entity whose mission is to lead the implementation of the country's commitments to the international agreements on climate change.

### 3.2. Agricultural Sector Institutions

The **Ministry of Agriculture and Livestock**<sup>13</sup> (MAG, Spanish acronym) has authority over livestock and forestry and its main mission is to insure the sustainable development of the agricultural sector and forestry in Paraguay.

The **National Forestry Service**<sup>14</sup>, within the Ministry of Agriculture and Livestock has as a main function the control of production forest resources and of lands not yet covered by forests, but classified as forest land.

### 3.3. Fostering Capacity to Deal with Climate Change

**Emissions inventory:** Paraguay counts with two National GHG Inventories for 1990 and 1994. The inventories include data on emissions from agriculture and land-use change and forestry, providing disaggregated data by type of emission and type of agricultural resource. A third inventory is being developed and will be included in the Second National Communication once this is completed. The World Bank published a flagship document for the entire region of Latin America and the Caribbean titled "Low Carbon, High Growth: Latin American Responses to Climate Change"<sup>15</sup>, 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-high growth policies.

**Studies related to climate change and agriculture:** various vulnerability and adaptation studies have been carried out in preparation of the First National Communication for the agricultural sector<sup>16</sup> and the livestock<sup>17</sup> one in particular.

## 4. The Impact of Agriculture on Climate Change - Mitigation Measures

Agriculture is the main responsible for methane emissions, 97% of total, mainly from enteric fermentation of farm animals. Land-use change and forestry is responsible for 82% of total CO<sub>2</sub> emissions in 1994.

### 4.1. Action Frameworks

#### 4.1.1. Forestry and Land Use Change

According to the First National Communication, land-use change and forestry are responsible for 29.2% of all GHG emissions in 1990 and for 22% in 1994. Regarding total CO<sub>2</sub> emissions, there has been an increase in the contribution of this sector, from 25% of total CO<sub>2</sub> emissions in 1990 to 82% of total CO<sub>2</sub> emissions in 1994.

The average annual deforestation rate for Paraguay for the period 1990-2005 stands at 0.8%. Though actual rates may be higher, due to increased deforestation for agricultural land and pasture for livestock in the Chaco ecosystem. Although deforestation has historically been more pronounced in the eastern part of Paraguay, the Environmental Secretariat (SEAM) has made some progress in lowering deforestation there, notably through the 2004 Law no 2524, *Ley de Prohibición en la Región Oriental de las Actividades de Transformación y Conversión de Superficies con Cobertura de Bosques*. The law prohibits most deforestation activities in the eastern region. However, the law seems to have pushed active deforestation to the western Chaco region, which is not covered by the law.

In 2006, SEAM was also instrumental in the approval of the Environmental Services Law no. 3000, which provides a framework for maintaining a 25 percent forest cover on most of the former forested areas in the east, and a tradable-rights mechanism for reforestation and forest cover maintenance. Presently, there are at least 250 thousand ha required to be reforested under the new law. However, little progress has been made.

The Paraguayan state offered a series of incentives and initiated a number of projects which lead to the reforestation and forestation of 39,278.05 hectares of land as follows:

- a) The National Reforestation Plan, through law 422/73 managed the reforestation of 10,025 hectares by eliminating the taxes on rent if this amount were going to be invested in forest plantations.

<sup>13</sup> <http://www.mag.gov.py/>

<sup>14</sup> <http://www.mag.gov.py/SFN.htm>

<sup>15</sup> [http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2009/02/27/000334955\\_20090227082022/Rendered/PDF/476040PUB0Low0101Offi](http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2009/02/27/000334955_20090227082022/Rendered/PDF/476040PUB0Low0101Offi)

<sup>16</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

<sup>17</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

- b) Reforestation of 1,227 hectares through a compensation regime
- c) "Model Forests" (Bosques modelo) project achieved the reforestation of 115 hectares
- d) Law 536 for promotion of forestation and reforestation, achieved the reforestation of 26,148 hectares of land during its first years, through an incentive of 75% of the costs of plantation and maintenance for the first 3 years. However, this mandate has been left largely unfunded.

Paraguay was selected into the World Bank's **Forest Carbon Partnership Facility (FCPF)** Readiness Mechanism<sup>18</sup>. The FCPF aims to assist Paraguay in its efforts to reduce emissions from deforestation and forest degradation (REDD).

#### 4.1.2. Livestock

In Paraguay, 61% of the national territory is used for grazing of livestock. According to the First National Communication, agriculture is responsible for 97.5% of total methane (CH<sub>4</sub>) emissions in 1994, the majority from enteric fermentation of livestock and from handling of farm manure. The amount of methane emissions depends on the type of animal (around 55kg CH<sub>4</sub>/head/year for buffaloes compared to 1 kg CH<sub>4</sub>/head/year for pigs) and their diet.

Vulnerability studies for the livestock sector have shown that increases in temperature and precipitation reduction will put tremendous pressure on livestock in Paraguay. It is recommended to avoid a diet rich in fibers in the summer (forage, hay) when temperatures are high and to reduce the quality of corn and sorghum flower and, instead, to administer the skin of citrus fruit. In addition, housing and shade provision is recommended for livestock<sup>19</sup>.

#### 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 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)<sup>20</sup> 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, Paraguay has one registered CDM project under the afforestation/reforestation category and none in agriculture<sup>21</sup>.

The World Bank has mobilized a fund to demonstrate projects that sequester or conserve carbon in forest and agro-ecosystems. The BioCarbon Fund, a public/private initiative administered by the World Bank, aims to deliver cost-effective emission reductions, while promoting biodiversity conservation and poverty alleviation. In principle, the BioCarbon Fund can consider purchasing carbon from a variety of land use and forestry projects; its current portfolio includes Afforestation and Reforestation, Reducing Emissions from Deforestation and Degradation and the Fund is currently exploring innovative approaches to account for agricultural soil carbon.

#### 5.1. Action Frameworks

##### 5.1.1. Land Management

According to the First National GHG Inventory for 1990, agriculture was responsible for 98% of total nitrous oxide emissions, mainly from the use of cropland and from the use of nitrogen based fertilizers. The intensity of use of fertilizers in Paraguay of 29kg/hectare of cropland in 1999 is lower than the South American average of 74kg/hectare of cropland, although it has showed a sharp increase by almost tripling its amount used in 1999 as compared to 1990 (around 10kg/hectare of cropland)<sup>22</sup>.

The Soil Conservation Project was initiated in 1993 with the help of the German Development Agency (GTZ, German acronym), in collaboration with the Ministry of Agriculture and Livestock and its main mission was to introduce no-tillage practices for small producers aimed at soil conservation in Paraguay. As a result of this project, 52% of mechanized agriculture in the country is currently under no-tillage practices. In order

## 5. Impact of Climate Change on Agriculture - Adaptation Measures

<sup>18</sup> <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTCARBONFINANCE/0,,contentMDK:21631703~menuPK:5216269~pagePK:64168445~piPK:64168309~theSitePK:4125853,00.html>

<sup>19</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

<sup>20</sup> <http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html>

<sup>21</sup> <http://cdm.unfccc.int/Projects/projsearch.html>

<sup>22</sup> [http://earthtrends.wri.org/pdf\\_library/country\\_profiles/agr\\_cou\\_600.pdf](http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_600.pdf)

to continue soil conservation in the country, it is recommended to expand this practice to cover 80% of total cropland<sup>23</sup>.

### 5.1.2. Water Use

In Paraguay, agriculture is responsible for 71% of all freshwater extraction. Of the total cropland in use in the country, only 2.1% of it is under irrigation, much lower than the Latin America and the Caribbean average of 11.4%<sup>24</sup>. This makes the sector very vulnerable to climatic variability due to the fact that a large part of agriculture relies on rainfall for water supply.

The **Framework Program for Sustainable Management of Water Resources of the Plata Basin**<sup>25</sup>, executed by the **Inter-governmental Coordinating Committee of the countries of the Plata River Basin**<sup>26</sup> (CIC, Spanish acronym) in collaboration with national institutions (The Environment Secretariat in the case of Paraguay) was designed with the objective to offer assistance to Paraguay, Uruguay, Argentina, Bolivia and Brazil in the protection and integrated management of their water resources and for adaptation to weather variability and climate change.

## 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.

Paraguay is the most rural South American country and has the highest rate of population growth rate. Additionally, inequality in income distribution and land tenancy is extremely severe. In 2002, the Gini coefficient for income was 0.58 making Paraguay one of Latin America's most inequitable countries<sup>27</sup>. Notably, poverty has steadily increased over the past several years in Paraguay. By 2005, 32% of the total population lived below the poverty line, and in rural areas that number was as high as 40.1%. In the absence of an effective official welfare system in Paraguay, private income transfers (mostly family help) have contributed to halving extreme poverty. As heads of households, women in particular, benefit from these transfers<sup>28</sup>.

In the last few years, **PROPAIS** has been the main social assistance program in Paraguay, financing 397 projects with a total budget of US\$23 million assigned between 1996 and 2002 (US\$20 million financed by an IADB loan and US\$3 million as the Government's contribution)<sup>29</sup>.

The **National Council on Agrarian Reform** was created in November of 2008. This Council is to be coordinated by the **National Institute on Rural Development and Land (INDERT, Spanish acronym)** which is responsible for public policies concerning small farmers, especially regarding access to and distribution of land. The Council will consist of representatives of the ministries of agriculture, education and health, small farmer organizations and civil society groups<sup>30</sup>.

**Rural Network of Paraguay** (Red Rural de Organizaciones Privadas de Desarrollo) is an umbrella group of non-governmental organizations dedicated to rural development in Paraguay<sup>31</sup>.

**Farmers' Association in Alto Paraná (ASAGRAPA)** is a regional organization of the **National Center of Indigenous and Popular Organizations (CENOCIP)**. ASAGRAPA encourages small scale organic farming of various crops for self-supply and promotes community ownership of land to protect farmers from isolation and land speculation<sup>32</sup>.

## 5.3. Insurance Instruments

Agricultural insurance was first introduced in Paraguay in 2005 after a big drought. At present, there are three private insurance companies covering 36,000 ha of cropland, representing 1% of total cropland. There are no Government subsidies; insurance companies offer MPCI through alliances with input suppliers. The risks covered are drought, flood, frost, wind, snow and hail and the three crops covered are : soybeans, corn and wheat. There's currently no public sector strategy for development of the agricultural insurance market in Paraguay.

<sup>23</sup> <http://www.seam.gov.py/cambioclimatico/principal.htm>

<sup>24</sup> World Development Indicators, 2005

<sup>25</sup> <http://www.cicplata.org/marco/?id=inicio>

<sup>26</sup> [www.cicplata.org](http://www.cicplata.org)

<sup>27</sup> <http://go.worldbank.org/SF4HZC92Q3>

<sup>28</sup> <http://go.worldbank.org/0KRGVAFK40>

<sup>29</sup> [http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2004/10/20/000012009\\_20041020134302/Rendered/PDF/273520PA.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2004/10/20/000012009_20041020134302/Rendered/PDF/273520PA.pdf)

<sup>30</sup> <http://ipsnews.net/interna.asp?idnews=44622>

<sup>31</sup> <http://www.redrural.org.py/V2/miembros.php>

<sup>32</sup> <http://www.pej.org/html/modules.php?op=modload&name=News&file=article&sid=6675&mode=thread&order=0&thold=0>



### **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.



LATIN AMERICA AND THE  
CARIBBEAN REGION  
AGRICULTURE AND RURAL  
DEVELOPMENT TEAM

### **Feedback**

For comments and/or suggestions, please contact Svetlana Edmeades at [sedmeades@worldbank.org](mailto:sedmeades@worldbank.org)

