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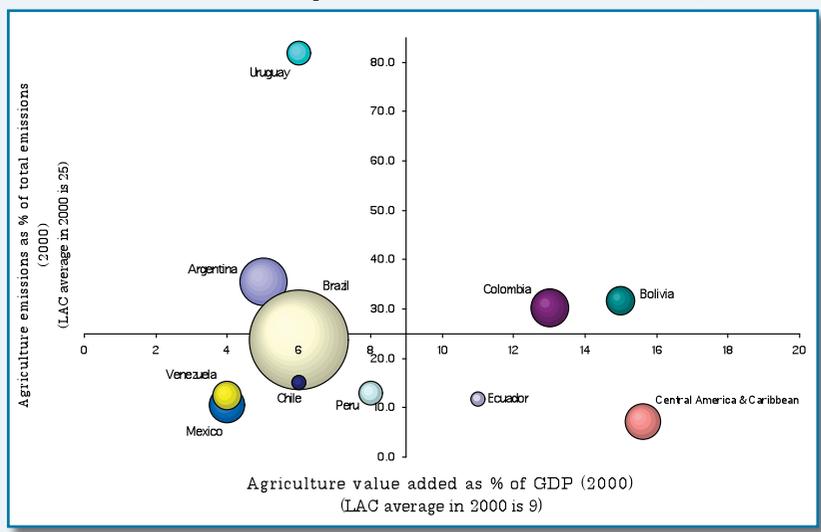
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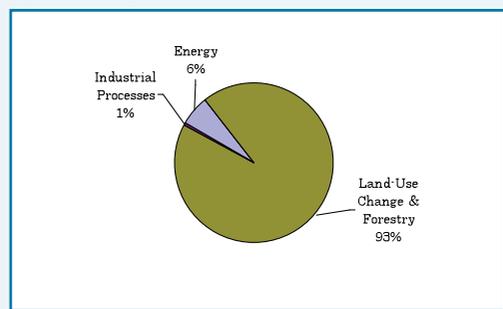
Country Note on Climate Change Aspects in Agriculture

This Country Note briefly summarizes information relevant to both climate change and agriculture in Nicaragua, 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 MTCO₂ of LUCF emissions; axes cross at LAC average)

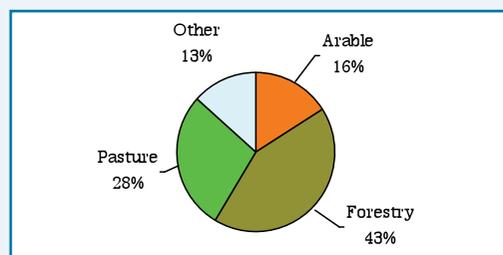


Percent of GHG emissions in CO₂ equivalent, by sector (2000)



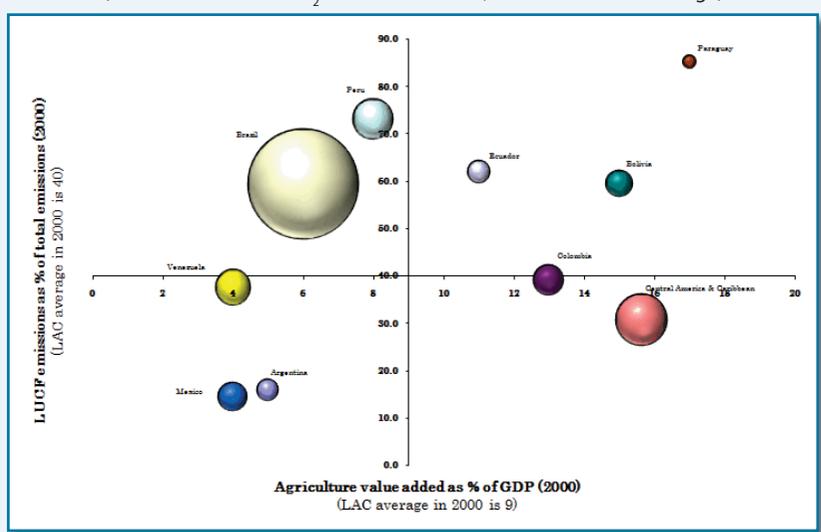
Source: World Resources Institute <http://cait.wri.org>

Land use (2005)

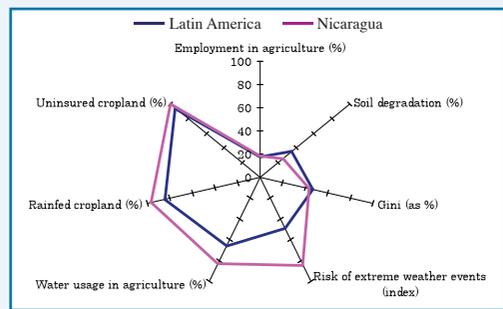


Source: World Development Indicators

Contribution of agriculture to the economy and of LUCF to emissions in LAC countries (size of bubble in MTCO₂ of LUCF emissions; axes cross at LAC average)



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 2005¹; ****Germanwatch

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.

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

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Summary

Like most countries in Latin America, Nicaragua 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 by far the largest contributors to GHG emissions in the country. The emission reduction potential of the sector is large, but not sufficiently explored. Nicaragua counts with only 3 CDM projects, none of which are in the agricultural sector. It is estimated that Central America produces less than 0.5% of global carbon emissions, but it is one of the most vulnerable regions to climate change related impacts on the planet². Agriculture is highly vulnerable to climate variability and weather extremes, this coupled with problems of land degradation in the country. A greater emphasis on reducing soil degradation, reforestation and 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:

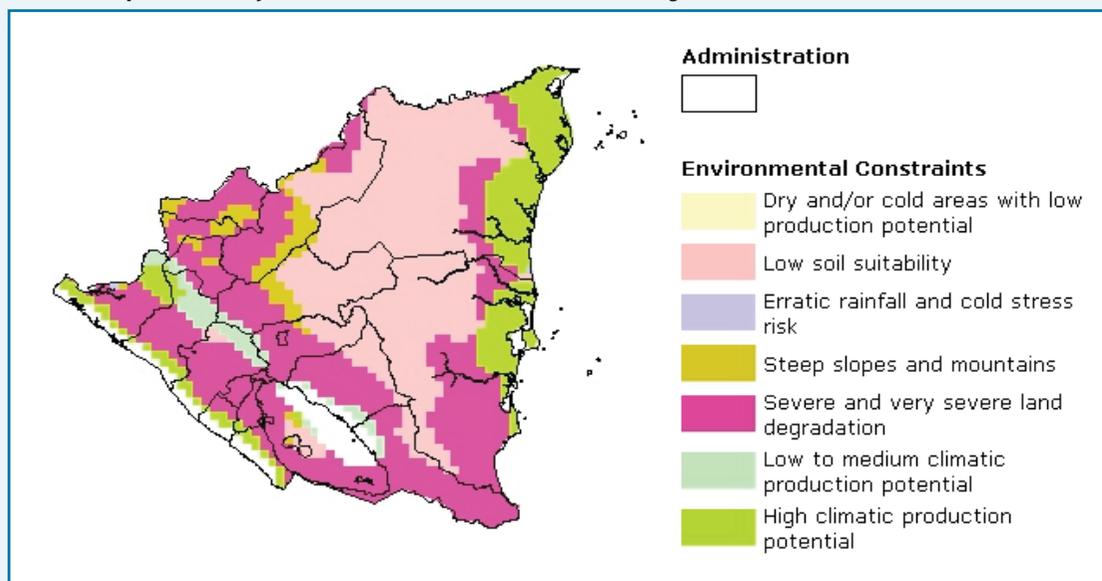
This *Country Note* was produced by a World Bank team of specialists (in agriculture, forestry, social development, risk and knowledge management) from the Latin America and the Caribbean region and other units of the World Bank. The team is very grateful for all the comments and suggestions received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

² <http://www2.ohchr.org/english/issues/climatechange/docs/submissions/Guatemala.pdf>, pg.6

1. The Climate Context

The baseline map provides a visual characterization of Nicaragua's agricultural potential given current environmental constraints and their regional distribution. Around 44% of Nicaragua's land is used for agriculture (28% for pasture and 16% for cultivation), with forestry occupying 43% 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 Nicaragua and agricultural resources, go to <http://www.fao.org/countryprofiles/Maps/NIC/04/ec/index.html>

1.1. Country Projections

Based on climate scenarios developed for the elaboration of the First national Communication for the next 100 years, the following climatic changes with relevance to agriculture are to be expected in Nicaragua:

- increases in temperature** – it is probable that the temperature will increase by 0.9°C in the Pacific side and by 0.8°C in the Caribbean side by 2010, 2.1°C (Pacific) and 1.9°C (Caribbean) by 2050 and by 3.7°C (Pacific) and 3.3°C (Caribbean) by 2100 according to the most pessimistic scenario.
- decreases in precipitation** – it is probable that the average annual precipitation will decrease from 8.4% (2010) to 36.6% (2100) on the Pacific side and from 8.2% (2010) to 35.7% (2100) on the Caribbean side, according to the most pessimistic scenario. The most significant precipitation changes are to be expected in regions of the country that are currently relatively dry, such as the northern municipalities of Chinandega and León.
- decreased cloud cover** – it is probable that a reduction in cloudiness will occur from 3.6% (2010) to 15.6% (2100) on the Pacific side and from 4% (2010) to 17.2% (2100) on the Caribbean side according to the most pessimistic scenario.

In recent years (between 2000 and 2008), storms and floods have had the highest human and economic impact in Nicaragua, with losses for the period 1997-2006 averaging at 2.71% of GDP – 221,472 people have been affected by storms (3 events) with the cost of damages reaching US\$ 3 million and 24,000 people have been affected by floods (1 event) with the cost of damages reaching US\$ 50,000³.

³ [http://www.emdat.be/Database/CountryProfile/countryprofile2.php?disgroup=natural&country=nic&period=1999\\$2008](http://www.emdat.be/Database/CountryProfile/countryprofile2.php?disgroup=natural&country=nic&period=1999$2008)

1.2. Agriculture-Related Impacts

The main crops at the national level are corn, beans, rice and sorghum. Agriculture is one of the most vulnerable sectors to climatic variability due to the fact that it relies mostly on rainfall. Hurricane Beta which hit Nicaragua in November 2005 led to the destruction of 250 hectares of crops, 240km² of forest and 2,000 artisan fishermen were affected⁴.

2. The Policy Context

Nicaragua has submitted only one **National Communication**⁵ to the **United Nations Framework Convention on Climate Change**⁶ (UNFCCC) in March 2001. The Communication established the National GHG Inventory with 1994 as its base years, it presents future climate change scenarios for Nicaragua for the 21st century, it includes vulnerability and adaptation studies to climate change for the water sector and it presents mitigation options in protected areas of the country, forestry and agriculture as well as a description of the National Climate Change Action Plan.

A **Second National Communication** is under preparation and it will include a Second National GHG Inventory with 2000 as its base year, which is already completed.

2.1. National Climate Change Plans, Strategies and Programs

In December 2007, Nicaragua formulated its **National Climate Change Action Plan**⁷ (PANCC, Spanish acronym) based on a series of studies on vulnerability, mitigation options and climate change impact, whose objective is to develop adaptation measures for the most vulnerable sectors of the economy, such as agriculture and water resources and to contribute to the mitigation of GHG gases, particularly in the forestry sector.

Nicaragua is in the process of publishing their first **National Climate Change Strategy**. The Strategy was conceived with the help of UNDP and the Embassy of Denmark and the main vulnerabilities taken into account for Nicaragua and the main actions proposed are focused on extreme weather events, leaving aside the analysis of gradual climatic changes.

2.2. Regional initiatives

Institutions:

The **Central American Commission on Environment and Development**⁸ (CCAD, Spanish acronym) is a regional institution in charge of the environmental agenda of the region. It counts with an information portal -**Ecoportal**⁹- which includes information on various environmental issues from the region, including information on climate change issues (programs, plans, initiatives) in all the Central American countries.

The **Regional Technical Assistance Unit**¹⁰ (RUTA, Spanish acronym) is a common initiative of the governments of the seven Central American countries and seven international development agencies aimed at fostering the sustainable development and reduction of poverty in rural areas of Central America. Amongst its working areas are the environment and natural resources and the Central American agricultural policy.

Projects:

The **Project Forests and Climate Change in Latin America**¹¹ (PBCC, Spanish acronym) financed by the Food and Agriculture Organization (FAO) and the government of the Netherlands with the headquarters in Honduras and realized in coordination with the **Central American Commission on Environment and Development**¹² (CCAD, Spanish acronym) was developed with the purpose of helping Central American countries develop the mitigation potential of forests to climate change and to take advantage of the opportunities offered by the Clean Development Mechanism. As part of this,

⁴ Magrin, G., C. Gay Garcia, D. Cruz Choque, J.C. Gimenez, A.R. Moreno, G.J. Nagy, C. Nobre and A. Villamizar, 2007: *Latin America. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 581-615

⁵ <http://unfccc.int/resource/docs/natc/nicnc1.pdf>

⁶ www.unfccc.int

⁷ http://www.marena.gob.ni/index.php?option=com_content&task=view&id=33&Itemid=97

⁸ www.ccad.ws

⁹ <http://www.ccad.ws/ecoportal/cambio/camnica.html>

¹⁰ www.ruta.org

¹¹ <http://www.fao.org/regional/honduras/pbcc/Descripcion.htm>

¹² <http://www.ccad.ws/>

it launched a **Central American Series on Forests and Climate Change**¹³ for Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama and a regional one. These eight publications describe the mitigation potential of forests and the legal and institutional framework for each Central American country and for the region. It also includes a regional document presenting the overall situation of the region in the Clean Development Mechanism.

The Project on **Capacity building for Stage II adaptation to climate change (Costa Rica, Cuba, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama)** is funded through the GEF Trust Fund and is implemented by UNDP. Central America, Mexico and Cuba serve as the pilot region for elaborating and applying an Adaptation Policy Framework for preparing adaptation strategies, policies and measures. The application of this framework will demonstrate how policy for adaptation can be integrated into national sustainable development for at least three human systems: water resources, agriculture and human health. This demonstration project builds upon the Stage I vulnerability and adaptation assessments of the Initial National Communications of the eight participating countries of the region and will prepare them to move onto Stage III Adaptation. The outputs of the project, Stage II adaptation strategies may be used for preparing second National Communications¹⁴.

Programs:

The **Regional Strategic Program for Management of Forest Ecosystems**¹⁵ (**PERFOR**, Spanish acronym) designed for the period 2008-2012 has as a main objective the improvement of forest management in Central America and the Dominican Republic. Among others, it aims to position the forest agenda in the inter-sectoral agenda of the **Regional Agro-environmental Strategy (ERA)**, Spanish acronym), thus contributing to poverty reduction, reduction of vulnerability to climate change events and to mitigation and adaptation to climate change.

A **Regional Climate Change Strategy**¹⁶ for Central America is currently in preparation and will include five areas: i) vulnerability and adaptation; ii) mitigation; iii) institutional and capacity development; iv) education, public awareness and v) international management. The initial guidelines for this strategy have been approved in April 25, 2008, an action plan should be completed within six months from the approval of the guidelines and the strategy should be finished within one year. The strategy will represent a key instrument for future climate change adaptation and mitigation actions in the region.

The **Central American Forest Program**¹⁷ (**PROCAFOR**, Spanish acronym), is a program financed by the Finnish Cooperation, aimed at improving the well-being of rural communities through sustainable forest management in the region.

2.3. Agricultural Sector Initiatives

A proposal for a **Strategy of Adaptation to Climate Change of Water Resources and Agriculture in the No. 64 Basin of Nicaragua**¹⁸ was put forward and it includes adaptation measures to be implemented in the water sector as well in soil management practices.

The **Ministry of Environment and Natural Resources**¹⁹ (**MARENA**, Spanish acronym), created in 1979, is the national environment authority and is also the Designated National Authority (DNA) on climate change to the United Nations Framework on Climate Change (UNFCCC) in Nicaragua through its **National Clean Development Mechanism Office (ONDL)**, Spanish acronym). Its role is to regulate, control and formulate policies on the sustainable use of the environment and natural resources in the country. MARENA initiates and manages programs in deforestation and watershed management, among others.

3.1. Inter-Sectoral Coordination

The **National Commission on Climate Change**²⁰ (**CNCC**, Spanish acronym) was created in June 1999 and its purpose is to be a national consultation entity between the Ministry of Environment and

3. The Institutional Context

¹³ http://www.ccad.ws/forestal/pp_regional.htm

¹⁴ http://unfccc.int/files/adaptation/adverse_effects_and_response_measures_art_48/application/pdf/200609_background_latin_american_wkshp.pdf

¹⁵ <http://www.sica.int/ccad/program.aspx?IdEnt=2>

¹⁶ <http://www.sica.int/ccad/temporal/LINEAMIENTOS.pdf>

¹⁷ <http://www.elsalvadorforestal.com/nota.php?id=53>

¹⁸ http://www.marena.gob.ni/index.php?option=com_remository&Itemid=181&func=fileinfo&id=1064

¹⁹ www.marena.gob.ni

²⁰ [http://legislacion.asamblea.gob.ni/Normaweb.nsf/\(\\$AII\)/362C00F592B0D31F0625725D005604BB?OpenDocument](http://legislacion.asamblea.gob.ni/Normaweb.nsf/($AII)/362C00F592B0D31F0625725D005604BB?OpenDocument)

Natural Resources and the rest of the Nicaraguan society and sectors of the economy on all issues related to climate change. The Commission is formed of officials from the various Ministries, among these the Ministry of Agriculture and Forestry, the private sector, civil society and universities.

3.2. Agricultural Sector Institutions

The **Ministry of Agriculture and Forestry**²¹ (**MAGFOR**, Spanish acronym) is an institution whose objective is to promote the development of agriculture and forestry by formulating, monitoring and evaluating the policies, strategies and programs of the farming and forestry sector.

The **National Forestry Institute**²² (**INAFOR**, Spanish acronym) is a decentralized government entity linked to the Ministry of Agriculture and Forestry whose objective is to execute the forestry development policy of Nicaragua, implement necessary measures to prevent, mitigate and combat forest fires and to promote and implement forestry development programs with the help of local governments, especially those related to reforestation of degraded areas.

The **Nicaraguan Institute of Territorial Studies**²³ (**INETER**, Spanish acronym) is a government institution in charge of managing water and weather station networks with information useful in agriculture and generating research studies that help reduce the vulnerability to natural disasters.

3.3. Fostering Capacity to Deal with Climate Change

Emission inventory: To date, Nicaragua counts with two National GHG Inventories, first with 1994 as its base year and the second with 2000 as its base year. Both include information on emissions from the different sectors of the economy, such as agriculture, land use change and forestry, providing disaggregated information by type of emission and type of agricultural resource.

Studies related to climate change and agriculture: A few studies were done at the National Agrarian University of Managua on the vulnerability to climate change of soybeans, corn and beans in the Central part of Nicaragua. Additionally, in preparation of the First National Communication, two studies were performed on *Climate Scenarios for Nicaragua for the XXI Century and on Mitigation Options to Climate Change in Protected Areas*. A GEF-funded **AIACC**²⁴ project in Central America (Costa Rica, El Salvador and Nicaragua): "Assessment of impacts and adaptation measures for the water resources sector due to extreme events under climate change conditions in Central America"²⁵.

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"²⁶, 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.

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

According to the First National Communication, land-use change and forestry account for 93% of GHG emissions in the country for 2000. This is mainly a result of deforestation activities and of clearing of forests to make space for agricultural land. Agriculture is responsible for 63% of methane emissions, mainly due to enteric fermentation from farm animals and from flooded rice fields and for 70% of nitrous oxide emissions from cultivated farmlands. Nicaragua's carbon dioxide emissions per capita in 2004 stand at 0.7tCO₂/capita, compared to the Latin America region of 2.6tCO₂/capita and the world at 4.5tCO₂/capita²⁷.

4.1. Action Frameworks

4.1.1. Forestry and Land Use Change

In Nicaragua 46.5% of the whole territory is covered by forests. The average annual deforestation rate for the period 1990-2000 stands at 1.6% (FAO). However, due to increased government control in this

²¹ www.magfor.gob.ni

²² www.inafor.gob.ni

²³ www.ineter.gob.ni

²⁴ <http://www.aiaccproject.org/>

²⁵ http://www.aiaccproject.org/aiacc_studies/aiacc_studies.html

²⁶ http://www-wds.worldbank.org/external/default/WDSContentServer/WDS/IB/2009/02/27/000334955_20090227082022/Rendered/PDF/476040PUB0Low0101Offi0Use0Only1.pdf

²⁷ http://hdrstats.undp.org/countries/country_fact_sheets/cty_fs_NIC.html

area, this rate dropped to 1.4% for the period 1990-2005²⁸. Deforestation activities with the purpose of making space for farmland and livestock grazing are the main responsible for CO₂ emissions in Nicaragua totaling 57,632.67 GgCO₂ for 1994. Decomposition of organic matter is responsible for an additional 12.97 GgCO₂. However, new forest growth along with abandoned farmland followed by natural regeneration of soils lead to CO₂ capturing of 72,429.73 GgCO₂, exceeding the amount emitted. This resulted in a total balance of 14,784.09 GgCO₂ captured by this sector. Despite the GHG capturing capability of this sector, failing to implement mitigation measures will lead to a higher emission of GHGs in the future compared to the current capturing capacity of the sector due to the advance of the agricultural frontier and to deforestation.

According to the study on mitigation options to climate change for six protected areas²⁹ analyzing the carbon capture capability over a period of 15 years and considering an annual deforestation rate for these areas of 1.21%, by implementing mitigation projects, the net benefit to the atmosphere (no emissions coupled with carbon sequestration) would be of 137.7 million tons of carbon.

The National Climate Change Action Plan identified the following mitigation measures for the forestry sector:

- a) design of a national strategic plan for forest fire control and realization of preplanned burnings of stubble and vegetative residue
- b) introduction of pay for environmental services which would improve the environment at the same time as satisfying the needs of the population
- c) contribute to the approval of the Forest Development Law
- d) proposing a pilot initiative of mitigation options within the Mesoamerican Biological Corridor (Corredor Biológico Mesoamericano)

The World Bank's BioCarbon Fund is currently supporting two afforestation/reforestation projects in Nicaragua. The Precious Woods project would generate an estimated 297,045 tCO₂e emission reductions by 2017 through the reforestation of 600 ha of privately owned degraded agricultural lands in southern Nicaragua. The *Futuro Forestal* project (concept stage) would reforest, over a 5-year period, 12,000 hectares of land on Nicaragua's Pacific coastal plains, all of which had been previously deforested for use as pastoral grazing land or low intensity cropping. Total sequestration would equal an estimated 4 Mt CO₂e by 2017 (including 1.6 Mt CO₂e by 2012).

In October 2008, Nicaragua was selected into the World Bank's **Forest Carbon Partnership Facility (FCPF)**³⁰. The FCPF aims to assist Nicaragua in its efforts to reduce emissions from deforestation and forest degradation (REDD). The Facility has the dual objective of building capacity for REDD, and testing a program of performance-based incentive payments in some pilot countries, on a relatively small scale, in order to set the stage for a much larger system of positive incentives and financing flows in the future. As a first step, Nicaragua will participate in the so-called Readiness Mechanism of the FCPF. This mechanism supports Nicaragua to arrive at a reliable estimate of its national forest carbon stocks and sources of forest emissions. In addition, Nicaragua will define its reference scenario based on past emission rates for future emissions estimates. More details regarding Nicaragua's next steps under the Readiness Mechanism of the FCPF can be found in Nicaragua's **Readiness Plan Idea Note (R-PIN)**³¹.

4.1.2. Livestock

According to the First National GHG Inventory for 1994, agriculture was responsible for 63.1% of methane (CH₄) emissions, mainly from enteric fermentation from farm animals (89% of total). The remaining 11% come from flooded rice fields (.6% of total), handling of farm manure (3% of total) and the burning of pastures (2%).

²⁸ World Development Indicators, 2005

²⁹ GEA, Center for Management and Environmental Studies, "Estudio para las opciones de mitigación del Cambio Climático en Áreas protegidas", 2000

³⁰ <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTCARBONFINANCE/0,,contentMDK:21631703~menuPK:5216269~pagePK:64168445~piPK:64168309~theSitePK:4125853,00.html>

³¹ <http://wbcarbonfinance.org/Router.cfm?Page=FCPF&FID=34267&ItemID=34267&ft=DocLib&CatalogID=43113>

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)³² 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 4 registered projects in Nicaragua. Currently, there are no registered CDM projects in agriculture in Nicaragua, nor there are projects registered under the “afforestation and reforestation” category³³. This is a shortcoming given the impact of the sector on GHG emissions in the country.

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. As mentioned above, the BioCarbon Fund is currently supporting two afforestation/reforestation activities in Nicaragua.

5. Impact of Climate Change on Agriculture - Adaptation Measures

The International Red Cross/Red Crescent Centre on Climate Change and Disaster Preparedness in the Netherlands is providing support to National Red Cross and Red Crescent Societies to eventually reduce the loss of life and the damage done to the livelihoods of people affected by the impacts of climate change and extreme weather events. For example, in Nicaragua the climate change and disaster preparedness project was set up to improve the capacities of vulnerable communities to cope with disasters caused by climate change and extreme weather events along the Atlantic coast, specifically in the Municipalities of Bluefields (El Bluff) and Puerto Cabezas (Betania and Wawabom)³⁴.

5.1. Action Frameworks

5.1.1. Land Management

The excessive application of nitrogen based fertilizers, along with poor farm practices contribute to nitrous oxide (N₂O) emissions. According to the First National GHG Inventory for 1994, agriculture was responsible for 70% of nitrous oxide emissions, mainly from croplands.

The National Climate Change Action Plan identified the following potential mitigation measures:

- a) enlargement of the network of water and weather stations of INETER in order to improve the quality of data useful for agriculture
- b) promotion of agro-sylvan production systems
- c) adaption of the sowing times in order to avoid period of water deficit
- d) sowing of short cycle varieties
- e) encouragement of low cost alternative agriculture
- f) promoting the sowing of combined crops (for example, soybeans together with other legumes)

³² <http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html>

³³ <http://cdm.unfccc.int/Projects/projsearch.html>

³⁴ http://unfccc.int/files/adaptation/adverse_effects_and_response_measures_art_48/application/pdf/200609_background_latin_american_wkshp.pdf

- g) introduction of corn varieties that adapt to areas of higher climatic risk such as San Isidro, Tiptapa and Ocotal
- h) generating and adapting genetic varieties of beans tolerant to water deficit or drought
- i) introduction of soybeans resistant to adverse climate conditions

5.1.2. Water Use

Currently, Nicaragua has between 30,000 and 50,000 ha under irrigation and the main crops benefitting from this are: sugarcane (66%), rice (25%), banana (3%), fruit, orchards and other grains (1%). The future potential for irrigation is very large as the Lake Nicaragua alone has an irrigation potential of 15,000million m³/year³⁵.

According to a vulnerability study performed by the **National Clean Development Office (ONDL**, Spanish acronym) on adaptation options for water resources and agriculture, 75% of harvest losses were due to droughts and the rest of 25% due to floods.

Based on a vulnerability study of water resources using future climate scenarios in the three regions of the country (Pacific, Atlantic and Central), surface water proved to be highly vulnerable to climatic variability in the Pacific and Central regions by 2050 and 2100, while the Atlantic region proved to be not vulnerable at all, mainly due to flooding. Vulnerability is associated with impacts on agriculture in the Pacific and Central parts, due to intense use of water for irrigation. Regarding underground water, a sharp reduction of this will be noticed as of 2050 with the base water flow being four times smaller compared to the current one by 2050 and only 10% of the current one by 2100.

The First National Communication identified the following adaptation measures for the water sector:

- a) prevention of deforestation in the most vulnerable areas of the water basin
- b) implementation of a conservation and water basin management plan in the most vulnerable areas to climate change
- c) implementation of an Action Plan for Water Resources
- d) decentralization of the water administration at the water basin level and promotion of integrated use of water
- e) implementation of complementary irrigation techniques in areas with water availability in order to prevent the effects of precipitation reduction
- f) use of low cost-low technology irrigation techniques (use of drop irrigation which uses less water than surface irrigation and leads to less salinity of soil)

Payment for Environmental Services³⁶ (PES) – a pilot project started in 2002 in the municipality of San Pedro del Norte (NW Nicaragua; one of the lowest HDI-scoring municipalities in the country) to increase climate resilience by investing in ecosystem restoration³⁷ which had experienced severe droughts and water scarcity. About 65% of the territory of the municipality was devoted to agriculture (maize, sorghum, beans) and pasture lands, and only 3.8% to forestry. Firstly, the project conducted basic studies on the investments needed to improve the hydrological balance in the ecosystem, and on the willingness of residents to pay for conservation. Secondly, a Local Fund for Environmental Services was created. Farmers can access this Fund for the following activities: avoidance of fires; soil conservation to capture water from rainfall (through stone ditches and barriers); forest regeneration. The project showed positive outcomes: improved water availability during the dry season (every 3 days, compared to every 8-10 days in the past); increased social capital and institutional cooperation (between farmers and the Water Committee; between water authorities and the environmental commission; and among farmers themselves).

³⁵ <http://www.centrogeo.org.mx/unep/documentos/Nicaragua/NICARAGUAagua.pdf>

³⁶ <http://www.cifor.cgiar.org/trofcca/america/docs/Community%20based%20adaptation%20in%20the%20dry%20tropics%20of%20C.A..pdf>

³⁷ This pilot was sponsored by the Program for Sustainable Agriculture in the Hillside of Central America (PASOLAC) to which the municipality applied via the Municipal Environmental Commission (MEC) of Nicaragua.

Program for Sustainable Agriculture in the Hillside of Central America³⁸ (PASOLAC, Spanish acronym) – implemented by the Swiss Inter-cooperation Foundation, it operates in Nicaragua, Honduras and El Salvador in cooperation with national authorities and municipalities and aims to support small and medium hillside agricultural producers by promoting sustainable water and soil management practices.

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.

Nicaragua's HDI value of 0.710 (an improvement from 0.648 in 1998) is close to the average for the region. Poverty rates also remain high with 45.1% of the population living on less than 1\$/day. The Gini coefficient for Nicaragua (43.1) is relatively low for the Central American region, indicating lower degree of inequality. Poverty is the lowest in the Pacific regions. By contrast, most of the rural poor population lives in the drought-prone central region, and in the harvest season migrate to the Pacific areas for seasonal work³⁹.

About 41% of Nicaragua's population resides in rural areas, 68% of whom live in poverty and 30% in extreme poverty⁴⁰. A 1998 Living Standards Survey (LSMS) showed that 18% of rural income is derived from a combination of farm and non-farm employment. Employment in agriculture is 31% of total employment in the country. Non-farm employment opportunities are geographically concentrated and hence not available to all rural residents; 80% of rural families still rely on agriculture for their livelihood. About 17% of rural households are managed by women; yet only 15% of rural women hold title to land or are eligible to receive credit⁴¹.

Program for Attention to Vulnerable Women and Children⁴²: administered by the Ministry of the Family, Children and Youth, it includes food support and nutritional information to parents, as well as promotes the cultivation of yard fruits and vegetables for family consumption. It operates in 8 municipalities.

Program for Integral Attention to Nicaraguan Children⁴³ (PAININ, Spanish acronym): it offers food and pre-school educational support to children under 5 and it operates in 66 municipalities.

Social Protection Network⁴⁴ (Red de Protección Social) consists of conditional cash transfer program, started in 2000, that includes food security transfers once every two months contingent on attending educational workshops and preventive health check-ups for their children under 5; and school attendance cash transfers for families with children aged 7-13 and attending school. The program covers rural areas in 17 departments of Nicaragua.

Emergency Social Investment Fund⁴⁵ (FISE, Spanish acronym) is a social investment fund realizing projects in education, water and sanitation, community capacity-building, health, attention to indigenous groups and afro-descendants, among others. It prioritizes municipalities with high and extreme poverty. More recently, priority has been put on investments in the autonomous Caribbean regions.

Central American Indigenous and Peasant Coordination Association⁴⁶ (ACICAFOC, Spanish acronym) - a community-based organization working with rural communities across Central America to exchange information and promote the sustainable use of natural and cultural resources. It works in the following areas: Community forest management; Community management of water and environmental services; Local eco-tourism and agro-ecotourism; Sustainable production and

³⁸ www.pasolac.org.ni

³⁹ HDR 2005 and FAO [ftp://ftp.fao.org/es/esn/nutrition/ncp/nicmap.pdf](http://ftp.fao.org/es/esn/nutrition/ncp/nicmap.pdf) pp. 6-7, and <http://www.ruralpovertyportal.org/english/regions/americas/nic/index.htm>

⁴⁰ [ftp://ftp.fao.org/es/esn/nutrition/ncp/nicmap.pdf](http://ftp.fao.org/es/esn/nutrition/ncp/nicmap.pdf)

⁴¹ <http://www.ruralpovertyportal.org/english/regions/americas/nic/index.htm>

⁴² <http://www.mifamilia.gob.ni/proyectos.php?ac=Asistencia>

⁴³ <http://www.mifamilia.gob.ni/proyectos.php?ac=PAININ>

⁴⁴ <http://www.ifpri.org/pubs/abstract/rr141.asp>

⁴⁵ <http://www.fise.gob.ni/contenido.asp?idcent=1>

⁴⁶ <http://en.acicafoc.org/>

commercialization. Its **Sustainable Watch** project created a network of NGOs and CSOs in Asia, Africa to promote consistent qualitative monitoring of sustainable development within countries and raise emerging issues to national and international attention. Focal points for this project in Central America so far are Guatemala, Nicaragua and El Salvador.

5.3. Insurance Instruments

Agricultural insurance was first introduced in Nicaragua in 2006 by INISER (public company). It was a MPCl contract that was discontinued due to commercial and legal constraints. Since then, INISER launched an index-based insurance product for peanut producers against the risk of lack of rainfall (drought). Since INISER launched the index based product, LAFISE (private company) developed other index-based product and is currently offering them in the market. There are a total of 2,000 ha of cropland insured, which represent 0.1% of total cropland in the country.

In terms of regional initiatives aimed to support the development of agricultural insurance in Central America, the **Inter American Federation of Insurance Companies**⁴⁷ (**FIDES**, Spanish acronym) groups the different agricultural insurance companies in Latin America. They currently provide technical assistance to the private insurance sector of Nicaragua, Guatemala and Honduras for developing agricultural insurance and are being financed by Grants from the World Bank, CABEL and Inter American Development Bank.

The Government of Nicaragua has a few instruments in place that support the agriculture sector in managing climate risks:

- a) **INISER** (Instituto Nicaraguense de Seguros): This public company offers agriculture insurance policies and has been at the forefront, for the past couple of years, of developing the market. INISER has taken on the role of investor in R&D of innovative instruments, such as index-based agricultural insurance, that is now being taken up by the private sector. Although the % of cultivated land under crop insurance is insignificant, the fact that the public sector is investing R&D resources for promotion of the market is commendable.
- b) **Agricultural Insurance Committee**: The Government, under the leadership of the Ministry of Agriculture (MAGFOR) has created a multi-stakeholder committee to promote the development of agricultural insurance in Nicaragua. The committee is currently considering implementing tax exemptions for agricultural insurance, as well as promoting a legal framework and incorporating agricultural insurance into public sector investments in the sector.

The following is a list of government entities and donors involved in initiatives relating to climate risk management for agriculture in Nicaragua:

1. Public sector:

- a) INISER: Public insurance company that offers crop (index-based) insurance.
- b) MAGFOR: The Ministry of Agriculture, along with the Public Rural Credit Fund (FCR), have been leading the public sector support to the development of agriculture insurance by establishing a committee to develop public policy for agricultural insurance market development.

2. Donors:

- a) WB: The Bank is supporting INISER and LAFISE in developing agriculture (index-based) insurance contracts.
- b) IADB and CABEL: They are currently financing work through the association of insurance companies (ANAPRI) for strengthening the regulatory framework and information platform for the development of agriculture insurance.

⁴⁷ www.fides.com



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.



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Feedback

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