

Climate Change Aspects in Agriculture

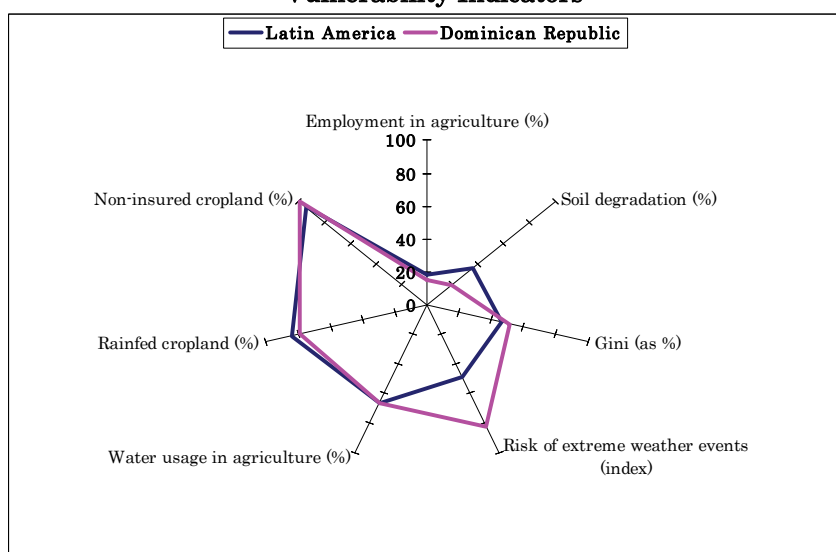
Dominican Republic Country Note



December 2008

This Country Note briefly summarizes information relevant to both climate change and agriculture¹ in the Dominican Republic, with focus on policy developments (including action plans and programs) and institutional make-up.

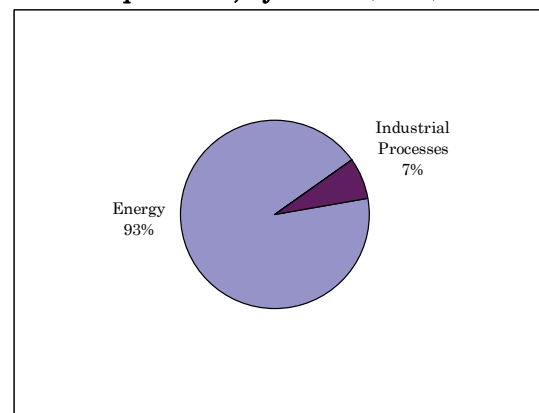
Vulnerability Indicators



Note: Employment in agriculture (% of total employment)*; Non-irrigated cropland (% of total cropland)*; Gini*²; Water usage in agriculture (% of total annual freshwater withdrawals)*; Insured cultivated land area (% of total cultivated land area)**; Soil degradation (% of total land)**³; Risk of extreme weather events (index; annual average 1997-2006)**⁴

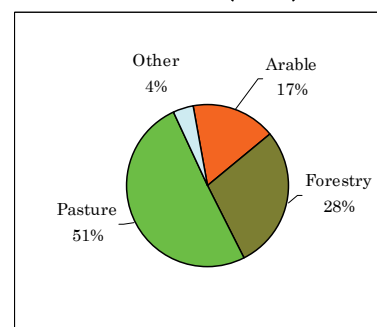
Sources: *World Development Indicators 2007, 2000-2007 average; **IADB, IICA, 2002/2003 figures; ***FAO AGL 2005²; ****Germanwatch

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

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Relevant Reference Material

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.

Feedback

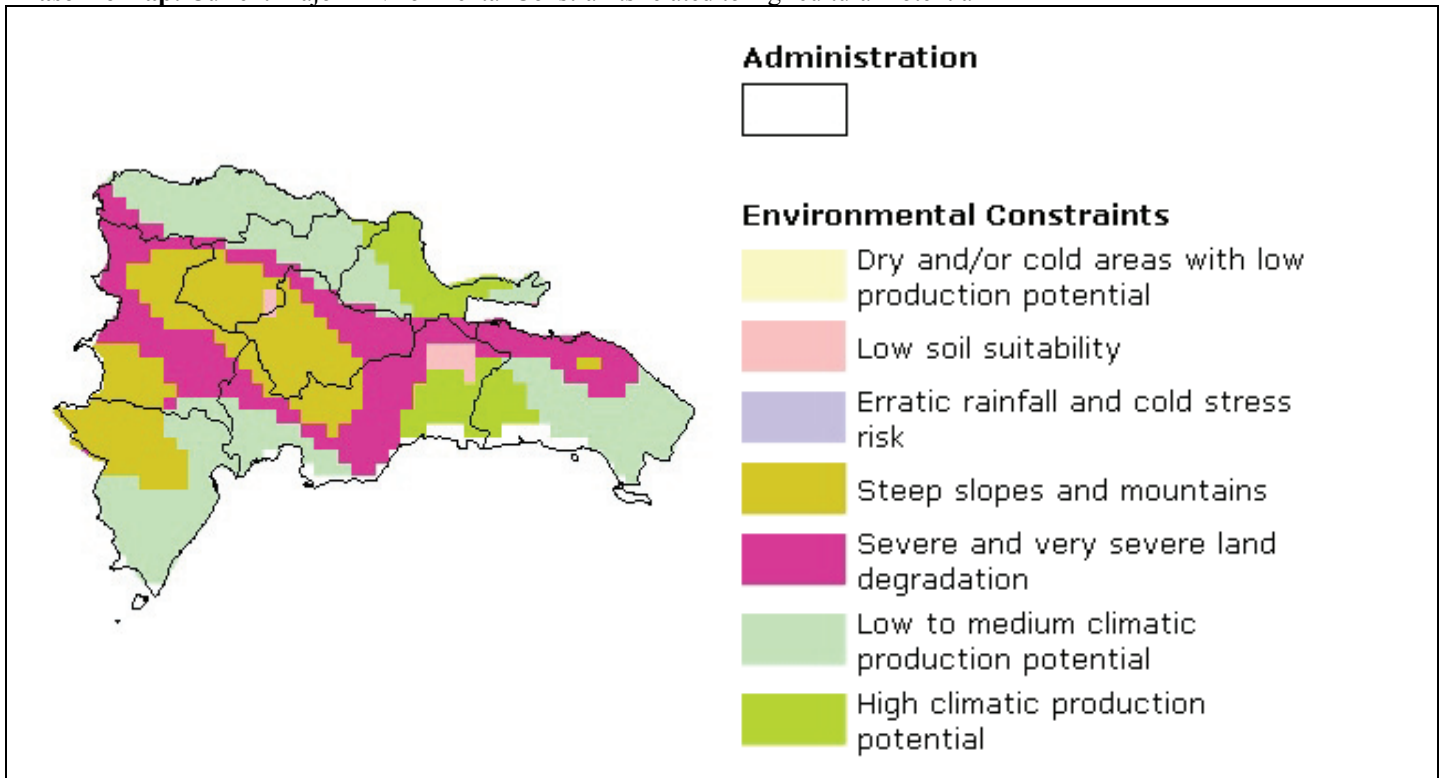
For comments and/or suggestions, please contact Svetlana Edmeades (LCSAR) at sedmeades@worldbank.org

Summary

This note summarizes information on climate change aspects in agriculture³ in The Dominican Republic, with a focus on policy developments (including action plans and programs) and institutional make-up. Agriculture has an insignificant contribution to GHG emissions in the country. However, it is fairly vulnerable to climatic variability, particularly in the south-west and north-west of the country where droughts have had a significant impact on crop yields. In addition, the country is highly vulnerable to extreme weather events, such as storms and floods, with direct negative impact on the agricultural sector. Thus, reducing vulnerability to climate change is of high importance in the agricultural sector in The Dominican Republic, considering the role the sector plays in food security and livelihoods of rural populations.

1. The Climate Context

Baseline map: Current Major Environmental Constraints related to Agricultural Potential



Source: FAO Note: For more maps on The Dominican Republic and agricultural resources, go to: <http://www.fao.org/countryprofiles/maps.asp?iso3=DOM&lang=en>

1.1. Country Projections

According to climate scenarios using general circulation models, prepared for the First National Communication, the following climatic change with relevance for the agricultural sector, are to be expected in The Dominican Republic:

- increases in temperature:** it is probable that the temperature will increase to 26.2C by 2010, 26.9C by 2030, to 27.7C by 2050 and to 29.6 by 2100;
- decreases in precipitations:** precipitations are expected to decrease to 1137 mm by 2030 (11% decrease from 2010), to 976 mm (23% decrease from 2010) and to 543 mm (57% decrease from 2010).
- sea level increase:** the sea levels are expected to increase between 1.47-13.55cm by 2010, 3.77-26.73 by 2030, between 6.53-47.27cm by 2050 and between 12.71-105.67 by 2100, depending on the scenarios (from the optimistic to the pessimistic).

The increased temperatures, coupled with a reduced precipitation regime will lead to increased evapo-transpiration and an increased water deficit, reflected in a reduction of runoff of up to 95% by 2100 with respect to the baseline, under the most pessimistic scenario. It is also expected to see a transition from the most humid zones of the country to the driest and an expansion of the areas that are historically the driest.

The **Global Climate Risk Index**⁴ constructed for the period between 1997 and 2006 and covering both human and economic impacts, ranks The Dominican Republic 5th in the World, underscoring the country's very high vulnerability to weather related events. In recent years (between 2001 and 2008), storms and floods have had the highest human and economic impact in The Dominican Republic, with losses for the period 1997-2006 averaging at 0.83% of GDP – 182,344 people have been affected by

storms (6 events) with the cost of damages reaching US\$ 459 million and 45,220 people have been affected by floods (4 events) with the cost of damages reaching US\$ 45 million⁵.

1.2. Agriculture-Related Impacts

Agriculture is highly vulnerable to weather related events in The Dominican Republic, particularly to storms. Hurricane Mitch which hit the country in 1998, led to total crop losses totaling US\$ 278 million, where one third of the area planted with crops had been destroyed⁶. Tropical storm Noel, which hit the Dominican Republic's shores in October 2007, is thought to have destroyed the entire plantain and vegetable crops in some areas of the country⁷.

2. The Policy Context

Like most countries in the region, The Dominican Republic has submitted only one **National Communication**⁸ to the **United Nations Framework Convention on Climate Change**⁹ (UNFCCC) in March 2004, laying out the actions that the government has already taken and the analytical basis for its policy response to climate change and its commitments to take future actions within an official international framework.

The National Communication establishes the national GHG Inventory for 1990 and 1994, it includes vulnerability and adaptation studies to climate change for water resources, coastal area and the agricultural sector and mitigation options for natural disasters as well as for the forestry sector.

The Second National Communication is in the works and scheduled to be completed by 2009. Its goals are to include vulnerability studies as well as adaptation measures for the different sectors, a mitigation program for the forestry sector and a national adaptation plan for the water sector, forestry and agriculture¹⁰.

2.1. National Climate Change Plans, Strategies and Programs

The **National Climate Change Program**¹¹ was initiated in 2000 with funding from the Global Environment Facility (GEF) and its direct objective was to be involved in the preparation of the First National Communication.

2.2. Agricultural Sector Initiatives

3. The Institutional Context

The **State Secretariat for Environment and Natural Resources**¹² (SEMARENA, Spanish acronym), created in August 2000, is the national authority on the environment in the Dominican Republic, it oversees country's commitments to the UNFCCC and other climate change related actions and it represents the **Designated National Authority (DNA)** on climate change and in particular on Clean Development Mechanism (CDM) in the Dominican Republic through its Climate Change Office.

3.1. Inter-Sectoral Coordination

The **National Climate Committee (CNC)**, Spanish acronym), created in February 2002, serves as a link between the State Secretariat for Environment and Natural Resources and the private sector and civil society. It is divided into working groups: one responsible for National GHG inventories and mitigation, one for vulnerability and adaptation to climate change studies and one group for education and public awareness.

3.2. Agricultural Sector Institutions

The **State Secretariat for Agriculture**¹³ (SEA, Spanish acronym) is responsible for the formulation and directing of the national agricultural policy, according to the general development plans, it coordinates short- and long term programs of the entities linked and related to it and performs research in the agricultural sector. It has authority over livestock policies through its **General Directorate of Livestock**¹⁴ (DIGEGA, Spanish acronym).

The **National Weather Office**¹⁵ (ONAMET, Spanish acronym) offers forecasts on weather variables, useful for the agricultural sector. It also issues monthly climate change reports providing information on temperature and precipitation changes in the context of the last century. It is in the process of creating and **early alert system** issuing forecast for extreme weather events aimed at mitigation of floods and landslides.

The **National Institute for Water Resources**¹⁶ (INDRHI, Spanish acronym) is responsible for managing water and related resources as well as designing, implementing, monitoring and evaluating programs, projects and activities aimed at controlling and regulating surface and groundwater use. It is also in charge of irrigation systems management in the country.

3.3. Fostering Capacity to Deal with Climate Change

- *Emissions inventory*: To date, The Dominican Republic counts with one National GHG Inventory for 1990 and update for 1994. The inventory includes data on agriculture and land-use change and forestry, providing disaggregated information by type of emission and type of agricultural source.
- *Studies related to climate change*: SEMARENA, in collaboration with the Canadian Development Agency (CIDA) and UNDP have published a study on the adaptation to drought for the south-west and north-west of the Dominican Republic¹⁷. In addition, various vulnerability and adaptation to climate change studies have been completed in preparation for the First National Communication for coastal and water resources, agriculture and forestry.

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

According to the First National Communication, agriculture is responsible for only 1% of total GHG emissions in 1994. Of total methane (CH₄) emissions, 38% can be attributed to agriculture, mainly as a result of enteric fermentation from farm animals. Agriculture is also responsible for 86% of total nitrous oxide emissions from soil used for crop cultivation. Land-use change and forestry is responsible for CO₂ absorption.

4.1. Action Frameworks

4.1.1. Forestry and Land Use Change

The forestry and land-use change sector is responsible for the absorption of 6,633.17Gg CO₂ in 1994, which represents a 17% increase from the absorptions registered in 1990 (5,667.14Gg CO₂). These absorptions are due to conversion occurring in forests and pastures. Deforestation activities in the Dominican Republic have showed a sharp decrease since the 1990s due to increased controls of forest fires and of clearing of forests for agricultural purposes. Thus, the average annual deforestation rate for the period 1990-2005 in the country is nil¹⁸.

The **National Reforestation Program**¹⁹ was created in 2001 and its main objective is to restore degraded areas in the most important water basins with the final aim of improving the well being of populations in the area through maintenance of forest plantations, among others. It consists of five programs: i) Plant Production Program; ii) Reforestation Program; iii) Water Basin Management Program; iv) Forest Management Program and v) Promising Specie Program.

The Project: Rehabilitation and Community Development of the Artibonito River Basin and other Areas of the Border Region: reforestation of 11,732 hectares, establishment of 500 hectares of agroforestry plots.

Management and Conservation of the High Yaque River Basin²⁰ (PROCARYN, Spanish acronym), initiated in 1999 with the help of the German Development Bank (KfW) and the German Aid Agency (GTZ) in collaboration with national institutions, is aimed at fostering investments for the promotion of sustainable use of natural resources and increased economic benefits from forest production and agroforestry. It consists of the following activities: management of existing forests, reforestation, agroforestry projects, sustainable agriculture and management of protected areas, among others.

4.1.2. Livestock

According to the First National Communication, livestock is responsible for 87% of total methane emissions from agriculture in 1994, which represents an increase of 3% from 1990 due to a higher number of livestock in the country. Of these methane emissions, 94% of these are from the enteric fermentation process from farm animals and the rest of 6% from handling of farm manure.

4.2. Carbon Trading and Agriculture

5. Impact of Climate Change on Agriculture - Adaptation Measures

5.1. Action Frameworks

5.1.1. Land Management

Flooded rice fields are responsible for 11% of methane emissions from agriculture in 1994, which represents a decrease from 1990 when these emissions stood at around 14%. In terms of nitrogen based fertilizers, whose intensive use leads to the emission of

nitrous oxide in the air, the intensity of use of fertilizers in the Dominican Republic in 1999 is 60kg/hectare of cropland, very close to the Central America and the Caribbean average of 65kg/hectare of cropland²¹.

Some adaptation measures that have been implemented in the country to revert degradation are:

- sustainable agriculture and implementation of organic practices (banana, coffee),
- sustainable agriculture with conservation tillage and improvement of eroded land terrain with slopes
- sustainable land use and sustainable land management including irrigation.
- implementation of better norms to generate cultivars of crops that can resist to extreme climate conditions.

The following adaptation measures for the agricultural sector are identified in the First National Communication, as a result of a vulnerability study to climate change for potatoes, rice and corn for 2100, showing a decreasing yield of these crops by 2100:

- an increased use by producers of weather services oriented toward agriculture, such as early alert systems capable of forecasting droughts, agricultural fires, plagues and diseases and the necessity to create a forecasting system for crop yields and agricultural production
- national zoning of crops according to the suitability of the available cropland for certain crops
- development of educational programs for farmers on the use of sustainable methods in agriculture
- introduction of sustainable practices of crops aimed at soil and humidity conservation and avoiding of soil salinity
- development of new crop varieties, resistant to high temperatures and more tolerant to lack of humidity in soil
- introduction of crops resistant to drought which affects the country in the south-west and the north-west
- improvement of soil quality in areas struck by drought

5.1.2. Water Use

In the Dominican Republic, agriculture is responsible for 66% of all freshwater withdrawal. Of the total land dedicated to agriculture, 17.2% (280,000 hectares) of it is irrigated, which is higher than the Latin America and the Caribbean average of 11.4%²², but it is lower if taken into account just the Central America and the Caribbean average of 19.1%²³. Public investment in irrigation has been the main driver for the development of the irrigation infrastructure in the country. Surface irrigation represents 96% (270,000 hectares) of total irrigation. Most of the irrigated areas are located in the valleys between the mountain ranges, with a medium to low rainfall and few limitations on its soil such as slope, depth of soil, and in some cases, salinity problems associated with irrigation or the presence of saline groundwater²⁴.

The following adaptation measures have been identified in the First National Communication, as a result of a vulnerability study for water resources showing a decrease runoff by 2100 as a result of temperature increases and precipitation decreases in the country:

- changes in the storing capacity of water
- implementation of methods for increased saving of water
- changes in crop systems and implementation of no-till practices which require less water
- increased efficiency in water management and protection of the resource against contamination, especially for underground water
- installation of shallow water pumps to supplement water extractions in areas not suited for traditional water extraction techniques

Some adaptation measures identified in the south-west and north-west part of the Dominican Republic affected by drought are: i) storing of rainwater; ii) construction of water wells; iii) introduction of crops resistant to drought.

5.3. Social Aspects

5.4. Coping with Risk

6. Regional initiatives

Caribbean Community Climate Change Center²⁵ (CCCCC, Spanish acronym): Established in August 2005 as the official coordinating body of the Caribbean response to climate change. It is the official repository for regional climate change data, providing climate change-related policy advice to the Caribbean Community (CARICOM) member states.

Association of Caribbean States²⁶: Coordinates various projects on disaster preparedness and relief with own and donor funding e.g. a **Database of Financial Mechanisms for Disasters** (a list of all organizations that provide reimbursable and non-

reimbursable post-disaster funding), a **Radio Soap Opera on Natural Disasters in the Caribbean**, and assistance to member states in creating **National Post-Disaster Funds**. <http://www.acs-aec.org/projects/projects.htm>

Red Cross- Caribbean²⁷: Prepares training materials and coordinates training campaigns for disaster preparedness and resilience to other climate-change induced risks, including through **Community Based Disaster Risk Management²⁸** (CBDRM, Spanish acronym).

OAS/Caribbean Disaster Mitigation Project²⁹ (CDMP): in the Dominican Republic it established an NGO that has continued operating beyond the project. It contributes to attract and leverage external resources for community flood mitigation projects, and is used by almost all municipalities. With one exception, all community flood control works withstood flooding from Hurricane George in 1998. This project involves a number of community initiatives (see <http://www.oas.org/CDMP/rdom/Comminit.htm>)

Relevant Reference Material:

¹ General information on the linkages between climate change and agriculture can be found at http://en.wikipedia.org/wiki/Climate_change_and_agriculture, including the references and links provided.

² <http://www.fao.org/landandwater/agll/glasod/glasodmaps.jsp?country=DOM&search=Display+map+%21>

Relevant Reference Material:

³ General information on the linkages between climate change and agriculture can be found at http://en.wikipedia.org/wiki/Climate_change_and_agriculture, including the references and links provided.

⁴ <http://www.germanwatch.org/klima/cri2008.pdf>

⁵ [http://www.emdat.be/Database/CountryProfile/countryprofile.php?disgroup=natural&country=dom&period=1999\\$2008](http://www.emdat.be/Database/CountryProfile/countryprofile.php?disgroup=natural&country=dom&period=1999$2008)

⁶ <http://www.fao.org/DOCREP/MEETING/003/X9178E.HTM>

⁷ http://www.associatedcontent.com/article/433473/tropical_storm_noel_devastates_the.html

⁸ <http://unfccc.int/resource/docs/natc/domrepnc1.pdf>

⁹ www.unfccc.int

¹⁰ http://pnud.onu.org.do/sites/pnud.onu.org.do/files/prodoc_cambio_climatico_00047173.pdf

¹¹ http://www.unccd.int/cop/reports/lac/national/2002/dominican_republic-spa.pdf, pg. 25

¹² www.medioambiente.gov.do

¹³ www.agricultura.gob.do

¹⁴ <http://www.agricultura.gob.do/SobreNosotros/Dependencias/tabid/290/language/en-US/Default.aspx>

¹⁵ www.onamet.gov.do

¹⁶ www.indrhi.gov.do

¹⁷ <http://www.globalfoundationdd.org/seminars/cambiosclimaticosII2007/docs/PROYECTORDPDF.pdf>

¹⁸ World Development Indicators, 2007

¹⁹ http://www.unccd.int/cop/reports/lac/national/2002/dominican_republic-spa.pdf, pg. 27

²⁰ www.procaryn.gov.do

²¹ http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_214.pdf

²² World Development Indicators, 2006

²³ http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_214.pdf

²⁴ http://en.wikipedia.org/wiki/Irrigation_in_the_Dominican_Republic

²⁵ www.caribbeanclimate.bz

²⁶ <http://www.acs-aec.org/>

²⁷ <http://www.caribbeanredcross.org/what/dm/climatechange/index.htm>

²⁸ <http://www.caribbeanredcross.org/what/dm/ccws-ppt/cbdrm.pdf>

²⁹ <http://www.oas.org/CDMP/rdom/Homepag.htm> and UNDP and World Bank Colloquium on Microfinance: Disaster Risk Reduction for the Poor, Feb 2002 http://www.proventionconsortium.org/themes/default/pdfs/microfin_workshop_2000_proceedings.pdf p.5