

Climate Change Aspects in Agriculture

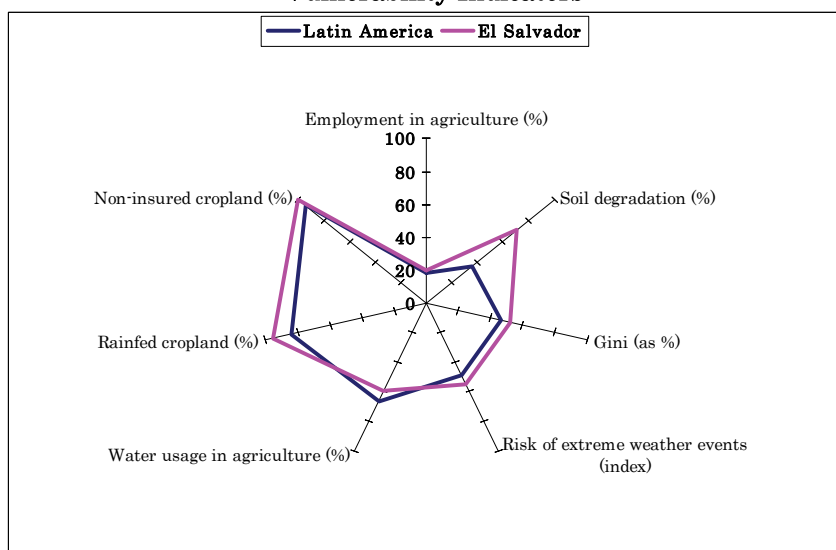
El Salvador Country Note



December 2008

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

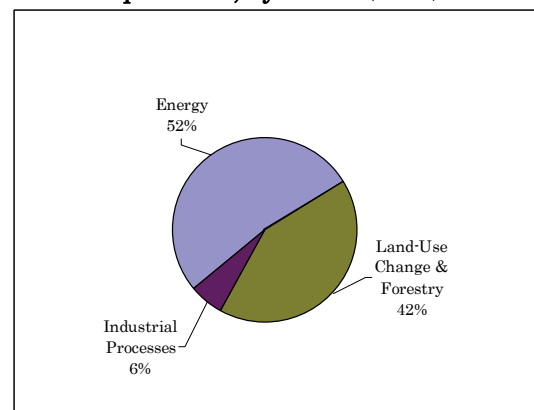
Vulnerability Indicators



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

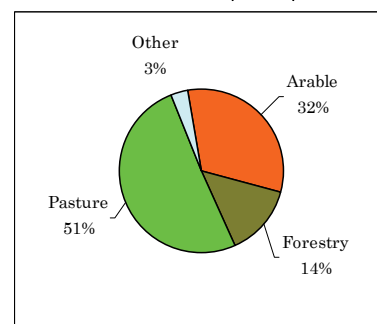
Sources: *World Development Indicators 2007, 2000-2007 average; **IADB, IICA, 2002/2003 figures; ***FAO AGL 2005²; ****Germanwatch

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

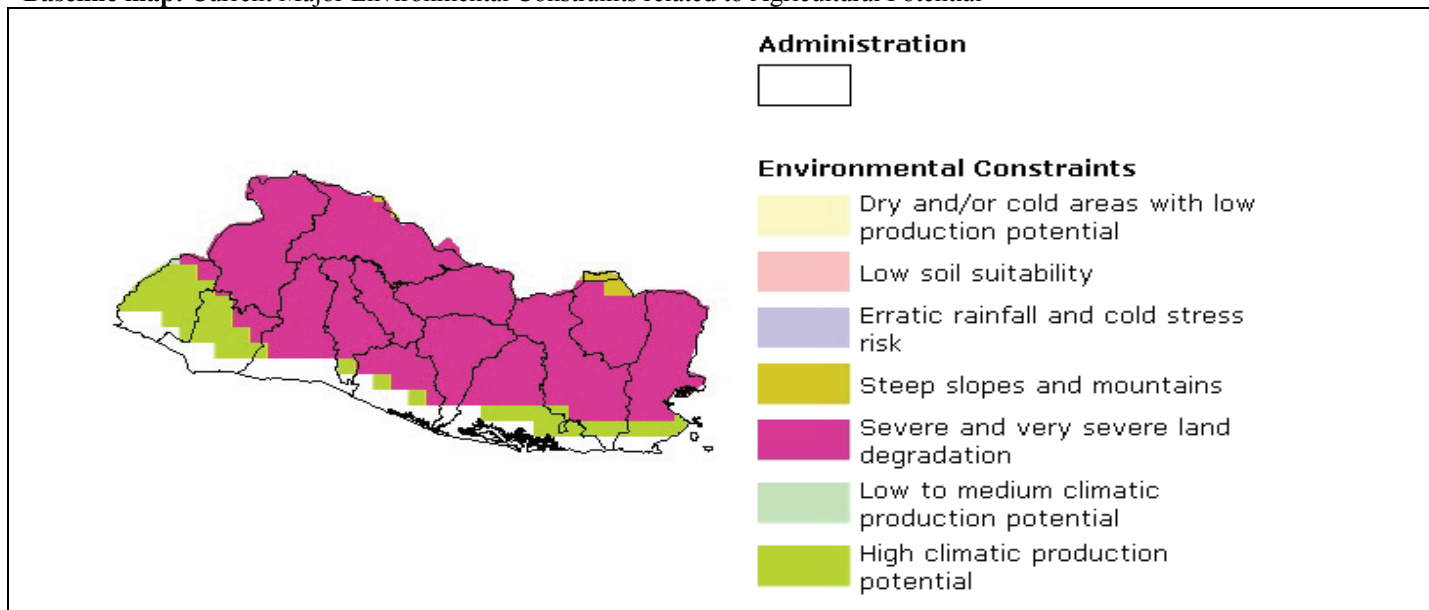
For comments and/or suggestions, please contact Svetlana Edmeades (LCSAR) at sedmeades@worldbank.org

Summary

This note summarizes information on climate change aspects in agriculture³ in El Salvador, with a focus on policy developments (including action plans and programs) and institutional make-up. Land use change and forestry is the second largest contributor to GHG emissions in the country and the carbon sequestration potential of the forestry sector is significant. Agriculture is highly vulnerable to climate variability, particularly to droughts and floods, affecting the country on a yearly basis. The forestry sector is highly vulnerable due to intense deforestation activities to make space for agricultural land. Thus, reducing vulnerability to climate change is of utmost importance in the agricultural sector and forestry, 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 El Salvador and agricultural resources, go to <http://www.fao.org/countryprofiles/Maps/SLV/04/ec/index.html>

1.1. Country Projections

According to climate scenarios developed by researchers for El Salvador, the following climate changes with impact on agriculture are likely to be noticed⁴:

- temperature increases:** it is probable that the temperature will increase by 0.8-1.1C by 2020 and between 2.5C-3.7C by 2100 according to the moderate scenario
- change in precipitation regime:** precipitation changes of between -11.3% to 3.5% are to be expected by 2020 and between -36.6% to 11.1% by 2100
- sea level increase:** it is probable that the sea level will increase by around 20cm by 2030, 40cm by 2040 and up to 70cm by 2100.

According to a study on adaptation strategies to climate change realized by the Ministry of Environment and Natural Resources in collaboration with the National Service of Territorial Studies (SNET) in the coastal plains of El Salvador, between the municipalities of Zacatecoluca, Tecoluca and Jiquilisco⁵, the following was concluded for the year 2015; i) loss of between 10 and 19% of the territory due to sea elevation of 13-55 cm, especially in the mangrove swamp area; ii) forest fires and forest plagues; iii) increased soil erosion and loss of humidity in soil and iv) diminishing productivity of corn of between US\$3.1 million and US\$7.5 million for the years 2025 and 2100 respectively caused by droughts.

The **Global Climate Risk Index**⁶ constructed for the period between 1997 and 2006 and covering both human and economic impacts, ranks El Salvador 30th in the world, underscoring the country's high vulnerability to climate related events. In recent years (between 2001 and 2005), storms and droughts have had the highest human and economic impact in the country- 400,000 people have been affected by droughts (1 event) with the cost of damages reaching US\$22.4 million and 74,941 people have been affected by storms (2 events) with the cost of damages reaching US\$355 million⁷.

1.2. Agriculture-Related Impacts

Tropical storm Stan which hit El Salvador on October 3, 2005 destroyed 70% of the basic grains and crops (corn and beans) that 30% of the population depends on for subsistence and survival. Fifty percent of the coffee crop from the area near the Llamatepeque volcano in Santa Ana was lost, representing 5% of the total coffee crop in the country⁸. Furthermore, Hurricane Mitch led to the loss of 49% of the agricultural and livestock sector in El Salvador with a total loss of US\$ 165.4 million⁹.

The earthquakes hitting El Salvador in 2001, led to the destruction of 30,000 farms and 20% of coffee processing plants, thus greatly affecting the incomes of rural families who were just recovering from the damages inflicted by Hurricane Mitch¹⁰. The drought of 1987 in El Salvador resulted in losses for rice and maize of 83.8% and 65.8% respectively¹¹.

2. The Policy Context

To date, El Salvador has submitted only one **National Communication**¹² to the **United Nations Framework Convention on Climate Change**¹³ (UNFCCC) in February 2000, 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. It contains the First National GHG Inventory with 1994 as its base year, the results of future climate change scenarios, as well as climate change impact assessment in agriculture along the coast line and adaptation projects currently active in the region. The Second National Communication is currently in the works and will contain the Second National GHG Inventory with 2000 as its base year.

2.1. National Climate Change Plans, Strategies and Programs

A National Climate Change Action Plan does not currently exist. However, the Ministry of Environment and Natural Resources is currently working on elaborating such plan that can offer mitigation and adaptation actions for the various sectors of the economy.

2.2. Agricultural Sector Initiatives

3. The Institutional Context

The **Ministry of Environment and Natural Resources**¹⁴ (MARN, Spanish acronym) created in 1997, is the environmental authority in the country, it oversees El Salvador's commitments to the UNFCCC and other climate change related actions and represents the Designated National Authority (DNA) on climate change and, in particular, on Clean Development Mechanism (CDM) in the country. It counts with a **Climate Change Unit**, managed by the Physical and Energy Resources Management, which is responsible for coordinating various projects and instruments related to climate change. The Climate Change Unit is currently in the process of legalization and its main objective will be to coordinate and design the execution of national mitigation and adaptation programs to climate change.

3.1. Inter-Sectoral Coordination

3.2. Agricultural Sector Institutions

The **Ministry of Agriculture and Livestock**¹⁵ (MAG, Spanish acronym) has authority over agriculture, livestock, forestry and fisheries in the country. It counts with a **General Directorate of Forestry, River Basin and Irrigation Management**¹⁶ (DGFCR, Spanish acronym) in charge of generating and distributing information and technical and legal assistance about forest, soil and water resources, as well as implementing programs contributing to the sustainable development of forest, water and soil resources in El Salvador. The Irrigation and Drainage Division is in charge of administrating and regulating the irrigation systems.

3.3. Fostering Capacity to Deal with Climate Change

- *Emissions inventory*: To date, El Salvador counts with one National GHG Inventory with 1994 as its base year. The inventory includes data on emissions from agriculture, land use change and forestry, providing disaggregated data by type of emissions and type of agricultural resources. A second National GHG Inventory for 2000 is in the works and will be included in the Second National Communication.
- *Studies related to climate change*: the United Nations Development Program produced a publication titled "The ABC of Climate Change in El Salvador" which is intended to be an information instrument about climate change in El Salvador. A further study was done on "Evaluating the Impacts of Climate Change in the Agricultural Sector of the Coastal Area of El Salvador"¹⁷ with the objective to assess the vulnerability of the said area in order to propose adaptation measures to face climate variations.

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

According to the First National Communication, land-use change and forestry represents the second highest source of GHG emission in the country (45% of total GHG emissions) in 1994. Agriculture accounts for 60% of all methane (CH₄) emissions in the country, mainly from enteric fermentation from farm animals and 25 come from rice cultivation, and for 96% of total nitrous oxide emissions, from crop cultivation and pasturing.

El Salvador's carbon dioxide emissions per capita in 2004 stand at 0.9tCO₂/capita, compared to the Latin America region of 2.6tCO₂/capita and the world at 4.5tCO₂/capita, thus showing the country's relatively small contribution to the global CO₂ emissions¹⁸.

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 45% of total GHG emissions for 1994, this including the sequestration of CO₂ from regenerated vegetation growing on abandoned land during the armed conflict of the 80's. This amount was estimated at 718.7Gg CO₂, corresponding to an area of 98,000 hectares of recovered forests after 20 years of abandonment. The Main source of CO₂ emissions is change of forests and firewood consumption (87%), followed by burning of grasslands and farming waste (12%) and biomass decay (1%).

The average annual deforestation rate for 2002 for El Salvador is 4.6%, the second largest in the region after Haiti, and the main reason for it is clearing up land for agriculture and cattle grazing¹⁹.

According to the Forestry Strategy for El Salvador, a study realized by the Ministry of Agriculture and Livestock, in collaboration with MARN, the Ministry of Tourism, FAO and the Agricultural and Agro-industrial Chamber of El Salvador in 2002-2006, the carbon capturing potential of the forestry sector in El Salvador is of approximately 53 million metric tons of carbon if reforestation activities of 415,424 hectares are taking place.

The following potential mitigation actions are identified in the First National Communication for the forestry sector, given that they represent the second source of GHG emission in El Salvador: i) reforestation and sustainable management of the main watersheds in the country; ii) protection of forests to avoid deforestation; iii) sustainable management of natural areas and iv) promotion of agri forestry and prevention of forest fires.

4.1.2. Livestock

According to the First National Communication, livestock is responsible for 94% of total methane (CH₄) emissions in the country due to enteric fermentation of farm animals. These depend on the type of animal and the animal diet.

According to a study evaluating the impacts of climate change on the agricultural sector of the coastal area of El Salvador, the floods affecting the Paz, Jiboa and Grande river basins in San Miguel lead to 80% loss in pastures and livestock.

4.2. Carbon Trading and Agriculture

5. Impact of Climate Change on Agriculture - Adaptation Measures

El Salvador has initiated a few studies and assessments, mainly on the vulnerability of agriculture in coastal areas to climate change related events and a climate change assessment on food security in the country. It has proposed clear adaptation measures for this sector in order to face the future challenges faced by this phenomenon on the agricultural sector.

5.1. Action Frameworks

5.1.1. Land Management

The agricultural sector is the main responsible for nitrous oxide emissions in El Salvador in 1994 (96% of total emissions), mainly due to poor farming practices and fertilizer use in crop cultivation (22%) and pasturing (27%). Although showing a decreasing trend over the years, the intensity of fertilizer use in El Salvador in 1999 of 106kg/hectare of cropland is much higher than the Central America and the Caribbean region of 65kg/hectare of cropland²⁰.

The First National Communication identifies the following potential mitigation options for the agricultural sector; i) post harvest management to avoid the burning of farm waste and the preservation of farm soil; ii) erosion, sedimentation and runoff control; iii)

more appropriate and rational use of fertilizers; iv) generation of new crop varieties resistant to pests, tolerant of droughts and salinity; v) cultivation of different varieties with the capacity to resist to the negative effects of climate change; vi) foster zoning programs for the better use of soil to adjust cultivation times to climate forecasts.

5.1.2. Water Use

In 1998, arable and permanent cropland represented 38.5% of the country's total land area, which is much higher than the Central America and Caribbean average of 16%. However, the percentage of the arable area that is irrigated is only 4.9%, much lower than the region's average of 19.1%.²¹ Of the total area under irrigation, 89% of it is done by surface irrigation (flooding) and the rest of 11% by sprinklers. Agriculture accounts for 46% of all water extraction in the country, mainly for irrigation purposes. The main crops under irrigation in the country are: pastures, sugar cane, coffee and basic grains, mainly maize²².

Program for Sustainable Agriculture in the Hillside of Central America²³ (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.

The **Drought Response and Mitigation Project²⁴** in El Salvador, implemented by the Red Cross in 2002 as a form of mitigating the effects of droughts affecting the country on a yearly basis. The objective of this initiative is to increase the capacity of subsistence farmers in the east of the country to better respond to adverse effects of climate conditions, by providing technical assistance to diversify and market crops, to improve income and daily diet and to improve environmental conditions through reforestation by the use of fruit trees, use of organic fertilizers and small scale irrigation systems.

5.3. Social Aspects

El Salvador's Human Development Index stands at 0.735, with a high inequality level in the country reflected in the Gini coefficient at 52.4. The rural population (40.2%) and indigenous groups (about 5% of the population) are the most vulnerable to climate shocks due to their lower education, access to information and mobility. A map of regions with high marginalization is available at: <http://www.redsolidaria.gob.sv/content/view/678/47/>.

About 47% of the rural population in El Salvador lives in poverty²⁵. Small farmers, in particular in remote hilly areas are among the most vulnerable rural groups due to rapid soil degradation in their plots and fewer opportunities for non-farm employment. Similar to the rest of the region, migration has been one of the main coping strategies for rural households in El Salvador. Currently, about 2.5 million Salvadorans live outside of El Salvador, and the emigration rate is estimated to continue being at more than 10,000/year.

ProVention Consortium, Community Risk Assessment and Action Planning Project²⁶: it is a toolkit for disaster preparedness and risk prevention that uses participatory research methods (community interviews and workshops; assignment of community focal points, etc.). Once a community identifies key risks and vulnerabilities, it develops an action plan for prevention and/or mitigation of risks. Risks could be associated with natural disasters (hurricanes, earthquakes, floods, etc.) or other threats e.g., conflict, environmental health hazards and epidemics. As part of this, El Salvador created the *Program for Prevention and Mitigation of Flood Disasters in the Lower Lempa River Basin²⁷* aimed at providing an integral diagnosis of the zone and proposing and integrated intervention strategy that could lead to substantial flood disaster risk reduction.

Solidarity Network (Red Solidaria)²⁸: Includes three main components – family solidarity network (health and education cash transfers to mothers, who are heads of household and live in extreme poverty); basic services network (improving social infrastructure in regions of extreme poverty); and household livelihood network (promoting microcredit and productive activities for small farmers and rural families). Coverage of the program has been expanded progressively. In January 2008 it covered 89,000 households in 77 municipalities with high and extreme grades of poverty.

5.4. Coping with Risk

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=SLV&search=Display+map+%21>

Relevant Reference Material:

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- 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.marn.gob.sv/uploaded/content/category/575225856.pdf>
- ⁵ <http://www.marn.gob.sv/uploaded/content/category/1847517184.pdf>
- ⁶ <http://www.germanwatch.org/klima/cri2008.pdf>
- ⁷ [http://www.emdat.be/Database/CountryProfile/countryprofile2.php?disgroup=natural&country=slv&period=1999\\$2008](http://www.emdat.be/Database/CountryProfile/countryprofile2.php?disgroup=natural&country=slv&period=1999$2008)
- ⁸ <http://www.reliefweb.int/rw/rwb.nsf/db900SID/RMOI-6JL56Z?OpenDocument>
- ⁹ <http://zeus.iica.ac.cr/docs/sc/coreca/200604/MJIMENEZ-SLV-2006.pdf>
- ¹⁰ http://www.oas.org/dsd/policy_series/4_spa.pdf
- ¹¹ <http://74.125.45.132/search?q=cache:hoTl6bIVtUIJ:www.fao.org/docrep/meeting/X4583E.htm+drought+effects+reduction+crop+yields+chile&hl=en&ct=clnk&cd=8&gl=us>
- ¹² <http://unfccc.int/resource/docs/natc/elsnc1e.pdf>
- ¹³ www.unfccc.int
- ¹⁴ www.marn.gob.sv
- ¹⁵ <http://www.mag.gob.sv>
- ¹⁶ <http://www.mag.gob.sv/forestal/>
- ¹⁷ <http://www.marn.gob.sv/uploaded/content/category/1272987648.pdf>
- ¹⁸ http://hdrstats.undp.org/countries/country_fact_sheets/cty_fs_slv.html
- ¹⁹ World Development Indicators, 2005
- ²⁰ http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_222.pdf
- ²¹ http://earthtrends.wri.org/pdf_library/country_profiles/agr_cou_222.pdf
- ²² http://www.fao.org/nr/water/aquastat/countries/el_salvador/indexesp.stm
- ²³ www.pasolac.org.ni
- ²⁴ http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=143
- ²⁵ <http://www.ruralpovertyportal.org/english/regions/americas/index.htm>
- ²⁶ <http://www.proventionconsortium.org/?pageid=43>
- ²⁷ http://www.proventionconsortium.org/themes/default/pdfs/CRA/El_Salvador.pdf
- ²⁸ <http://www.redsolidaria.gob.sv/>