

# Climate-Smart Agriculture in El Salvador

## *Supplementary material*

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This publication is a product of the collaborative effort between the International Center for Tropical Agriculture (CIAT), the lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS); the Tropical Agricultural Research and Higher Education Center (CATIE); and the World Bank to identify country-specific baselines on CSA in seven countries in Latin America: Argentina, Colombia, Costa Rica, El Salvador, Grenada, Mexico, and Peru. The document was prepared under the co-leadership of Andy Jarvis and Caitlin Corner-Dolloff (CIAT), Claudia Bouroncle (CATIE), and Svetlana Edmeades and Ana Bucher (World Bank). The main author of this profile is Andrew Halliday (CATIE), and the team was comprised of Andreea Nowak (CIAT), Miguel Lizarazo (CIAT), Pablo Imbach (CATIE), Beatriz Zavariz-Romero (CIAT), Rauf Prasodjo (CIAT), María Baca (CIAT), Claudia Medellín (CATIE), Karolina Argote (CIAT), Chelsea Cervantes De Blois (CIAT), Juan Carlos Zamora (CATIE), and Bastiaan Louman (CATIE).

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This Supplementary Material is in support of the Climate-Smart Agriculture in El Salvador profile within the Country Profiles for Latin America Series. The annexes below are references where relevant in the text. The Supplementary Material cannot and should not be read in isolation. It can only be read in association with the chapter.

**Annex I: Acronyms**

AECID	Spanish Agency for International Cooperation
AF	Adaptation Fund
AR5	IPCC Fifth Assessment Report
ASAP	IFAD's Adaptation for Smallholder Agriculture Program
ASILECHE	Association of Milk Producers of El Salvador
BANDESAL	Development Bank of El Salvador
C	Carbon
CAC	Agricultural Council of Central America
CASSA	Salvadorian Sugar Company
CATIE	Tropical Agricultural Research and Higher Education Center
CCAD	Central American Commission on Environment and Development
CCVI	Climate Change Vulnerability Index
CDKN	Climate and Development Knowledge Network
CDM	UNFCCC Clean Development Mechanism
CENTA	National Centre for Agricultural and Forestry Technology
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIF	Climate Investment Funds
CO <sub>2</sub> eq	Carbon dioxide equivalent
CONSAA	Salvadorian Council of Agro industrial Sugar Producers
CRS	Catholic Relief Services
CSA	Climate Smart Agriculture
ECADERT	Central American Rural Development Strategy
ERAS	Regional Agro-Environmental and Health Strategy
ERCC	Regional Strategy on Climate Change
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FFEM	French Global Environment Facility
FIAES	Americas Initiative Fund
FONAES	El Salvador Environment Fund
FUNDE	National Foundation for Development
FUNDESYRAM	Foundation for Development and Environmental Restoration
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
Gg	Gigagrams
GHG	Greenhouse gas
GIZ	German Agency for International Cooperation
GMCR	Green Mountain Coffee Roasters
HORIZONT3000	Austrian Organization for Development Cooperation
ICF	UK's International Climate Fund
IDB	Multilateral Investment Fund of the Inter-American Development Bank
IFAD	International Fund for Agricultural Development

IFC	International Finance Corporation
IICA	Inter-American Institute for Cooperation on Agriculture
IKI	International Climate Initiative of the German Federal Environment Ministry
ISTA	Salvadorian Institute of Agrarian Transformation
JICA	Japan International Cooperation Agency
KfW	German Development Bank
MAG	Ministry of Agriculture and Livestock
MARN	Ministry of Environment and Natural Resources
N <sub>2</sub> O	Nitrous oxide
NGO	Non-governmental organization
NH <sub>4</sub>	Methane
NICFI	Norway's International Climate and Forest Initiative
NORAD	Norwegian International Climate and Forest Initiative
OTC	over-the-counter
OXFAM	Oxford Committee for Famine Relief
PAF	Family Agriculture Plan
PES	Payments for Environmental Services
PREP	National Ecosystem and Landscape Restoration Program
PRISMA	El Salvador Research Program on Development and Environment
ProCafe	Salvadorian Foundation for Coffee Research
PROLECHE	Milk Producers Association of El Salvador
RCP	Representative Concentration Pathway
REDD+	Reduction of Emissions from Deforestation and Degradation Plus
SAIP	Sustainable Agriculture Initiative Platform
SCCF	UNFCCC's Special Climate Change Fund
SIDA	Swedish International Development Cooperation Agency
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
USAID	United States Agency for International Development

## Annex II: Agriculture and foreign trade in El Salvador

According to the Statistics data provided by the Central Reserve Bank of El Salvador, exports of agricultural products (raw goods, including sugar) contributed to 10% of the total value of national exports in 2013. In the last five years, the most important agricultural products exported by value were coffee and sugar (although coffee rust caused a decrease in exports of the first). Wheat flour, with an average participation of 3%, is derived from imported wheat grains (the raw material is not produced in the country). The main importers of Costa Rica's agricultural products in this period were the United States of America (32% of exports value), Germany (20%) and other countries of Central America (17%).

**Table 1** Major export products of the agricultural sector (2009 – 2013)

Agricultural products	Millions of US \$ FOB					Var % 2012 - 2013	Average participation % (2009 - 2013)
	2009	2010	2011	2012	2013		
Coffee (Gold)	229	212	463	299	233	-22	54
Sugar (from sugarcane)	88	128	133	167	189	14	27
Maize (flour)	34	33	46	43	39	-9	7
Wheat (flour)	3	5	17	21	16	-24	2
Un-rooted cuttings and slips	2	9	14	14	17	17	2
Other vegetables	6	5	7	7	7	-1	1
Rice	4	2	6	9	7	-22	1
Red beans	5	3	8	3	4	17	1
Sweet peppers	2	2	5	5	5	4	1
Others (<1% participation)	14	15	14	17	22	27	43
<b>TOTAL</b>	<b>388</b>	<b>414</b>	<b>713</b>	<b>586</b>	<b>541</b>	<b>-8</b>	<b>100</b>

Source: Foreign Trade Statistics, Central Reserve Bank of El Salvador

FOB: [Free On Board], price includes transportation of the goods to the port of shipment and loading costs.

According to the same source, imports of agricultural products constituted 4% of the total value of national imports in 2013. In the last five years, the most important agricultural products imported by value were all basic grains: maize, wheat, rice and red beans. Imports are sourced mainly from the USA (55%) and Guatemala (16%).

**Table 2.** Major import products of the agricultural sector (2009 – 2013)

Agricultural products	Millions of US \$ CIF					Var % 2012 - 2013	Average participation % (2009 - 2013)
	2009	2010	2011	2012	2013		
Maize	115	118	209	148	102	-31	31
Durum wheat	68	64	89	99	53	-47	17
Rice	38	33	35	38	39	2	8
Red beans	23	21	44	26	9	-66	6
Tomatoes	16	12	14	13	12	-7	3
Potatoes	13	13	11	11	11	-7	3
Apples	10	11	13	14	12	-14	3
Grapes	9	10	10	11	10	-8	2
Plantains	10	12	8	8	8	3	2
Wheat (flour)	3	3	11	13	13	4	2
Others (<2% participation)	97	101	113	114	144	27	26
<b>TOTAL</b>	<b>400</b>	<b>393</b>	<b>548</b>	<b>483</b>	<b>401</b>	<b>-17</b>	<b>100</b>

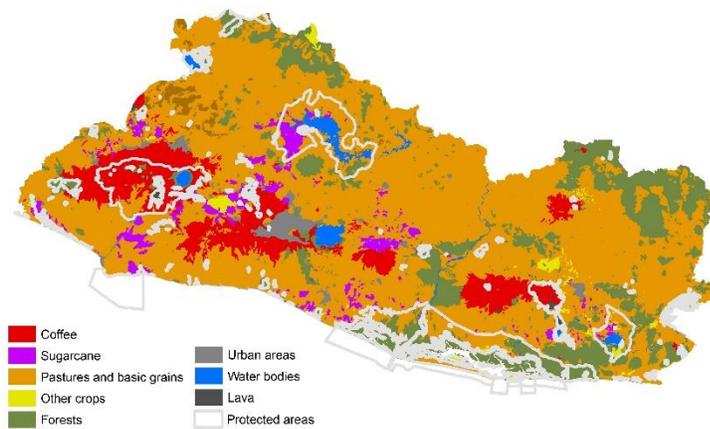
Source: Foreign Trade Statistics, Central Reserve Bank of El Salvador

CIF: [Cost, Insurance and Freight], price includes insurance and all other charges up to the named port of destination.

### Annex III: Land-use in El Salvador

With 306 people per square km of land area in 2013<sup>1</sup>, El Salvador is –after Haiti and Grenada - the most densely populated country in Latin America, and also one of the most severely deforested. By the end of the 1970s, less than 6% of El Salvador’s natural forest was considered undisturbed<sup>2</sup>, but since the 1980s area with tree cover has been increasing. A recent land-use analysis<sup>3</sup> shows that forests and wooded land cover at least 12% of the country, most of it secondary forests or trees associated with shade coffee<sup>4</sup>.

This process of reforestation reflects a reduction in agricultural area caused by civil war, migration, and associated remittances, as well as the transition of the national economy during the last decades to the service and manufacturing sectors<sup>5</sup>. Despite the decline in the economic importance of agriculture at the national level, subsistence farming remains a vital activity for most rural families<sup>6</sup>.



**Figure 1** Land use in El Salvador, 2007. Source: MARN

land reform failed many times during the past century, but different factors made difficult to correct the inequalities<sup>7</sup>. Improve land access and rights for vulnerable groups, support conflict resolution and land use planning, and strengthen water legislation and management capacity are key issues for the governance in the rural areas<sup>8</sup>.

Maize, along with other basic grains (beans and sorghum) and pastures are the most widespread crops in the country. The most important regions of coffee growing are in the Southern range of mountains that cross the country from east to west. Sugarcane is grown in the Pacific lowlands and in the Central Valleys.

In El Salvador inequity in land distribution has been a main factor of social instability. Attempts to implement

<sup>1</sup> The World Bank. 2012. World Development Indicators. Washington, D.C.: The World Bank. (Available from <http://data.worldbank.org/data-catalog/world-development-indicators>) (Accessed on 2 September 2014).

<sup>2</sup> Hecht SB, Saatchi SS. 2007. Globalization and forest resurgence: changes in forest cover in El Salvador. *Bioscience* 57, 663–672.

<sup>3</sup> Romero, B. 2012. *Uso de suelo de la República de El Salvador, C.A., año 2010*. San Salvador: Ministerio de Ambiente y Recursos Naturales.

<sup>4</sup> FAO. 2002. *Countries: Forests and the forestry sector, El Salvador*. (Available from <http://www.fao.org/forestry/country/57478/en/slv/>)

<sup>5</sup> Cuéllar N, Méndez VE, Larios S. de, Dimas L, Rosa H. 2004. *Estudio de tendencias y perspectivas del sector forestal en América Latina: Informe Nacional El Salvador*. Corporación Nacional Forestal, FAO.

<sup>6</sup> Rosa H, Kandel S, Cuéllar N. 2004. *Dinámica migratoria, medios de vida rurales y manejo de recursos naturales en El Salvador*. San Salvador: PRISMA.

<sup>7</sup> Vargas, A. 2003. *El Salvador Country Brief: Property Rights and Land Markets*. Madison, US: Land Tenure Center, University of Wisconsin.

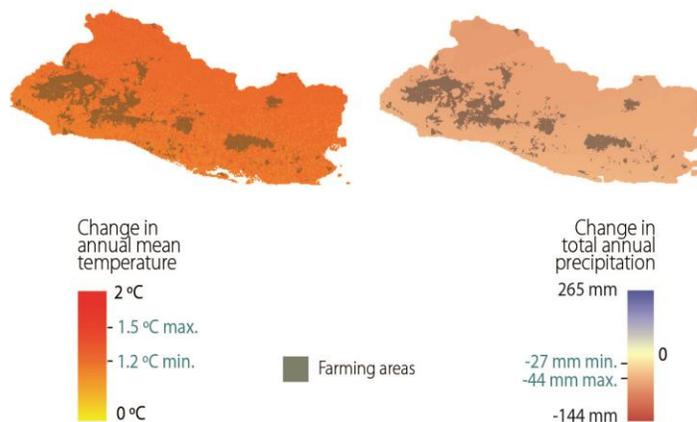
<sup>8</sup> USAID. SD. *Property rights and resource governance: El Salvador*. USAID Country Profile (Available from [http://ltp.rmpportal.net/sites/default/files/country-profiles/full-reports/USAID\\_Land\\_Tenure\\_EL\\_Salvador\\_Profile\\_0.pdf](http://ltp.rmpportal.net/sites/default/files/country-profiles/full-reports/USAID_Land_Tenure_EL_Salvador_Profile_0.pdf))

## Annex IV: Climate change projections for El Salvador

Future expected climate in Central America shows a consistent drying trend across models and global warming scenarios<sup>9</sup> in agreement with historical observed trends of increased temperatures<sup>10</sup>. Drier conditions are the result of an increase in mean annual temperature combined with reduced precipitation<sup>11</sup>. Although the northern part of Central America has larger agreement on future precipitation reduction across climate models relative to southern Central America, the whole region is expected to experience reduced water availability<sup>12</sup>. Larger precipitation reductions are expected during the rainy season<sup>8</sup>, resulting in a longer and stronger mid-summer drought<sup>13</sup> with important implications for the agricultural sector.

CIAT extracted annual rainfall and mean annual temperature data for El Salvador for 2030 from 19 global climate models (GCMs) forced with IPCC RCP 4.5. The RCP database aims to document the emissions, concentrations, and land-cover change projections of the Representative Concentration Pathways (RCPs). The data provided for the RCPs are extensive and have undergone several procedures to assure quality and consistency, synchronize regional base year emissions with recent inventories, and downscale the projections to 0.083 x 0.083 degrees (approximately 1 km<sup>2</sup>). Projections are derived from the GCMs and compared to a baseline period from 1960 to 2000.

### Projected change in temperature and precipitation in El Salvador by 2030<sup>5</sup> [x]



Mean precipitation is likely to decrease by 27-44 mm/year by 2030. Overall, mean annual temperatures are projected to increase by 1.2–1.5°C by 2030.

Sensitive crops such as coffee and beans may be negatively affected by the higher temperatures and changes in precipitation patterns. Most of the areas under 1,500 m altitude will become less suitable for both crops, while areas above this altitude – only a few peaks – will become more suitable. Some crops, like maize, sorghum, and sugarcane will be less impacted by the higher temperatures.

<sup>9</sup> Neelin JD, Münnich M, Su H, Meyerson JE, Holloway, CE. 2006. Tropical drying trends in global warming models and observations. *Proceedings of the National Academy of Sciences*, 103(16), 6110–5.

<sup>10</sup> Aguilar E, Peterson T, Ramírez Obando P, Frutos R et al. 2005. Changes in precipitation and temperature extremes in Central America and northern South America, 1961–2003. *Journal of Geophysical Research*, 110(D23107).

<sup>11</sup> Biasutti M, Sobel AH, Camargo SJ, Creyts TT. 2012. Projected changes in the physical climate of the Gulf Coast and Caribbean. *Climatic Change*, 112(3-4), 819–845.

<sup>12</sup> Imbach P, Molina L, Locatelli B, Rousard O, Mahé G, et al. 2012. Modeling potential equilibrium states of vegetation and terrestrial water cycle of Mesoamerica under climate change scenarios. *Journal of Hydrometeorology*, 13, 665–680.

<sup>13</sup> Rauscher SA, Giorgi F, Diffenbaugh NS, Seth A. 2008. Extension and intensification of the Meso-American mid-summer drought in the twenty-first century. *Climate Dynamics*, 31(5), 551–571.

**Annex V: CSA practices in El Salvador: a detailed list****Table 3** CSA Practices in El Salvador

Sector	Practice	Degree of adoption
Cattle	Composting cattle dung	2
	Worm culture on cattle dung	2
	Biodigesters	2
	Semi-stabled cattle with cut-and-carry pasture production	3
Coffee	Irrigation	3
	Development of drought resistant varieties	1
	Traditional shade coffee	5
	Improved shade coffee (more species, improved pruning and maintenance)	3
	Involving coffee farmers in integrated watershed management programmes	3
	Diversification (incorporating cocoa and other tree crops into coffee plantations)	2
	Crop switching <sup>14</sup>	1
Sugarcane	Irrigation (drip or sprinkler), water harvest	3
	Development of drought resistant varieties	1
	Proactive pest control (monitoring, diversification of varieties)	3
	Power co-generation from bagasse burning	4
	Green sugar harvest (Zafra Verde)	3
Basic grains	Development of drought resistant varieties (of maize, beans, fodder crops)	2
	No-burn agriculture	2
	Re-use of organic waste (mulch, compost, cut-and-carry fodder)	3
	Targeted irrigation (combination of rain fed and irrigated agriculture)	2
	Infiltration channels / contour planting / terracing	2
	Water capture	3
	Controlled use of agrochemicals	2
	Agroforestry	2
	Crop diversification	2
	Intercropping	3
Improved planning and preparation <sup>15</sup>	1	
Sector wide	Meteorological information and early warning service	4
	Ecosystem and Landscape Restoration Programme (PREP)	3

Source: Based on information from expert informants

<sup>14</sup> Recommended by scientific studies as the only option in lowland areas; possible replacement crops include avocado and citrus fruits. See: CIAT. 2012. *Escenarios del Impacto del Clima Futuro en Áreas de Cultivo de Café en El Salvador*. Managua: CIAT.

<sup>15</sup> Measures include: collaboration among communities, adapting planting calendars to changing climate, defining production zones, information services for small farmers, maintaining stores for emergencies

**Table 4** Criteria for degree of adoption scores

Score	Criteria for practices	Criteria for information services
0	Suggested by interviewee as a good idea	Suggested by interviewee as a good idea
1	Research and development / policy commitment	Information exists but cannot be accessed
2	Validation in field trials / small project / new measures being adopted by one or a few companies / new ideas being promoted by agencies	Information not readily available
3	Scattered adoption across the sector(s)/ large project / not known - default score	Some information available to producers / not known - default score
4	Widespread adoption	Information widely available to producers
5	80 to 100% adoption	Information available to all producers

Source: Based on information from expert informants