



Climate-Smart Agriculture in Colombia



Climate-smart agriculture (CSA) considerations

- A** CSA is already being practiced in Colombia, but these practices are often implemented unsystematically or have generally low adoption rates. There are a variety of practices that could **increase the climate smartness of landscapes and the agricultural sector** if taken to scale.
 - M** **Scaling up investments in agricultural research and development (R&D)**, which is currently only 0.2% of the gross domestic product (GDP), would foster innovation. This includes investment in science and technology, research and extension, and education and training, as well as support for farmers organizations and associated local institutions.
 - P** **Planning processes** with a focus on sub-national and local levels are needed to analyze the agro-climatic risks, to identify the most promising CSA practices, and to implement adaptation and mitigation responses. Assistance from public institutions is needed to help producers overcoming barriers to adoption.
 - M** **Livestock** are a major source of GHG emissions for Colombia. There is potential for scaling CSA options, such as **improved pastures and silvopastoral systems**, across 3 million hectares, which would mitigate climate change, improve livelihoods, and create sustainable landscapes, and should therefore be given priority status.
 - M** **Efficient use of nitrogen fertilizers**, especially in rice and maize, is an important mitigation opportunity.
 - A** **Agroforestry** practices are already implemented in more than 35% of coffee systems but could be expanded to include more farmers and to other crops, including cocoa, rubber, and fruit orchards. Opportunities exist to **scale out similar ongoing CSA activities in other production systems**.
 - \$** **International funds** and connections with the international finance community created through collaborations on **low-emissions development policies** (National Strategy for REDD+,¹ Nationally Appropriate Mitigation Actions [NAMAs], and the Colombian Low-Carbon Development Strategy [CLCDS]) could be linked to support integrated agriculture, conservation, adaptation to climate change, and mitigation opportunities and to scale out CSA adoption.
 - I** Strengthening inter-ministerial dialogue provides opportunities to **move agriculture initiatives beyond productivity** and to fully integrate climate change initiatives into the discussion.
 - I** The identification of suitable adaptation and mitigation options can be enhanced by the development of and access to **Integrated Decision Support Systems** that compile and analyze climatic, agronomic and market information, and deliver results to a range of stakeholders and decision makers.
 - \$** Despite increased efforts to boost financial support for rural development in Colombia, critical gaps exist, such as limited provision of **agriculture insurance**, which creates opportunities for further development of rural agricultural markets. A comprehensive **agriculture risk management strategy** is needed.
- A** Adaptation

M Mitigation

P Productivity

I Institutions

\$ Finance

The climate-smart agriculture (CSA) concept reflects an ambition to improve the integration of agriculture development and climate responsiveness. It aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), and require planning to address tradeoffs and synergies between these three pillars: **productivity, adaptation, and mitigation** [1]. The priorities of different countries and stakeholders are reflected to achieve more efficient, effective, and equitable food

systems that address challenges in environmental, social, and economic dimensions across productive landscapes. While the concept is new, and still evolving, many of the practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks [2]. Mainstreaming CSA requires critical stocktaking of ongoing and promising practices for the future, and of institutional and financial enablers for CSA adoption. This country profile provides a snapshot of a developing baseline created to initiate discussion, both within countries and globally, about entry points for investing in CSA at scale.

¹ REDD+: United Nations Programme for Reducing Emissions from Deforestation and Forest Degradation, plus conservation and sustainable management of forests and enhancement of forest carbon stocks.

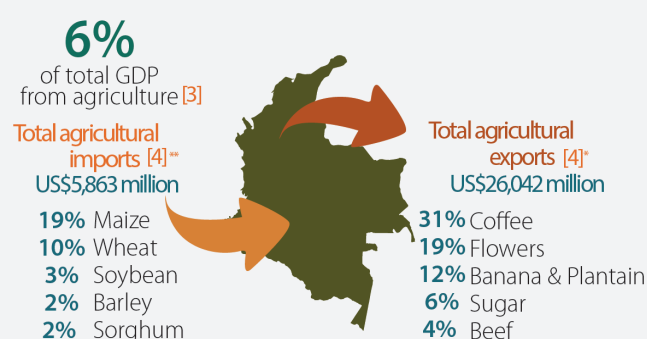
National context:

Key facts on agriculture and climate change

Economic relevance of agriculture

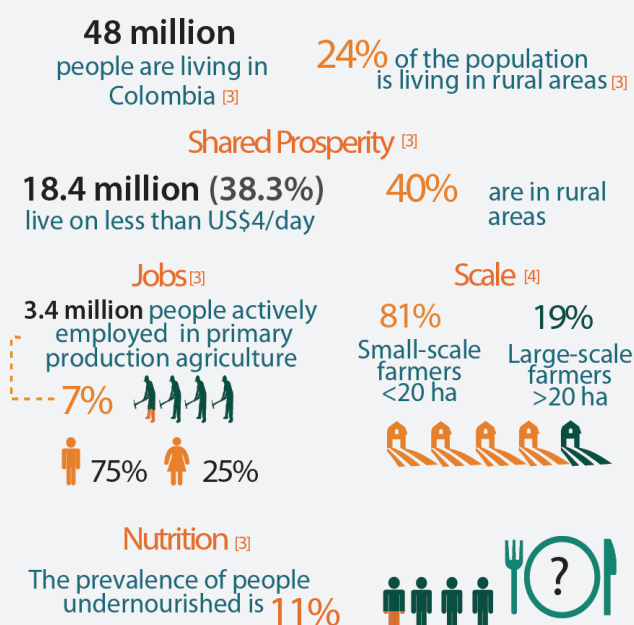
Colombia is an emerging economy, with a population growth rate of 1.4% per year. Agriculture has traditionally been one of Colombia's main economic activities. The agricultural (value added) GDP currently represents 6% of the national GDP, and the last five years were noted by the government as a critical growth period in the sector [3].² Colombian agriculture has the potential to continue growing and to feed the nation, but it needs to do so sustainably and by effectively managing the threats posed by climate change [4].

Economic Relevance of Agriculture



* FOB: free on board ** CIF: cost, insurance, and freight.

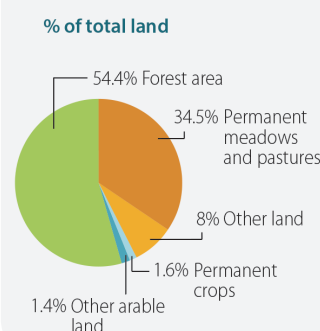
People and Agriculture



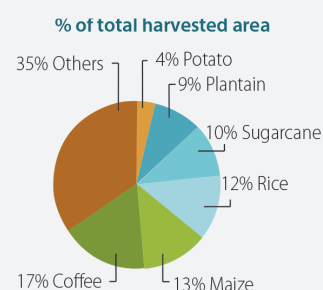
Land use

The rural Gini index, which measures inequality, grew from 0.74 to 0.88 [5]. Rural concentration of land and inequality have grown in the last decade. Colombia ranks 11th worldwide when looking at countries with the most unequal distribution land [6].³ Patterns of land use could be improved to more sufficiently capture the agricultural potential of the country. For example, fertile valleys that are used for extensive livestock rearing would be more efficiently utilized for crops. It is estimated that livestock production occurs on roughly three times the land area than is optimally suited for this land use [5]. This inequality is closely linked to rural poverty (40% of the rural population), and is both a cause and a consequence of the internal armed conflict that has ravaged the country for more than half a century [7].

Land Use [8]



Main Crops [9]



Agricultural production systems

In Colombia, 81% of farms cover less than 20 hectares. These small- and medium-scale producers represent two-thirds of the agricultural harvested area and just over half (52%) of the value of agricultural production. Smallholder farmers are involved mainly in the production of potato, maize, sugarcane, plantain, cassava, beans, tobacco, cocoa, coffee, vegetables, fruits, and other minor crops. Commercial crops produced by large agribusinesses include sugarcane, banana, flowers, palm oil, rice, cotton, sorghum, and soybean [4].⁴

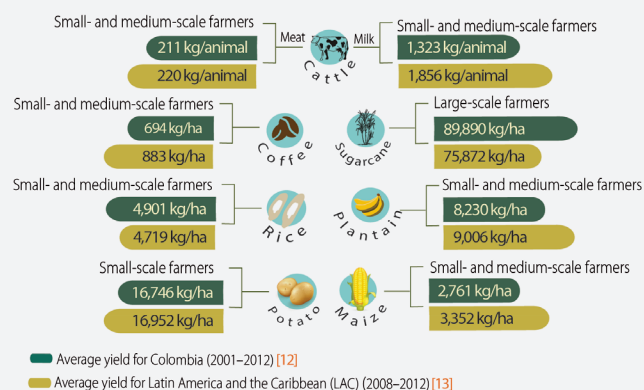
Agriculture exerts great pressure on water resources. In Colombia, 54% of national demand for water comes from agricultural land use (19,386 mm³), mainly in the Andean, Central, and Caribbean regions. Pastures require 27% of water available for agriculture, annual crops 14% (mainly rice and maize), and permanent crops 13% (mainly oil palm, export banana, sugarcane, and coffee) [10].

² See Annex II.

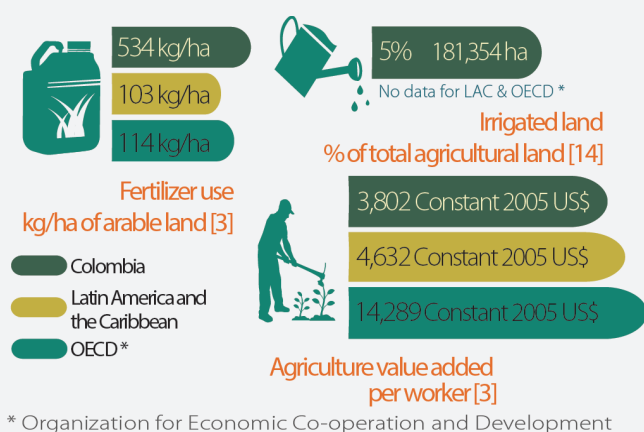
³ See Annex III.

⁴ See Annex IV.

Important Agricultural Production Systems



Productivity Indicators



Agricultural greenhouse gas emissions

The main sectors that contributed to emissions of GHGs in 2004 were agriculture (68.5 Mt CO₂ equivalent representing

38%) and energy (65.9 Mt CO₂ equivalent representing 37%), followed by land-use change and forestry (15%) [11].

Methane emissions are derived mainly from livestock (19% of national GHG emissions, 47.5% of emissions from agriculture), while nitrous oxide emissions result from the use of nitrogen fertilizers (18% of national GHG emissions, 48.6% of emissions from agriculture). These patterns mirror general GHG emissions trends globally. Minor sources include rice (2%), manure management (1.7%), and burning of agricultural residues and savannas (0.1% each), despite strong regulations in some regions banning this practice [11].

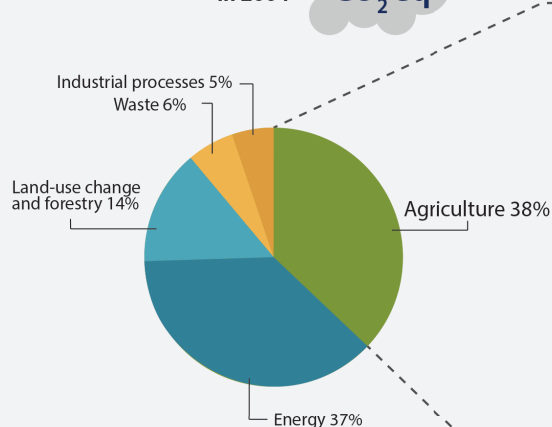
Challenges for the agricultural sector

Colombia is characterized by significant temporal and spatial climatic variability with differential impacts on agriculture. Therefore, a comprehensive strategy for agricultural risk management is needed. Given that 40% of the rural population lives in poverty and 17% of national employment comes from agriculture [3], strengthening government support to agriculture and developing and implementing technologies appropriate to the socioeconomic condition of farmers is required to improve shared prosperity and agricultural productivity.

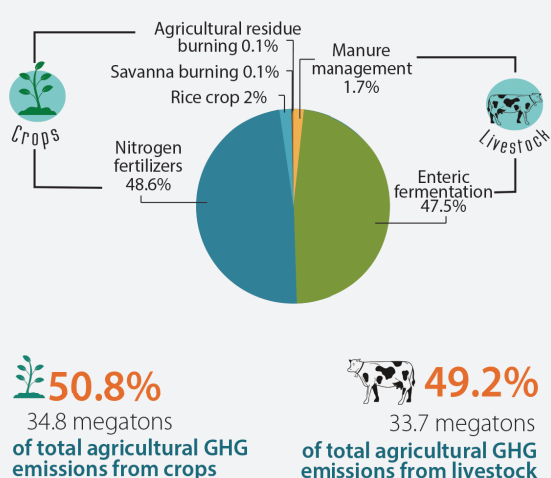
Most of the country has limited access to extension services, especially farmers not associated with producers' organizations. Increasing government investment in research, development and extension services, and strengthening local capacities are key facts to transform the family and small-scale agriculture to competitive and sustainable agriculture. Resulting in increased food production and a substantial improvement in income and quality of life for farmers.

GHG Emissions [11]

Total emissions 180 megatons in 2004



Agriculture GHG Emissions [11]



Agriculture and climate change

Between 1998 and 2011, 90% of natural disasters in Colombia were related to climate. The El Niño-Southern Oscillation (ENSO) has had a marked impact on Colombia. The excessive rain associated with the most recent La Niña (2010 – 2011) caused agricultural production losses equivalent to 2.1% of the GDP in addition to casualties and property damage due to flooding. In 2008, El Niño reduced yields of 17 nationally important crops by an average of 5%.⁵ Climate change is expected to increase the intensity and frequency of these disasters [10]. According to the Second National Communication of Colombia to the United Nations Framework Convention on Climate Change (UNFCCC), key projected changes under the Special Report on Emissions Scenarios (SRES) A2 climate scenario ('business as usual') include:

- A 1.4°C increase in annual mean temperature by 2040.
- Large temperature increases in the agricultural departments of Norte de Santander, Risaralda, Huila, Tolima, and Sucre, possibly resulting in prolonged and more intense drought seasons and proliferation of pests.
- Reduction in average annual rainfall of 10% or more in the departments of Antioquia, Caldas, Cauca, Córdoba, Huila, Nariño, Putumayo, Quindío, Risaralda, Tolima, and Valle del Cauca, raising concerns as to water availability for agriculture in irrigated rice-producing departments, such as Tolima and Huila.

Climate change could impact all farmers, from large- to small-scale. Large-scale producers are often better placed to deal with emerging challenges due to their higher incomes, better access to land, and greater ability to invest in new technologies. However, neither large- nor small-scale farmers will be able to fully adapt without the support of critical CSA practices, such as improved pest and disease control and resistant crop varieties.

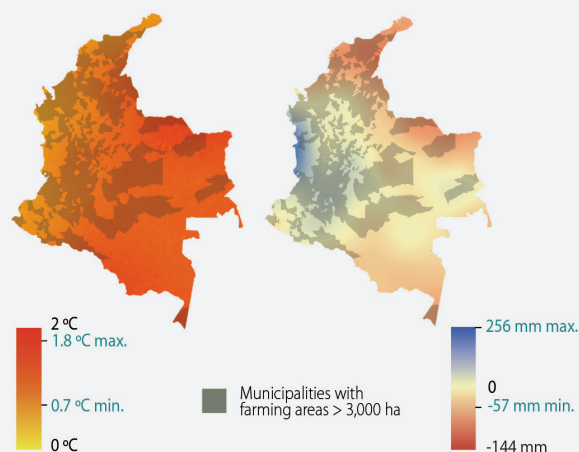
CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges, as well as for economic growth and development of agriculture sectors. For this profile, practices are considered CSA if they maintain or achieve increases in productivity as well as at least one of the other objectives of CSA (adaptation and/or mitigation). Hundreds of technologies and approaches around the world fall under the heading of CSA [2].

In Colombia, farmers have been using a variety of CSA techniques for decades. These include: agroforestry in coffee,

⁵ Coffee was not included in the study.

Projected Change in Temperature and Precipitation in Colombia by 2030⁶



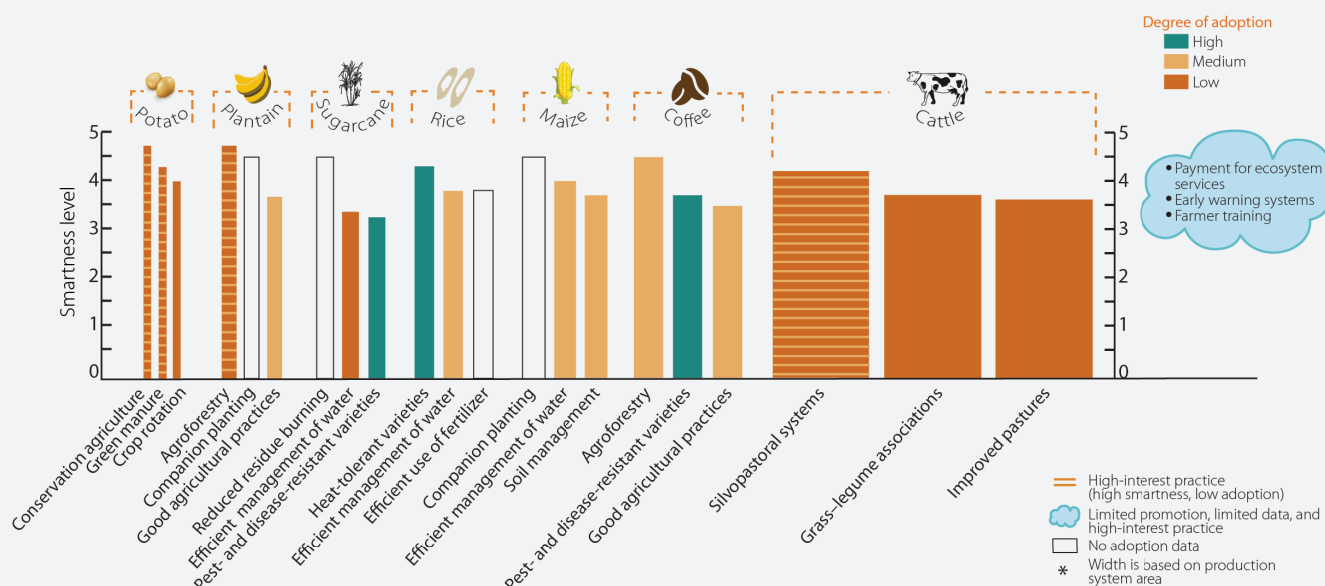
plantain, and cacao; intercropping and composting in short-cycle crops; silvopastoral systems, grass-legume associations, improved forages, best management practices for livestock and agriculture; conservation agriculture in maize, potato, and peas; organization of irrigation districts for rice and sugarcane systems; and genetic resource management for higher tolerance to heat, water stress, and pests and diseases in rice, coffee, maize, and sugarcane.

Despite a history of using CSA practices, the percentage of farmers currently implementing these practices is often quite low (Table 1). Low adoption is linked to the technologies being designed or transferred with a lack of farmers' perceptions of risk and local socioeconomic conditions in mind. This is the case for many practices with high potential for mitigation, adaptation, and productivity, such as improved pastures and silvopastoral systems in livestock (GHG emissions reductions from enteric fermentation and manure management), efficient use of nitrogen fertilizers in rice and maize crops, or agroforestry in coffee, banana, fruits, and cocoa (emissions reductions from carbon sequestration). Green manure, conservation agriculture, and companion planting are also under-adopted, despite their potential for improving water retention in soils and soil organic matter, diversifying livelihoods, and bolstering incomes via participation in organic markets.

Low adoption of these practices is mainly linked with institutional and financial challenges that farmers and producers associations face. These challenges include lack of consistency between climate change policies and agricultural, food security, forestry, conservation and economic development policies, lack of funds to support producers in the transition to CSA practices (extension services, R&D, financial incentives, etc.) and socioeconomic issues (poverty, low incomes, lack of education, land tenure, etc.).

⁶ Projections based on RCP 4.5 emissions scenario [15] and downscaled data using the Delta Method [16].

Selected Practices for each Production System with High Climate Smartness






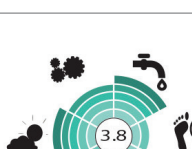
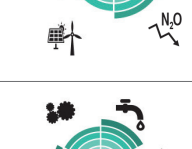
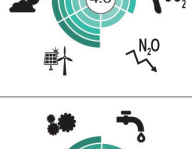




The graph above displays the smartest CSA practices for each of the key production systems in Colombia. Both ongoing and potentially applicable practices are displayed, and practices of high interest for further investigation or scaling out are noted. Climate smartness is ranked from 1 (very low positive impact in category) to 5 (very high positive impact in category).

Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in Colombia.⁷

The assessment of a practice's climate smartness uses the average of the rankings for each of the six smartness categories: weather, water, carbon, nitrogen, energy, and knowledge. Smartness categories emphasize the integrated components related to achieving increased adaptation, mitigation, and productivity.

	CSA Practice	Climate Smartness	Adaptation	Mitigation	Productivity
Potato 4% harvested area	Conservation agriculture ■ Low adoption (<30%)		Greater water retention in the soil avoids crop loss during dry periods.	Higher carbon in soils, reduced nitrogen loss.	Enhanced yields reported in specific contexts.
	Green manure ■ Low adoption (<30%)		Greater water retention in the soil avoids crop loss during dry periods.	Enhanced carbon in soil.	Organic inputs can enhance productivity.
Plantain 11% harvested area	Agroforestry ■ Low adoption (<30%)		Regulation of canopy temperature and increased soil moisture maintains yield during dry periods.	Increased carbon sequestration and carbon storage from greater tree density.	Diversified livelihoods, but no significant benefits reported.
	Good agricultural practices (GAP) ■ Medium adoption (30 – 60%)		Greater yield stability despite climate variability.	Improved efficiency in fertilizer use reduces nitrogen emissions.	Enhanced yields reported.

⁷ See Annexes V and VI.

	CSA Practice	Climate Smartness	Adaptation	Mitigation	Productivity
Sugarcane 10% harvested area	Efficient management of water ■ Low adoption (<30%)		Less water demand, especially in dry season.	No significant benefits.	Greater productivity and stability.
	Pest- and disease-resistant varieties ■ High adoption (>60%)		Reduced yield loss due to pests and diseases in periods of abiotic stress.	Minor benefits from reduced chemical inputs.	Reduced yield loss.
Rice 12% harvested area	Heat-tolerant varieties ■ High adoption (>60%)		Reduced yield loss due to sterility from high temperatures during flowering.	Improved emissions intensity due to productivity increases.	Reduced yield gap.
	Efficient management of water used in irrigation districts (Tolima) ■ Medium adoption (30–60%)		Lower water demand can reduce yield loss during dry seasons.	Alternate wetting and drying can reduce methane emissions by ~30%.	No significant benefits.
Maize 13% harvested area	Efficient management of water ■ Medium adoption (30–60%)		Greater yield stability despite climate variability.	Improved efficiency in fertilizer use reduces nitrogen emissions.	Enhanced yields reported.
	Soil management ■ Medium adoption (30–60%)		Greater yield stability despite climate variability.	No significant benefits.	Enhanced yields from improved varieties.
Coffee 17% harvested area	Agroforestry ■ Medium adoption (30–60%)		Reduced temperatures in coffee canopy, reduced pressure of rust and insect-borne yield losses.	Significant carbon sequestration and carbon storage in system.	Diversification in farm income can enhance livelihoods. No major productivity benefits, but shade can enhance coffee quality leading to higher income.
	Pest- and disease-resistant varieties ■ High adoption (>60%)		Less yield loss during periods of significant climate variability.	Minor benefits from reduced chemical inputs.	Significantly less yield loss.
Livestock 35% land use area	Silvopastoral systems ■ Low adoption (<30%)		Silvopastoral systems bolster resilience of livestock production systems to climate variability.	Significant above- and below-ground carbon sequestration, reduced nitrogen application.	In high potential areas, stocking rates of 2–3 heads per hectare (Colombia average is 0.5).
	Grass – legume associations ■ Low adoption (<30%)		Improved soil quality (physical/chemical) can contribute to increase in resilience.	Improved feed quality reduces emissions intensity, and nitrogen fixation reduces nitrogen fertilizer requirements.	Improved feed quality increases productivity and quality.

Case Study:

Silvopastoral systems for improved productivity, environmental conservation, and climate change mitigation in Colombia



A silvopastoral system in Colombia. ©CIAT

Silvopastoral systems (SPS) have been implemented as a measure to increase the environmental and economic sustainability of cattle ranching (see Table 1 for adaptation, mitigation, and productivity benefits of SPS). The World Bank, the Colombian Cattle Ranching Federation (FEDEGAN), the Center for Research on Sustainable Farming Systems (CIPAV), The Fund for Environmental Action and Childhood (Fondo Acción), and The Nature Conservancy (TNC) came together for a CSA initiative aiming to convert 48,000 hectares of open pasture to SPS. The project started in 2010 in Colombia with financing from the Global Environment Facility (GEF), and in 2014 it was extended with an additional financing from UK-DECC. Regions for implementation were selected given their proximity to critical biodiversity

hotspots: the watersheds of the Cesar and Lower Magdalena rivers, the coffee ecoregion in the Cauca watershed, the Orinoco piedmont, and La Guajira, among others. The initiative seeks to gather more evidence on the potential of SPS to help reduce deforestation caused by cattle ranching and to create an enabling environment for scaling out SPS throughout the country. Such an effort could be an entry point for South-South cooperation with countries that share the same agro-ecological and climatic conditions in livestock production systems. This initiative is also supported by the Colombian government and the Ministries of Environment and Sustainable Development and Agriculture and Rural Development [17].

Institutions and policies for CSA

For two decades, Colombia has been formally engaged in international policies on climate change, starting with its entry into the UNFCCC in 1994. It has since ratified the Kyoto Protocol, presented two UNFCCC national communications, and integrated climate change strategies into the current national development plan.

The four key aspects of Colombia's National Climate Change Strategy [18] are:

- The Climate Change National Adaptation Plan (PNACC)
- The Colombian Low-Carbon Development Strategy (CLCDS)
- The National Strategy for REDD+.
- Financial protection in the case of disasters

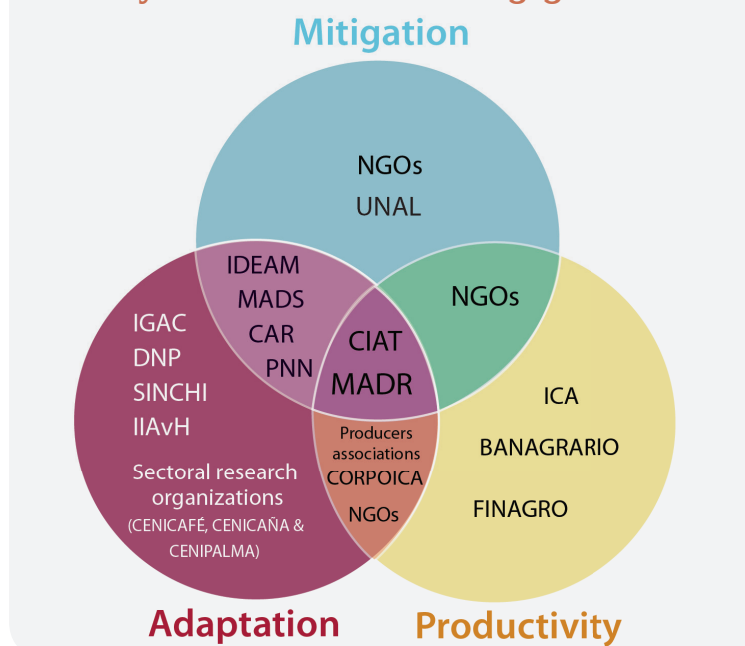
These strategies will be further articulated through the National System of Climate Change (SISCLIMA), and are expected to be integrated within the system by the end of 2014 [19].

The 2011 *Institutional Strategy to Articulate Climate Change Policies and Actions in Colombia* – CONPES⁸ 3700 Document created an entirely new institutional framework that gives authority for climate change policy to the National Planning Department (DNP) [20]. DNP, receiving direction from the President, formulates long-term public policies and has significant political power to coordinate all ministries linked to climate change strategies. These include the Ministries of Environment and Sustainable Development (MADS), Agriculture and Rural Development (MADR), Finance and Public Credit, Home Affairs, Mines and Energy, Transport, Foreign Affairs, and Health and Social Protection. These main institutions have strengths in different pillars of CSA (see institutions graphic), and with increasing levels of cooperation between them these strengths can be used synergistically.

In the productivity pillar, institutions such as the Colombian Agricultural Institute (ICA), the Colombian Corporation of Agricultural Research (CORPOICA), various non-governmental organizations (NGOs), and some producers associations support national research on agriculture. MADR also has policies that focus on generating employment and income for the rural population.

Adaptation policies are led by DNP, with the support of MADS at the national level and Autonomous Regional

Primary Focus of Institutions Engaged in CSA



Corporations (CAR) at the local level. Colombia, along with Brazil, is considered a pioneer in the region for the development of National Adaptation Plans (NAPs). In addition to governmental efforts, it is important to note the role of sectoral research organizations in adaptation. These include the National Center for Coffee Research (CENICAFÉ), which generates technologies for the welfare of the Colombian coffee growers, the National Center for Sugar Cane Research (CENICAÑA), which leads R&D initiatives for the sugar industry, and the National Center for Oil Palm Research (CENIPALMA), which conducts R&D for oil palm plantations. Additionally, CORPOICA is leading the MAP project (Models of Adaptation and Agro-climatic Prevention), which focuses on strengthening local capacity to increase the adoption of CSA practices and the generation of agro-climatic early warning systems.

Mitigation policies are led by MADS. Colombia has shown great interest in contributing to the global reduction of GHG emissions through the implementation of Nationally Appropriate Mitigation Actions (NAMAs). The NAMAs portfolio is currently being drawn up for agriculture, energy, housing, industry, mining, oil, transport, and waste. These policies are intended to allow economic development without compromising the environment [21].

Improving agricultural production has been a consistently important priority for Colombia, and climate change mitigation and adaptation also rank high in public priorities and receive political and social support. The agriculture sector is becoming increasingly involved in implementation of these measures. MADS, DNP, and MADR are now broadening their agenda to link environmental initiatives with agriculture, and have reorganized to improve their coordination of international finance.

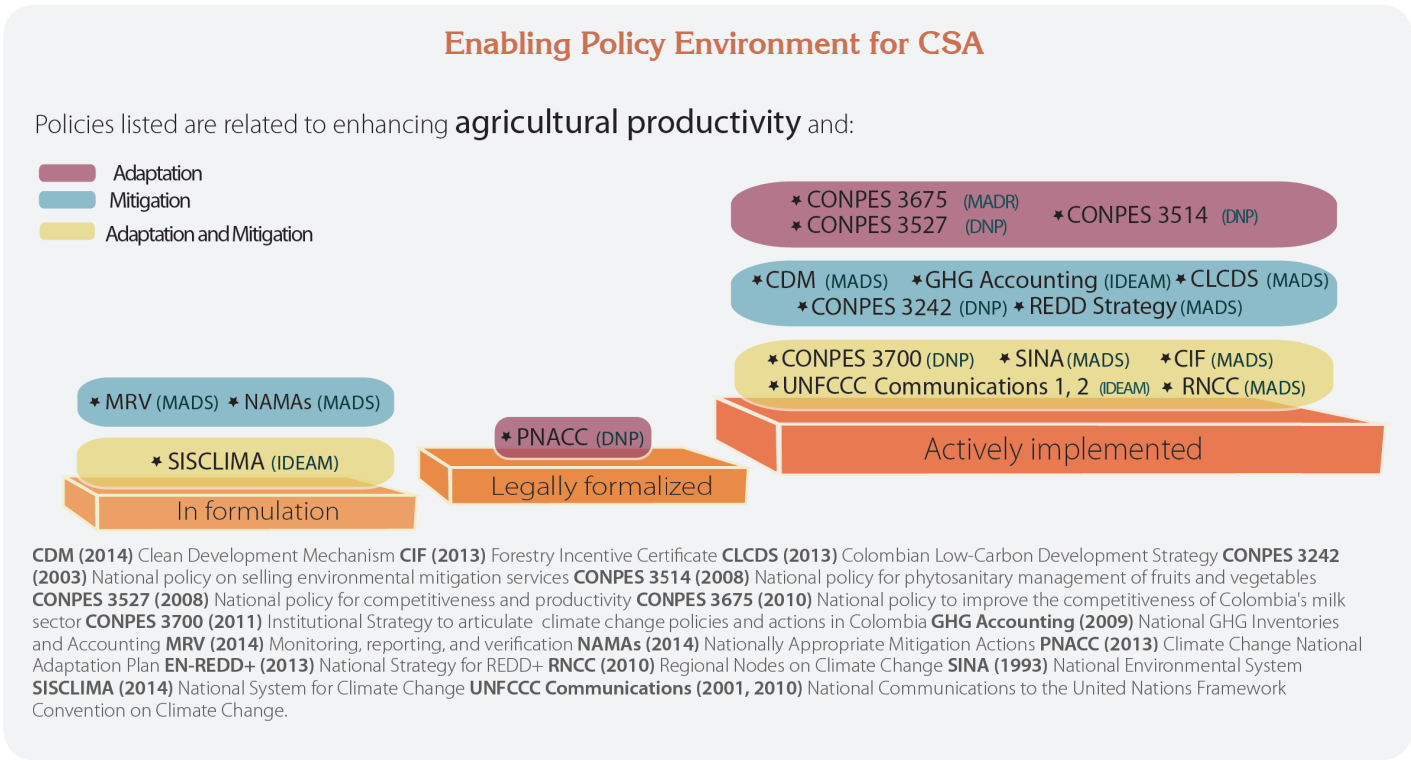
⁸ CONPES: National Council for Social and Economic Policy, which was created by Act 19 of 1958.

At the local level, MADS has created sectoral and geographic Regional Nodes on Climate Change (RNC C) to implement national climate change strategies.⁹ These nodes participate in interdisciplinary working groups made up of public and private institutions across local, departmental, regional, and national levels that implement actions to reduce vulnerability and increase regional capacity to respond to current and projected climate risks [22].

A strong example of a Colombian government initiative enabling CSA action is the landmark alliance between MADR and the International Center for Tropical Agriculture (CIAT),¹⁰ with farmers' participation through producers associations and other research institutions. Its objective is to improve the capacity of the agricultural sector to respond to climatic phenomena. This program is the first initiative in

Colombia that simultaneously promotes the three pillars of CSA: adaptation, mitigation, and productivity. This is a clear example of how the identification of suitable adaptation and mitigation options can be enhanced by the development of and access to Integrated Decision Support Systems that compile and analyze climatic agronomic and economic information.

As mentioned in the land use section, Colombia currently has a pattern of land use distribution that limits reaching the agricultural land potential. Government initiated development of instruments and institutions aimed at the regulation of appropriate land use according to suitability and its environmental functions, would enable CSA and improve the effectiveness of resources management.



International finance

The technical and financial international support for climate change initiatives has come from several sources including bilateral programs, non-profit organizations, and multilateral institutions. These resources have thus far been used to finance activities along the four lines of the National Climate Change Strategy, including the analytic process to define a low-carbon development strategy, capacity building in various sectors, and the monitoring, reporting, and verification (MRV) of mitigation and adaptation [18]. Agriculture represents a small part of funded initiatives.

For CSA-related activities,¹¹ Colombia accesses international bilateral public finance channels, such as the UK-DECC, UN Agency Programs, such as REDD, and various carbon markets. In private philanthropy, the Gordon and Betty Moore Foundation finances the project 'Institutional, technical, and scientific capacity to support REDD+ projects,' led by the National Institute of Hydrology, Meteorology and Environmental Studies (IDEAM).

Potential finance

Agriculture currently depends heavily on government support. However, public support for agriculture in Colombia is among the most unequally allocated in Latin America, and smallholders are often left without sufficient financial

resources. One way to reduce this imbalance would be to focus CSA projects on smallholders.

Payments for ecosystem services (PES) are a further opportunity for financing agricultural activities that promote conservation. Efforts in this sense have already been made in the country, but such initiatives need to be scaled out and translated into institutionalized financial schemes that can guarantee sustainability, possibly guided by the Costa Rican model.

Outlook

Colombia is making headway with respect to its climate change strategy, a process that will involve the transition to a new institutional structure, the design of early NAMAs, the implementation of local REDD+ initiatives, and the strengthening of conservation programs and CSA initiatives in the agriculture sector.

Through MADS, the environmental sector in Colombia has gained the confidence of international investors and supporters by consistently putting forward coordinated and rigorous initiatives, an important step towards generating strategies to scale out CSA.

Funds for Agriculture and Climate Change

AF Adaptation Fund **BANAGRARIO** Agricultural Bank
BANCOLDEX Business Development Bank **BMGF** Bill & Melinda Gates Foundation **CDCF** Community Development Carbon Fund **CICF** Conservation International Carbon Fund **CTF** Clean Technology Fund **DCF** Danish Carbon Fund **FAO** Food and Agriculture Organization of the United Nations **FCPF** Forest Carbon Partnership Facility **FINAGRO** Fund for Agricultural Financing **FONTAGRO** Regional Fund For Agricultural Technology **GCF** Green Climate Fund **GORDON & BETTY MOORE** Foundation **IDB** Inter-American Development Bank **IKI** Germany's International Climate Initiative **LDCF** Least Developed Countries Fund **NCDMF** The Netherlands Clean Development Mechanism Facility **NDF** Nordic Development Fund **NP** Natural Patrimony - National fund for Biodiversity and Conservation **NORAD** Norway's International Climate and Forest Initiative **SCCF** Special Climate Change Fund **SDF** Special Development Fund **UK-DECC** UK Department of Energy & Climate Change **UNDP** United Nations Development Programme **UNEP** United Nations Environment Programme **UN-REDD** United Nations Programme for Reducing Emissions from Deforestation and Forest Degradation **USAID** U.S. Agency for International Development **WB** The World Bank



National Funds



AF · CDCF · CICF · DCF · GCF · LDCF · NDF · SCCF · SDF

International Funds

★ Accessed Funds ★ Financing opportunities

¹¹ See Annex VII.

Works Cited

- [1] **FAO. 2010.** "Climate-Smart" Agriculture. Policies, practices and financing for food security, adaptation and mitigation. Rome: Food and Agriculture Organization of the United Nations (FAO).
- [2] **FAO. 2013.** Climate-Smart Agriculture Sourcebook. Rome: FAO.
- [3] **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 April 2014).
- [4] **MADR. 2013.** Memorias al Congreso de la República: Ministro Juan Camilo Restrepo Salazar (Agosto 2010–Mayo 2013). Bogotá: Ministerio de Agricultura y Desarrollo Rural de la República de Colombia.
- [5] **Acosta I. 2004.** Estudio de tendencias y perspectivas del sector forestal en América latina: Informe Nacional Colombia. Roma: FAO.
- [6] **IGAC. 2012.** Atlas de la distribución de la propiedad rural en Colombia. Bogotá: Instituto Geográfico Agustín Codazzi.
- [7] **Oxfam. 2013.** Divide and Purchase: How land ownership is being concentrated in Colombia. Bogotá: Oxfam International.
- [8] **FAOSTAT. 2014.** Yield statistics for Colombia and South America. Land use data 2011. (Available from <http://faostat3.fao.org/faostat-gateway/go/to/browse/area/44/E>) (Accessed on 8 September 2014).
- [9] **DANE. 2011.** Encuesta Nacional Agropecuaria. Bogotá: Departamento Nacional de Estadística.
- [10] **IDEAM. 2010.** Estimación de la Demanda de Agua: Conceptualización y dimensionamiento de la demanda hídrica sectorial. Bogotá: IDEAM.
- [11] **Gobierno República de Colombia. 2010.** Segunda Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. Bogotá: MADS, IDEAM.
- [12] **MADR. 2013.** Anuario estadístico del sector agropecuario 2012: Resultados evaluaciones agropecuarias municipales. Bogotá: Ministerio de Agricultura y Desarrollo Rural.
- [13] **FAOSTAT. 2012.** Yield data for Crops and Livestock primary from South America. Rome: FAO. (Available from <http://faostat.fao.org/site/567/default.aspx#anchor>) (Accessed on 19 May 2014).
- [14] **INCODER. 2009.** Memorias taller intersectorial para la formulación de la política hídrica nacional. Bogotá: Instituto Colombiano de Desarrollo Rural.
- [15] **Collins M; Knutti R; Arblaster J; Dufresne J-L; Fichet T; Friedlingstein P; Gao X; Gutowski WJ; Johns T; Krinner G; Shongwe M; Tebaldi C; Weaver AJ; Wehner M. 2013.** Long-term Climate Change: Projections, Commitments and Irreversibility. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker TF; Qin D; Plattner G-K; Tignor M; Allen SK; Boschung J; Nauels A; Xia Y; Bex V; Midgley PM (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1029–1136. doi:10.1017/CBO9781107415324.024.
- [16] **Ramírez J; Jarvis A. 2008.** High-Resolution Statistically Downscaled Future Climate Surfaces. International Center for Tropical Agriculture (CIAT); CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Cali, Colombia.
- [17] **Uribe F; Zuluaga A; Murgueito E; Valencia L; et al. 2011.** Establecimiento y manejo de sistemas silvopastoriles. Proyecto Ganadería Colombiana Sostenible. Bogotá: GEF, the World Bank, FEDEGAN, CIPAV, Fondo Acción, The Nature Conservancy.
- [18] **Comstock M; Santelices I; Vanamali A. 2012.** Colombia's National Climate Change Process. Washington, D.C.: Center for Clean Air Policy-CCAP.
- [19] **DNP. 2012.** Plan Nacional de Adaptación al Cambio Climático. Bogotá: DNP; IDEAM; MADS; Unidad Nacional para la Gestión del Riesgo de Desastres.
- [20] **DNP. 2011.** Documento CONPES 3700. Estrategia institucional para la articulación de políticas y acciones en materia de cambio climático en Colombia. Bogotá: DNP.
- [21] **MADS. 2013.** Acciones Nacionalmente Apropriadas de Mitigación (NAMAs) en Colombia. Bogotá: MADS.
- [22] **MADS; WWF. 2013.** Nodos Regionales de Cambio Climático. Articulando acciones e intereses frente al cambio climático. Bogotá: MADS.
- [23] **Mahul O; Stutley CJ. 2008.** Government Support Agricultural Insurance. Challenges and options for developing countries. Washington, D.C.: The World Bank.

For further information and online versions of the annexes, visit:

<http://dapa.ciat.cgiar.org/CSA-profiles/>

Annex I: Acronyms

Annex II: Economic relevance of agriculture in Colombia

Annex III: Land-use change in Colombia

Annex IV: Top production system methodology

Annex V: Climate smartness methodology

Annex VI: Detailed smartness assessment for ongoing CSA practices in Colombia

Annex VII: Use of international climate-smart funding in Colombia

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 Andrew Jarvis and Caitlin Corner-Dolloff (CIAT), Claudia Bouroncle (CATIE), and Svetlana Edmeades and Ana Bucher (World Bank). The main authors of this profile were Karolina Argote and Andrew Jarvis; and the team was comprised of Andreea Nowak (CIAT), Miguel Lizarazo (CIAT), Pablo Imbach (CATIE), Andrew Halliday (CATIE), Beatriz Zavariz-Romero (CIAT), Rauf Prasodjo (CIAT), María Baca (CIAT), Chelsea Cervantes De Blois (CIAT), Juan Carlos Zamora (CATIE), and Bastiaan Louman (CATIE).

This document should be cited as:

World Bank; CIAT; CATIE. 2014. Climate-Smart Agriculture in Colombia. CSA Country Profiles for Latin America Series. Washington D.C.: The World Bank Group.

Original figures and graphics: Fernanda Rubiano

Graphics editing: CIAT

Scientific editor: Caitlin Peterson

Design and layout: Green Ink and CIAT

Acknowledgements

Special thanks to the institutions that provided information for this study: MADR, DNP, MADS, FEDEGAN, FEDEARROZ, FENALCE, and FUNDESOT.

This profile has benefited from comments received from World Bank colleagues: Willem Janssen, Marc Sadler and Eija Pehu, as well as from Natalia Gómez and Luz Díaz.