Climate-Smart Agriculture in Mexico

Climate-smart agriculture (CSA) considerations

A M Mexico is a diverse country with multiple agro-ecosystems and socio-economic conditions. **CSA practices need to be tailored to local and regional contexts.**

M Fertilizer use, especially high in the north, can be made more efficient by using **soil nutrient tests, precise fertilization,** and use of **organic or less impactful inputs.**

A Adaptation to frost and hail is needed in the northern irrigated region. This can be done by continuing to invest in **protected agriculture** (greenhouses), **drip irrigation,** and **agriculture insurance.**

A M P High biodiversity and environmental services, such as in Mexico's maize–bean region, can be maintained through activities, such as **agroforestry** and **silvopasture,** that support diversity and provide means for secure livelihoods, **diminishing tradeoffs between development and conservation.**

M P **Conservation Agriculture,** a bundle of CSA practices that can be applied to maize, wheat, sorghum, or even tomato in the case of Sinaloa, could increase crop productivity and prevent soil degradation.

M P Diet management, system intensification, waste management, and biodigestors are CSA technologies that could **minimize the amount of greenhouse gas emissions (GHG) from livestock production**, increase profitability and provide alternative sources of electricity in rural Mexico.

A $ **Climate risk management strategies** such as early weather notifications, warning systems, and agricultural insurance along with **capacity building and extension services** can help farmers adapt to different climate extremes and related challenges, such as floods and pest infestations, which are challenges in the maize–bean region of the south.

A **Knowledge exchange strategies** are essential for increasing the productivity and resilience of Mexico's agricultural sector. A formalized **innovation system** with public, private, and academic actors is important for knowledge generation, collection, and dissemination.

A M The identification of suitable adaptation and mitigation options can be enhanced by development and access to **Integrated Decision Support Systems** that compile and analyze weather, agronomic, and market information, and deliver results to a range of stakeholders and decision makers.

P **Strengthening governance and democratic landscape management** of farmers associations, *ejidos**, and communities can help increase productivity by creating economies of scale that bring connectivity to the fragmented land tenure in Mexico dominated by small farm plots.

$ Initiatives that facilitate agricultural loans and guarantees with the promotion of farmer innovation and entrepreneurship could **promote farmer-led investment** that is sustainable in the long term.

A Adaptation M Mitigation P Productivity 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.

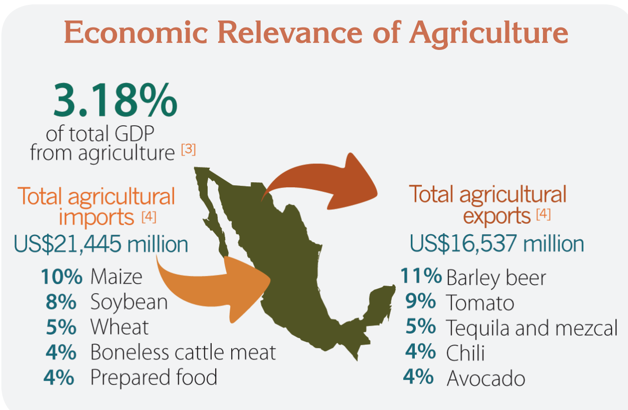
* An ejido is an area of communal land used for agriculture, on which community members individually possess and farm a specific parcel. Regularly, land use decisions are made by community consensus.

WORLD BANK GROUP
CGIAR
RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security
CCAFS
CIAT
CATIE Solutions for environment and development
Soluciones para el ambiente y desarrollo

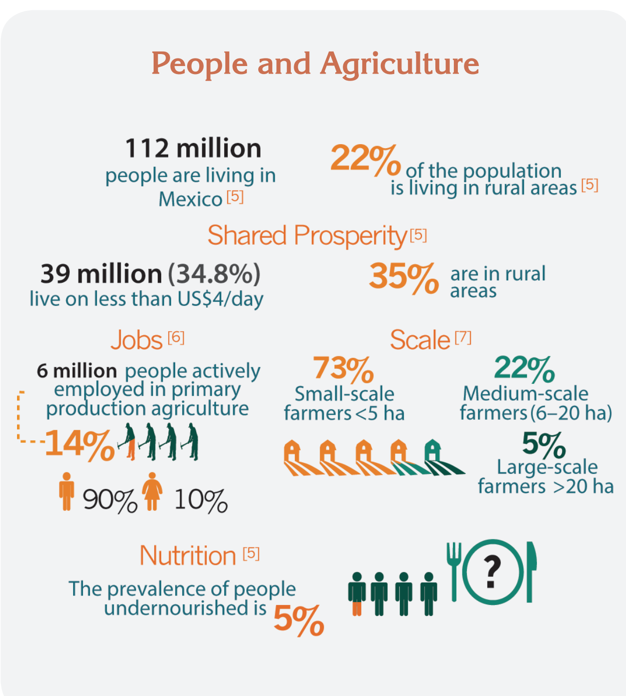
National context:
Key facts on agriculture and climate change

Economic relevance of agriculture

In Mexico, agriculture is the third most important economic activity, contributing 3.18% to the country gross domestic product (GDP) [3]. This low percentage is due to a diversified economy that is transitioning into secondary (industry and manufacture) and tertiary (tourism and services) activities.



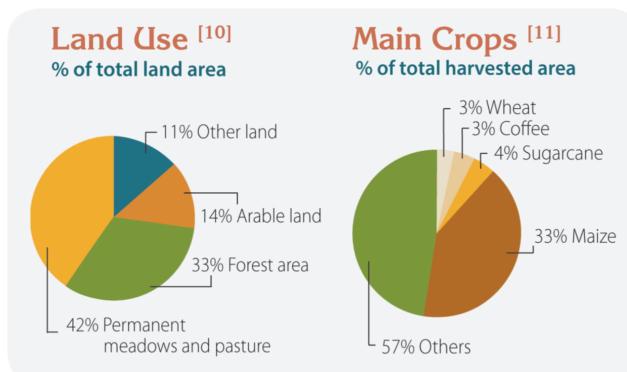
Roughly 22% of Mexico's population lives in rural areas (almost 24 million people) [5], with a little under half (44%) of the rural population actively employed in agriculture [6].



Land use

Land tenure in Mexico is based on the communal *ejido* system. Most land owners (73%) are smallholders that own 5 or fewer hectares. Medium-sized land owners (representing 22% of all land owners) own up to 20 hectares and only 5% of landholders own more than 20 hectares [8].[1] The small size of plots impedes economies of scale, unless effective farmers organizations are in place. Low productive scales impede financial elegibility and reduction of production costs. Where farming in small plots is isolated, productivity and competitiveness are compromised [9].

Productivity objectives are related to land holding size; smallholders produce for subsistence, medium-sized farmers are transitioning into commercial production, and large-scale farmers are mainly focused on commercial production. Approximately 5–10% of agricultural land is worked without legal tenure. Women or young family members related to deceased, aging, or absent legal land owners may account for this statistic [9]. Mexico's Gini land distribution coefficient of 0.71[2] indicates a highly inequitable land distribution.



Agricultural production systems

Mexico encompasses four main agricultural regions: irrigated, maize–bean, dryland-mixed, and coastal plantations. The two systems with the largest land area are the irrigated region (north) and the maize–bean region (central and southwest) [12].

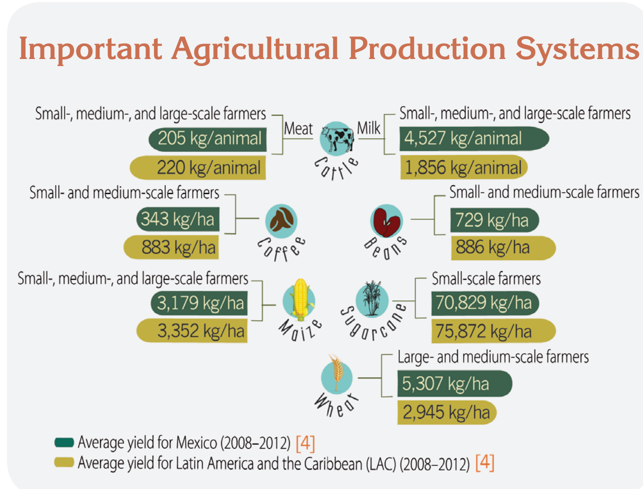
Two sub-national CSA profiles were developed to complement this national profile. This was done to accurately represent

1 Computed by dividing total surface by the number of production units reported by scale in the National Agriculture, Livestock and Forestry inventory of 2007.

2 Computation based on methodology in Bouroncle et al. (2013) [13] and data from the latest agricultural census in Mexico for 2007 [7].

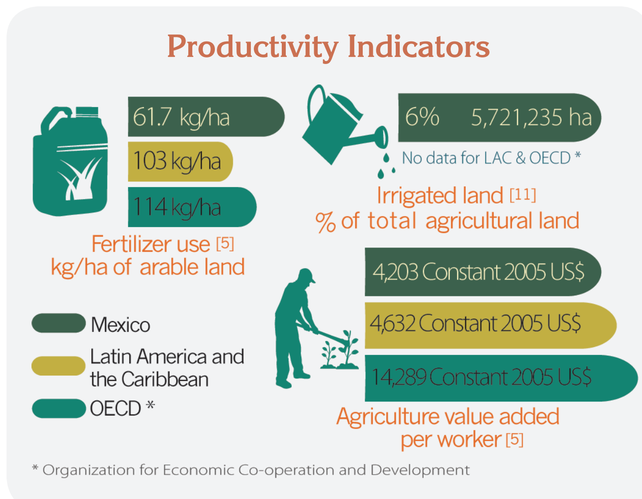
the irrigated region, captured in the Sinaloa profile, and the maize–bean region, captured in the Chiapas profile.[3]

The most important agricultural production systems at the national level are maize, beans, coffee, sugarcane, wheat, and cattle (beef and milk). Relative importance is based on the product's share of crop area (e.g., maize occupies 33% of total cropland [4]), the production value (US$5.6 billion for beef; $3.6 billion for poultry [4]), and the contribution to daily kilocaloric consumption per capita per day (170 kcal/capita/day for milk; 446 kcal/capita/day for sugarcane; 102 kcal/capita/day for beans; 1,030 kcal/capita/day for maize [4]).



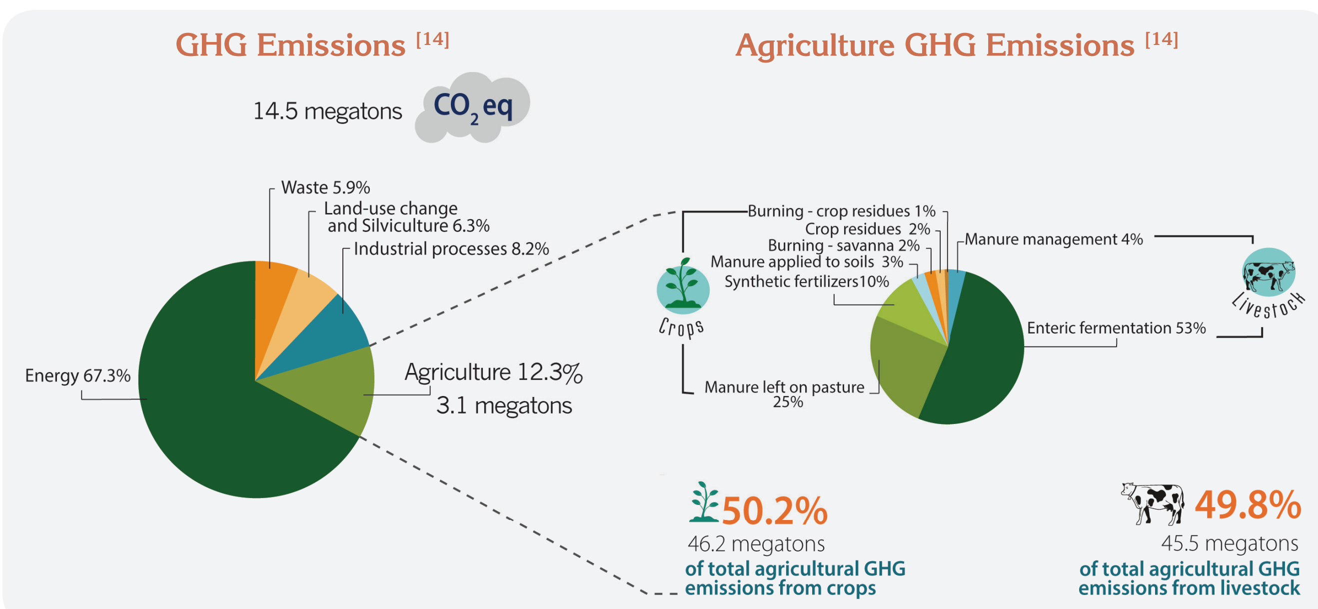
Agricultural greenhouse gas emissions

The sectors contributing the most to GHG emissions in 2010 were energy (67.3%), agriculture (12.3%), and industrial processes (8.2%). Land use change contributed 6.3% of the total GHG emissions. Within agriculture, the highest contributions to emissions were from enteric fermentation[4] (53% of agriculture emissions), manure left on pasture (25%), and synthetic fertilizers[5] (10%) [7].



Challenges for the agricultural sector

Mexico's agriculture sector faces several challenges. Although the country is the world's eighth largest food producer, national food production does not meet the internal demand for basic products, such as yellow maize, rice, oilseeds, and wheat [9].



3 Both of these profiles can be consulted in their printed version or in the webpage of the CSA country profiles series.

4 Methane gas produced in digestive systems of ruminants and, to a lesser extent, non-ruminants.

5 Emissions from synthetic fertilizers were in the form of nitrous oxide gas from synthetic nitrogen additions to managed soils.

Productivity, competitiveness, and profitability in Mexico have stagnated. Government support is generally directed to large farmer organizations that have negotiation power over smaller and with lower capacity farmers. Moreover, the generally low income from agriculture no longer incentivizes youth to work in the sector and replace senior farmers, thus affecting generational changeover [9].

Water is a basic input, which is at times unavailable. The adoption of irrigation technologies in rain-fed land has not increased in the last 40 years, and existing infrastructure is deteriorated, generating usage inefficiencies. Nonetheless, 60% of agriculture production is obtained in irrigated land, while rain-fed plots are increasingly exposed to climate change effects [9].

Many inputs are expensive and not easily accessible. There is high dependency on imported fertilizers only available to farmers at high costs. (77% of national consumption is imported). Also, high-quality seeds are not readily available to farmers [9].

Livestock production has a high untapped potential due to the undercapitalization of its productive units. In some cases, infrastructure is abandoned or underutilized, causing a national deficit in the availability of milk and meat. However, there are some enterprises that export high-quality meat products [9].

There is a large amount of human capital working on innovation, research, technology development, and education for the agriculture sector. However, this capital is less effective in linking their developments with producers. For instance, less than a third of productive units apply fertilizer based on soil analysis, four out of five people use native seeds instead of improved seeds, and only half of livestock ranchers calculate the adequate animal density limits of their fields [9].

Availability of and access to financial resources is a major challenge. Only 1.5% of finance products are channeled to the rural sector. Farmers often struggle to access finance products because these are not aligned with farmers' productive conditions [9].

Agriculture and livestock production are generally unsustainable and negatively impact natural resources. Environmental challenges include soil erosion and salinization, overexploitation of aquifers, contamination of freshwater bodies, greenhouse gas emissions, and ecosystem damage. Environmental degradation is influenced by unclear land tenure rights, inefficient public policies, and lack of knowledge of sustainable agricultural practices [9].

Mexico's agriculture development presents regional differences. Between 2004 and 2010, primary GDP grew 2.5% in the north, 1.3% in the center and 0.1% in the south. In northern Mexico, farmers are vulnerable to extreme climate events, such as drought and frost. Farmers in the North also depend on large amounts of agrochemicals, which are often used in excess. In southern states, such as Guerrero, Chiapas, and Oaxaca, farmers lack access to information and new technologies to improve production. In the southwestern states of Veracruz and Tabasco, farmers also face severe climate risks, such as floods and pest infestations [15].

Agriculture and climate change

According to climate projections [16], precipitation will decrease in most of the country. Some regions will be more severely affected than others. Precipitation changes include:

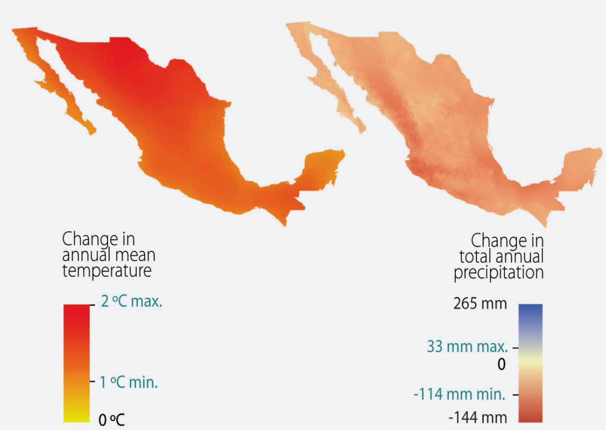
- Rainfall fluctuations between -14 mm and +33 mm in the northwestern parts of the country (Baja California, Baja California Sur, sections of Sonora, and Chihuahua).
- Severe decreases in rainfall of up to -114 mm in important food-producing states (e.g., Sinaloa, Jalisco, Michoacán, Veracruz, Tabasco).

Temperature increases will range from:

- +1 °C in neotropical regions.
- Up to +2 °C in arid regions (e.g., Sonora, Chihuahua, Coahuila).

Smallholder farmers in Mexico are highly vulnerable to climate variability and change. Their vulnerability is related to:

Projected Change in Temperature and Precipitation in Mexico by 2030 [6]



6 Projections based on RCP 4.5 emissions scenario [17] and downscaled using the Delta Method [18].

- Lower than average crop yields (e.g., average maize yields are less than half those of commercial farmers) [19].
- Small land tenure size (73% of farmers own less than 5 ha) [19].
- Reliance on rain-fed systems (90% of subsistence farmers, in comparison to 63% of commercial farmers) and thus dependence on regularity of environmental conditions for production [19].
- Fewer resources (finances, savings healthcare, subsidies, tools, and inputs) available to help cope and adapt to climate impacts [19, 20].

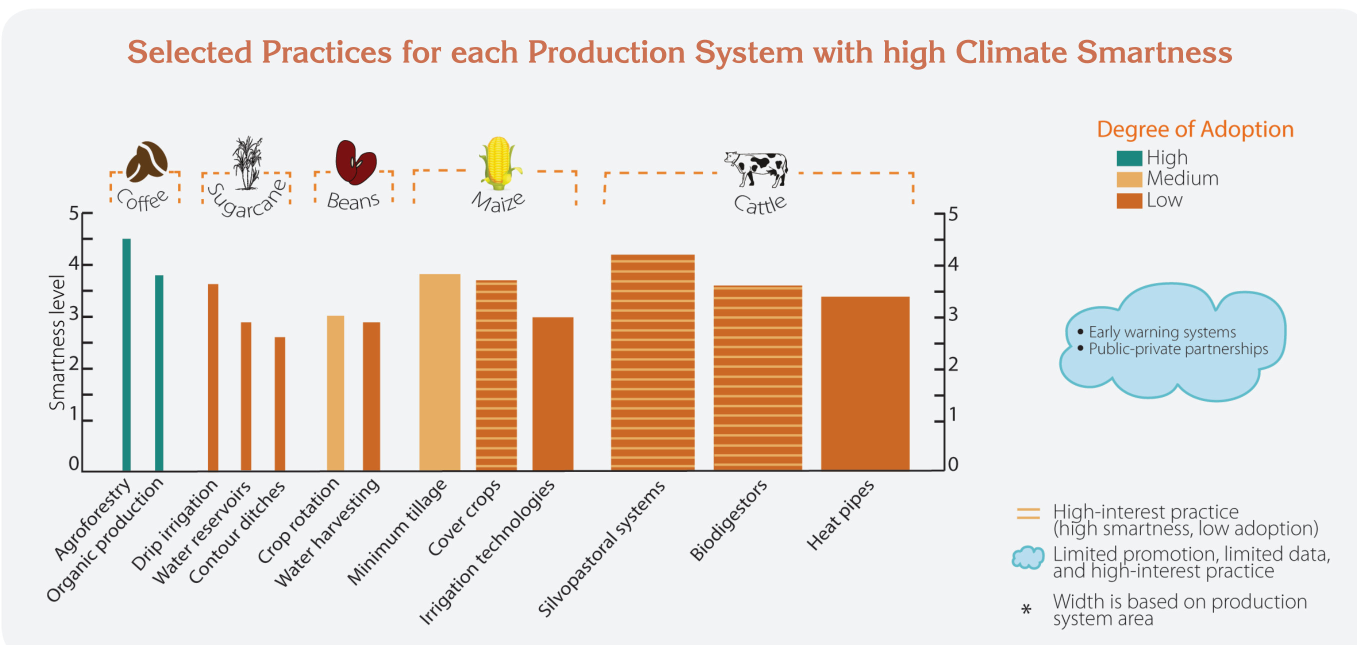
Mexico is the country most exposed to extreme weather events in Latin America. The country experienced 18% of all disasters in the region from 1970 to 2009. In particular, Mexico is highly exposed to heavy rainfall and landslides [21]. Other extreme events affecting agriculture in Mexico are droughts, floods, frost, and hail [19]. Fifteen percent of farmers were affected by extreme events between 1980 and 2000. Frequency and intensity of future extreme events is uncertain. For example, while tropical cyclones are generally likely to become more intense under a warmer climate as a result of higher sea-surface temperatures, there is great uncertainty as to changes in frequency [22].

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].

Farmers in Mexico have begun to adopt a variety of CSA techniques: agroforestry and organic production in coffee, silvopastoralism, biodigestors, energy efficiency, renewable energy, improvement of intensive systems environment, improved fodder, genetic improvement in livestock, crop rotation in maize, wheat, and beans, and conservation agriculture[7] practices in maize and wheat.

A matter of utmost importance in Mexico's agriculture is water availability, as well as water-use efficiency. As a result, farmers have adopted many CSA practices, such as water harvesting, well perforation, water reservoirs, contour ditches, accurate irrigation scheduling, and land leveling for irrigation in maize, sugarcane, beans, and other crops. Moreover, drip irrigation is seen as one of the most



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

7 Conservation Agriculture, a CSA practice itself, is comprised of a bundle of other CSA practices including minimum tillage, organic fertilizers, accurate irrigation scheduling, biofertilizers, vegetation coverage, infrared sensors, and permanent beds, among others.

promising water-related CSA practices for maize, sugarcane, tomato, and cucumber, among others.

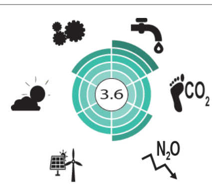
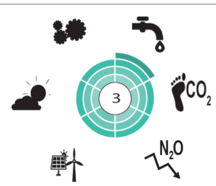
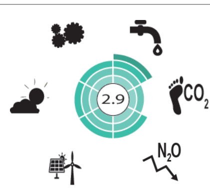
These practices coupled with effective basin-wide planning approaches can ensure higher water availability without the need to expand agricultural area even more.

The percentage of farmers implementing CSA practices is often low (see Table 1). Such is the case for practices with high potential for mitigation, adaptation, and productivity like the full bundle of Conservation Agriculture (CA) practices or some of its components (no-tillage agriculture, cover crops, silos, land leveling for irrigation, biofertilizers, etc.) in maize and wheat, drip irrigation in maize, wheat, sugarcane, tomato, and cucumber, intercropping with beans and other crops, and silvopastoral systems, biodigestors, renewable energy, and energy efficiency in livestock systems.

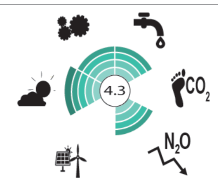
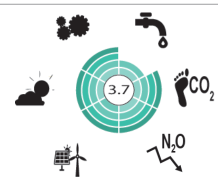
Along with field practices, such as the ones mentioned above, there are also important ongoing programmatic activities worth noting in Mexico, such as payments for ecosystem services, sustainable forest certifications, pilot projects of REDD+[8] activities, insurance against natural disasters, loans, guarantees, and farmers organizations.

Table 1. This graph displays the smartest CSA practices for each of the key production systems in Mexico.

Climate smartness is ranked from 1 (very low positive impact in category) to 5 (very high positive impact in category). 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
Coffee 4% harvested area	Agroforestry ■ High adoption (>60%)		Reduced temperatures in coffee canopy, reduced pressure of rust and insect-borne yield losses	Significant carbon sequestration in system.	Diversification in farm income enhanced livelihoods. No major productivity benefits, but shade can enhance coffee quality leading to higher income.
	Organic production ■ High adoption (>60%)		In certain contexts, enhanced soil quality can enhance water retention and soil functioning to overcome climate-related stresses.	Reduced nitrogen fertilizer use resulting in less N_2O emissions.	Product differentiation can enhance income.
Sugarcane 3% harvested area	Drip irrigation ■ Low adoption (<30%)		Lower water requirements increased resilience of the system to climate variability.	May imply increase in energy use.	Targeted and controlled irrigation system ensured water requirements of the crop are satisfied and increased yield. This in turn increases profitability.
	Water reservoirs ■ Low adoption (<30%)		Great irrigation potential to maintain production in periods of water stress.	Implies increase in energy use.	Irrigation system ensured water requirements of the crop are satisfied and increased yield. Yield increases profitability.
Beans 7% harvested area	Crop association ■ Medium adoption (30–60%)		Double cropping decreases risk due to diversification strategy.	Limited, if any.	Intercropping may give a bonus crop of beans without affecting maize yields.
	Water harvesting ■ Low adoption (<30%)		Ground water recharge and check dams can be used for domestic use and irrigation and be utilized in times of water scarcity.	In certain contexts reduced energy needs for irrigation pumping.	Increased water availability in arid areas can increase yields. Yield increases profitability.

8 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.

	CSA Practice	Climate Smartness	Adaptation	Mitigation	Productivity
Maize 33% harvested area	Minimum tillage Medium adoption (30–60%)		Increased water retention reduced crop losses due to drought.	Promoted carbon storage in soil. Water retention increased, which in turn reduced energy needs for irrigation.	Increased productivity due to higher content of nutrients in soil. Higher productivity increases incomes.
	Cover crops Low adoption (<30%)		Water infiltration increased, which reduced risks of floods.	Reduced nitrogen fertilizer use resulting in less N_2O emissions.	Less need for inputs, which reduced costs. Crop time was reduced, soil fertility increased.
Cattle 38.58% land-use area	Silvopastoral systems Low adoption (<30%)		Silvopastoral systems bolstered 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.
	Biodigestors Low adoption (<30%)		Limited adaptation benefits.	Reduced methane emissions from manure, and energy generation on farm.	Organic fertilizers produced can be used on forages and others on farm crops to enhance productivity.

CO_2 Carbon smart — Water smart — Weather smart — N_2O Nitrogen smart — Energy smart — Knowledge smart

Case Study: Conservation Agriculture

for soil quality, productivity, and climate change mitigation in Mexico

In Mexico, Conservation Agriculture (CA) (a bundle of practices including no-tillage, crop rotation, crop association, and improved varieties) is being promoted in a joint effort between the International Wheat and Maize Improvement Center (CIMMYT) and the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) through the Sustainable Modernization of Traditional Agriculture (MasAgro) program.

MasAgro disseminates CA technologies through innovation hubs that promote synergistic investment and interaction between stakeholders in the agricultural supply chain. Up to 180 institutions collaborate with MasAgro, including federal and state government entities, 35 private seed companies, and 33 research institutions across the world.

MasAgro's efforts have led to the adoption of CA throughout the country, either as demonstrative platforms or at full-scale implementation. Central Mexico has the highest rates of adoption; states, such as Guanajuato, Michoacán, Queretaro, and Jalisco have an uptake rate of up to 50%. The total uptake area in these states is 36,547 hectares, primarily in maize systems. Conservation agriculture has increased farmer's profitability through higher productivity and lower input costs.

The next steps for MasAgro are to replicate the program at different scales and in other regions in the country and the world. The knowledge hubs model will likely surpass its agricultural development goals to be applied in other spheres, such as environmental conservation or the provision of weather forecasts through information and communication technologies.

Conservation Agriculture harvest demonstration ©CIMMYT

Albeit Mexico has progressed on the implementation of CSA activities, stakeholders emphasize the need for policies, programs, funding, and institutions that can assist climate change management. Further possibilities include development of early-warning weather systems, promotion of private sector innovation, and more investment in research and development that is integrated with implementation.

Practices presented in Table 1 (page 6), are an indication of the broad range of CSA practices applicable to the country. These practices therefore are not applicable to the whole spectrum of agro-ecosystems existent in Mexico. Adequate practices need to be assessed at a more localized scale. Two CSA Profiles for the states of Chiapas and Sinaloa were developed to depict local differences. See CSA in Sinaloa and CSA in Chiapas notes for further information.

Institutions and policies for CSA

The federal government has traditionally spearheaded agricultural development in Mexico and the country has a strong political commitment to addressing climate change. In addition to the government's development of a series of key climate change policies, national institutions have incorporated climate-smart approaches, and sectoral programs have addressed climate change transversally. Six key national strategies that are related to CSA refer to:

- The General Law on Climate Change, 2012.
- The National Climate Change Strategy, vision 10-20-40, 2012 (ENACC).
- The Special Program for Climate Change (PECC).
- The National Strategy for Reducing Emissions from Deforestation and Forest Degradation (ENAREDD+) (under consultation).
- The Mexico Low Emissions Development Program, 2013.
- The Law for Sustainable Rural Development.
- The Sectoral Program for Agriculture and Livestock Development, 2013–2018.

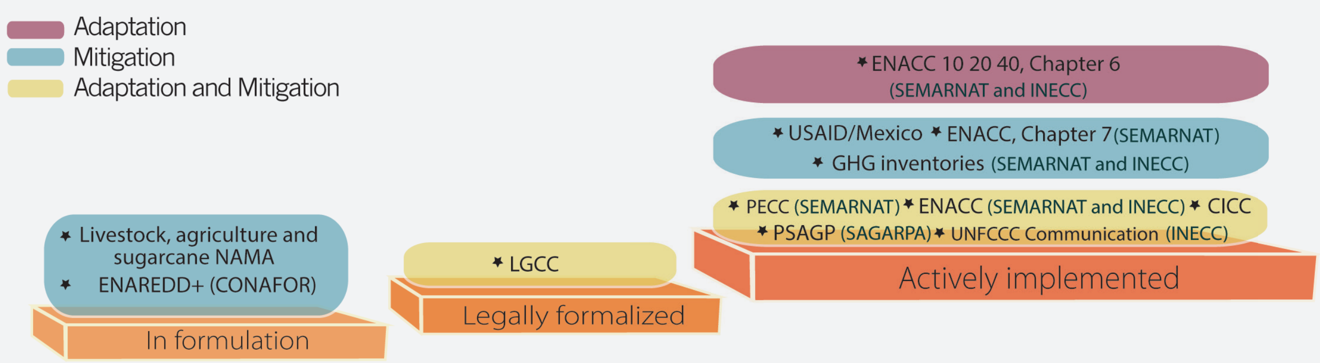
The graphic below (Primary Focus of Institutions Engaged in CSA) represents the main thematic foci of public and private institutions in Mexico related to the three pillars of CSA: adaptation, mitigation, and productivity. CSA-related institutions are strongest in the productivity pillar of CSA. However, given the increased cooperation and incorporation of climate change aspects in their agendas, most of these institutions are beginning to address more than one CSA pillar (see diagram on page 9).

For the productivity pillar, universities, such as the Autonomous University of Chapingo, the Autonomous University Antonio Narro, and the Monterrey Institute of Technology and Higher Education, focus on education and research on how to increase agricultural productivity. The National Financing Board of Agricultural, Rural, Forestry and Fisheries Development (FINADE), a government financial institution, provides subsidies, guarantees, and loans for the acquisition of inputs and extension services.

The Trust Funds for Rural Development (FIRA) and the Trust Fund for Shared Risk (FIRCO) promote synergies between mitigation and productivity by providing

Enabling Policy Environment for CSA

Policies listed are related to enhancing **agricultural productivity** and:



CICC Climate Change Interministerial Commission **ENACC (2013)** National Climate Change Strategy 10 20 40 **LGCC (2012)** Climate Change General Law **NAMA (2013)** Nationally Appropriate Mitigation Action (Livestock, agriculture and sugarcane elaboration contemplated in PECC [USAID]) **PECC (2014–2018)** Climate Change Special Program **PSAGP (2013–2018)** Sectoral Program for Agriculture, Livestock and Fisheries **ENAREDD+** United Nations Programme for Reducing Emissions from Deforestation and Forest Degradation + **UNFCCC** National Communication to the United Nations Framework Convention on Climate Change subsidies and loans for the adoption of efficient and renewable energy technologies in livestock production systems. The National Committee for the Sustainable Development of Sugarcane (CONADESUCA) promotes natural resource use efficiency and green harvest for sugarcane system sustainability, among others. The National Forestry Commission (CONAFOR) and the Nature Conservancy work to develop an integral REDD+ strategy. The Mexican Civil Council for Sustainable Silviculture (CCMSS) observes this process and provides policy recommendations. CCMSS also implements two integral landscape management approaches that create synergies through effective governance in community forest management.

Synergies between productivity and adaptation are led by the National Meteorological System (SMN), which publishes weather bulletins for the agricultural sector and manages a network of weather information stations. Similarly, the National Arid Zones Commission (CONAZA) helps farmers adapt to water-limited conditions, and the National Organism for the Integration of Insurance Funds (OINFA) and AGROASEMEX S.A. (national insurance institution) provide insurance services against adverse weather events.

The National Water Commission (CONAGUA) is the leading water institution in Mexico. It promotes the adoption of irrigation technology in the northern regions of the country and infrastructure to improve water provision in rain-fed plots in the South. It also leads investment in public infrastructure for water capture and storage.

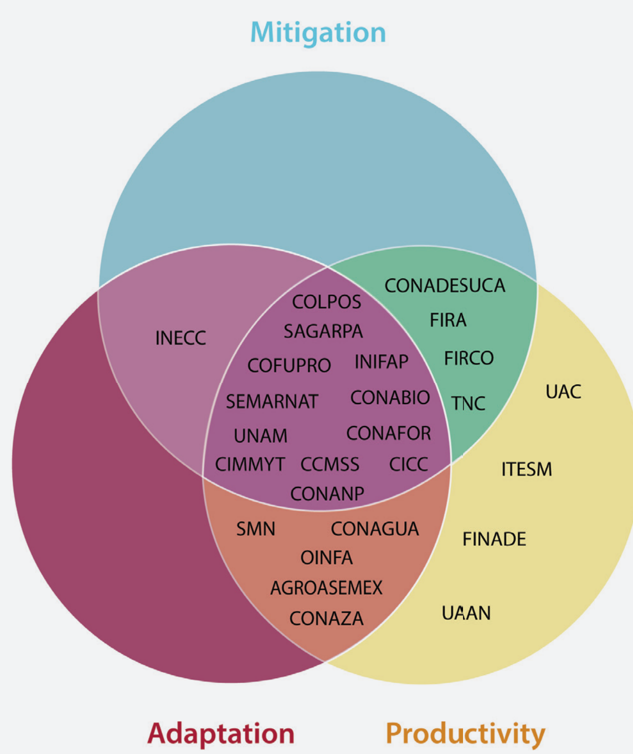
The National Institute for Ecology and Climate Change (INECC) focuses mainly on climate change policy development across all sectors.

Many institutions promote synergies across all three CSA pillars. The Inter-Institutional Climate Change Commission (CICC), which includes representatives from the Ministry of Agriculture, promotes the implementation of a cross-cutting climate change policy. The National Institute for Forestry, Agriculture and Livestock Research (INIFAP), the Post-Graduate College (COLPOS), and the National Autonomous University of Mexico (UNAM) perform research on CSA activities. The Coordinating Institution for Productivity Foundations (COFUPRO) is a public-private association that represents farmers at the national level and promotes sustainable agro-business development. Some of their ongoing innovations are the promotion of carbon neutral ranches, carbon capture through bamboo plantations, and dissemination of climate-smart information to farmers.

The International Wheat and Maize Improvement Center (CIMMYT) leads the MasAgro program, among many other CSA activities. MasAgro is an umbrella program that promotes conservation agriculture at a national level. The Secretariat of the Environment and Natural Resources (SEMARNAT), the Natural Protected Areas Commission (CONANP), and the Biodiversity Commission (CONABIO) work on sustainable land management initiatives such as Natural Protected Areas, biodiversity-friendly production programs, and Sustainable Land Management Units.

In addition to leading Mexico's agricultural agenda, the Secretariat of Agriculture, Livestock, Rural Development, Fisheries, and Food (SAGARPA) participates in diverse CSA initiatives through several directorates within its structure. These initiatives include the promotion of sugarcane green harvest, crop rotation, irrigation, protected agriculture, energy efficiency in vessels, livestock vulnerability information, efficient machinery, biofertilizers, fuel efficiency, small dams, water reservoirs, soil improvement, cogeneration of energy, biofuels, biodigestors, thermic solar systems, fotovoltaic systems, organic fertilizers, natural disaster risk insurance for states and municipalities (CADENA program for the attention of natural disasters), and development of Nationally Appropriate Mitigation Actions (NAMAs) in livestock production, among others.

Primary Focus of Institutions Engaged in CSA



Financing CSA

National finance

A country's plans for investment in the agricultural sector are a proxy for assessing CSA financing, as they reflect the way national funds will be allocated across the institutional body. According to an expert assessment of Mexico's Agriculture Sectoral Plan, 10% of strategic investment lines are dedicated to agricultural adaptation, 20% to mitigation, 55% to food security (productivity), and 15% to other purposes. Federal funds are allocated to ministries, decentralized institutions, state-level governments, and private-sector subsidies [23].

Private-sector investment in CSA at the national level comes primarily from farmers' own resources [24]. These resources include labor, savings from previous harvests, and loans from relatives or acquaintances. Furthermore, National Development Banks, such as FIRA and FINADE, provide loans and guarantees to contribute to CSA investments made by farmers.

SAGARPA's CADENA program offers insurance against natural disasters to state governments. Farmers also have the option of acquiring insurance directly through AGROASEMEX, farmers associations, or private insurance services. A multi-state study by CIMMYT estimates that 28.8% of farmers have some form of agricultural insurance nationwide [25].

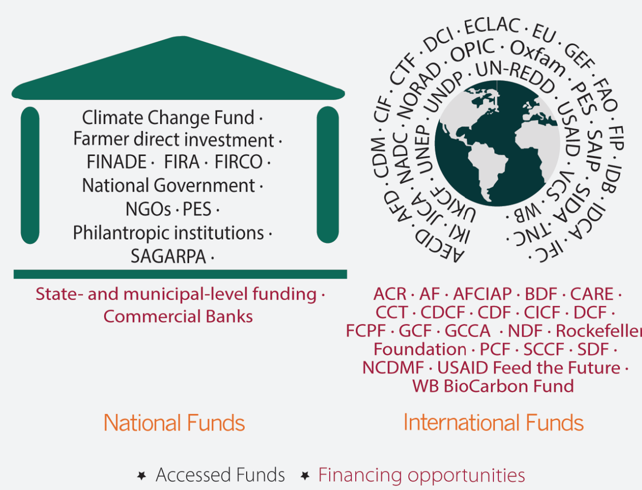
International finance

Mexico has also obtained funds from international organizations to implement its national CSA projects. Channels of climate change funding are to be centralized through the Climate Change Fund created in the General Law on Climate Change of 2012.

According to a study by Transparencia Mexicana in 2013 [26], Mexico accessed US$2.6 billion in climate finance (applied and committed funds) from 2009–2010 from non-government sources. The main sources of finance reported were the World Bank, the Inter-American Development Bank (IDB), the French Agency for Development (AFD), the Climate Investment Fund (CIF), the Clean Technology Fund (CTF), the Global Environment Facility (GEF), the German International Climate Initiative (IKI), and the U.S. Agency for International Development (USAID). Thus far, these resources have been used to finance activities such as GHG emissions mitigation projects, fair trade certifications for honey and coffee, diversification of agroforestry systems in Chiapas, REDD+ readiness, and integrative landscape management programs, among others.

Funds for Agriculture and Climate Change

ACR American Carbon Registry **AECID** Spanish Agency for International Development Cooperation **AF** Adaptation Fund **AFCIAP** Australia's Forest Carbon Initiative and Aid Program **AFD** French Agency for Development **BDF** Brazilian Development Fund **CARE** Humanitarian Organization **CCT** California Cap and Trade **CDCF** Community Development Carbon Fund **CDF** Chinese Development Fund **CDM** Clean Development Mechanism **CICF** Conservation International Carbon Fund **CIF** Climate Investment Funds **CTF** Clean Technology Fund **DCF** Danish Carbon Fund **DCI** Development Cooperation Instrument **ECLAC** Economic Commission for Latin America and the Caribbean **EU** European Union **FAO** Food and Agriculture Organization of the United Nations **FCPF** Forest Carbon Partnership Facility **FINADE** National Financing Board of Agricultural, Rural, Forestry and Fisheries Development **FIP** Forest Investment Program **FIRA** Trust Funds for Rural Development **GCCA** Global Climate Change Alliance **GCF** Green Climate Fund **GEF** The Global Environment Facility **IDB** Inter-American Development Bank **IDCA** International Development Cooperation Agency **IFC** International Financial Corporation **IKI** German International Climate Initiative **JICA** Japan International Cooperation Agency **NCDMF** The Netherlands Clean Development Mechanism Facility **NDF** Nordic Development Fund **NORAD** Norwegian Agency for Development Cooperation **OPIC** Overseas Private Investment Corporation **OXFAM** International **PCF** Prototype Carbon Fund **PES** Payment for Ecosystem Services **ROCKEFELLER** Foundation **SAGARPA** Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food **SAIP** Sustainable Agriculture Initiative Platform **SCCF** Special Climate Change Fund **SDF** Special Development Fund **SIDA** Swedish International Development Cooperation Agency **TNC** The Nature Conservancy **UKICF** United Kingdom International Climate Fund **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 **VCS** Verified Carbon Standard **WB** The World Bank



Potential finance

Mexico has accessed a broad variety of international funds for the implementation of CSA projects, evidence of a strong enabling environment and relationship with international donor institutions. Current transactions with donors could be complemented by further funding for the purposes of CSA. In addition, alternative funding sources exist that have not been sufficiently exploited by Mexico and could potentially help efforts to scale up CSA. Possible pathways include strengthening already existing cooperation with institutions focused on either climate change or agriculture-related topics in the country.

Outlook

Mexico is the world's eighth largest food producer [9]. Still, many of its key crops such as maize are imported in significant proportions. This implies higher food costs to vulnerable poor populations. Productivity needs to be increased by responding to the different regional circumstances across Mexico's highly diverse agro-ecologic conditions. The increase in productivity should align with climate-smart principles and effective natural resource management to ensure long-term sustainability. Scaling out CSA will require increased coordination efforts between public and private agriculture organizations across the national and local levels, as well as strengthened cooperation with climate-related international institutions.

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For further information and online versions of the Annexes, visit http://dapa.ciat.cgiar.org/CSA-profiles/

Annex I: Acronyms

Annex II: Production systems selection

Annex III: Agro-ecosystems

Annex IV: Climate change predictions (CIAT analysis)

Annex V: Ongoing CSA practices

Annex VI: CSA Institutions

Annex VII: Selected International CSA Finance projects

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