COUNTRY OVERVIEW
Guatemala has made significant economic and political strides over the last decade, but the country still struggles with high exposure to natural hazards and high rates of poverty (59 percent), malnutrition (54 percent) and maternal-child mortality. It also has one of the highest rates of violent crime and of inequality in Latin America. Climate change poses even greater challenges to long-term development goals. About one-third of Guatemalans depend on natural resources for their livelihoods, and that natural resource base is already degraded by overexploitation, deforestation, and slash-and-burn agricultural practices, leading to low productivity. Higher temperatures and more variable rainfall will further hamper productivity, increasing the risk of food and water insecurity among the most vulnerable, particularly indigenous groups, mainly subsistence farmers in remote geographic areas who represent at least 40 percent of the population. The 2015/2016 El Niño phenomenon led to one of the worst droughts in 35 years in Central America. Guatemala’s southeast region (known as the dry corridor) was especially affected, leading to widespread crop failure and food insecurity. In addition to potentially exacerbating these adverse impacts, climate change will increase disaster risks in rapidly urbanizing areas with highly unstable physical infrastructure, such as in the highlands (vulnerable to landslides) and Pacific coastal regions (vulnerable to flooding and storm surge from severe weather).

CLIMATE PROJECTIONS
Increased incidence and intensity of extreme rainfall events, droughts, floods
More frequent and prolonged heat waves, droughts and canículas

KEY CLIMATE IMPACTS
Agriculture
Crop loss/failure
Shifting production zones
Increased food prices & food imports
Water Resources
Water shortages
Reduced quantity and quality of water supplies, especially during dry season
Human Health
Increased risk of vector- and waterborne diseases, malnutrition and disaster events
Energy
Disruption in service provision
Reduced energy production potential
Ecosystems
Loss of critical ecosystems, coastal defense & carbon sinks
Expansion of arid areas

April 2017
This document was prepared under the Climate Change Adaptation, Thought Leadership and Assessments (ATLAS) Task Order No. AID-OAA-I-14-00013 and is meant to provide a brief overview of climate risk issues. The key resources at the end of the document provide more in-depth country and sectoral analysis. The contents of this report do not necessarily reflect the views of USAID.
CLIMATE SUMMARY

Guatemala has a warm, tropical climate that varies with the country’s topography, including humid coastal areas, cool highlands, tropical jungles in the northern Petén region, and dry scrub in the eastern dry corridor. Average annual temperatures range from 25°C–30°C along the coast, to 20°C in the highlands, to 15°C at higher altitudes. Two distinct seasons exist: a dry season from November–April and a rainy season from May–October. The rainy season includes a 5- to 15-day break with little or no rain in July or August called the canícula. Average annual rainfall varies between 600 mm in the eastern dry zone and 5,000 mm in coastal areas, with the majority of the country receiving around 1,100 mm. The climate is affected by the El Niño Southern Oscillation. El Niño events increase temperatures, decrease rainfall and prolong the canícula, while La Niña events decrease temperatures and increase rainfall. Cyclone season is June–November for the Atlantic coast and May–October for the Pacific coast. (2, 4, 10, 15)

HISTORICAL CLIMATE

Historical trends since the 1970s:
- Increases in maximum temperatures by 0.2°C and minimum temperatures by 0.3°C per decade, with greatest increases observed in the western highlands.
- Longer and warmer dry period, as number of cold days and nights decreased by 2.2 and 2.4 percent per decade, and number of hot days and nights increased by 2.5 and 1.7 percent.
- Average annual rainfall increased 13–27 percent across the country, with the greatest increase in the north and Pacific coast.
- Irregular start of rainy season and more intense rain across shorter periods of time.
- Increased frequency and intensity of El Niño/La Niña cycles, causing frequent and severe drought in the eastern dry corridor.

FUTURE CLIMATE

Projected changes in climate include:
- Temperature increase between 2.5°C–4°C by 2050, with greatest increases in the north, the Caribbean coast, the east, and the southern coast.
- Annual increases in rainfall until 2030, then a 9.5–12.4 percent decrease in rainfall by 2050.
- Decreases in precipitation appear to be greatest in beginning of rainy season and in the central highlands, and west and eastern regions.
- Expansion of semi-arid climate regions.
- Prolonged duration of the canícula (+18 days).
- Increased variable rainfall with heavy rainfall events followed by dry days, triggering more drought and flood events.
- Rise in sea levels by 9–13 cm by 2050.

SECTOR IMPACTS AND VULNERABILITIES

AGRICULTURE

The majority of agricultural production in Guatemala is rainfed (71 percent) and takes place on steep mountainous terrain, making it highly vulnerable to drought, excess rainfall and soil erosion. Higher temperatures and more variable rainfall are projected to adversely affect yields of major food crops, with the most dramatic decreases of up to 66 percent for beans and 34 percent for rice in the eastern dry corridor. Higher temperatures will restrict the area viable for coffee production (a major export), pushing production to higher altitudes, potentially leading to land conflicts, deforestation, erosion and loss of biodiversity. A prolonged canícula will impact corn and bean harvests, as well as timing of the second planting season. Agriculture contributes significantly to the economy (14 percent of GDP, 31 percent of total employment, and 50 percent of export earnings), so climate change will negatively impact both economic and food security. For example, the El Niño-intensified drought since 2014 reduced maize and beans harvests by more than 50 percent in the western highlands and eastern dry corridor, resulting in food insecurity for one in five households. (1, 2, 3, 4, 5, 13)
WATER RESOURCES
Guatemala has abundant water resources, but water shortages occur throughout the country, especially in the dry season; the eastern and west-central highlands, south coast and northern Petén region are most affected. Surface water is the main water source for rural and urban areas; however, reduced rainfall and higher temperatures are expected to reduce surface water flows by 10–50 percent by 2030 and total water availability by 5–30 percent by 2050. Moreover, heavy rainfall events increase runoff, reduce groundwater recharge and reduce water quality through contaminated floodwaters and increased sedimentation. Water quality is poor throughout the country, with every body of water in Guatemala considered biologically and/or chemically contaminated due to extremely low levels of wastewater treatment and lack of regulation for wastewater discharge. Groundwater from deeper wells is considered potable and provides around 30 percent of urban water supply. Saltwater intrusion, while currently not a problem for coastal areas, may occur in the future if wells are overpumped due to increased demand and reduced surface flows. Population growth, which is expected to increase water demand by 300 percent by 2050, coupled with reduced surface flows and heavy rainfall events will increase water scarcity and further reduce quality. (4, 11, 12, 15)

ECOSYSTEMS
Important ecosystems, such as mangroves, rainforest and coniferous forests already stressed by deforestation (Guatemala lost half its forest cover between 1950–2002), will face increasing stress due to climate change. Coniferous forests mitigate landslides, protect watersheds and contribute nearly 80 percent of forest-related domestic and export goods. Increased temperatures and variable rainfall are expected to replace large areas of coniferous forests with dry forest ecosystems. Dry forests cover 20 percent of the country but are projected to cover 40 percent by 2050 and 65 percent by 2080. This will increase the risk of forest fires, reduce watershed health, negatively impact agroforestry-based livelihoods and aggravate drought severity. Along the coasts, rising sea levels cause flooding and erosion that damage valuable wetlands and estuaries that support coastal livelihoods and fisheries. Mangroves are sensitive to low water flows during the dry season and increased sedimentation during heavy rainfall events, both of which are exacerbated by climate change. (4, 9, 10)

ENERGY
Hydropower currently generates 34 percent of Guatemala’s electricity, and is expected to increase to 46 percent by 2027. Rising temperatures, more variable rainfall and prolonged droughts already negatively impact hydropower production. For example, droughts in 2009 led to a 34 percent reduction in hydroelectric generation compared with the previous year. Increased temperatures and variable rainfall will stress the country’s energy supply in the face of growing demand. (1, 10)
HUMAN HEALTH
Climate change will increase risk of many diseases and health issues that are already leading causes of morbidity and mortality in Guatemala, such as respiratory and intestinal infections. During times of drought, risk of Leishmaniasis, Hantavirus and respiratory infections increases. Handwashing/hygiene may be discouraged to conserve water, increasing the spread of infectious diseases like gastrointestinal illness. During the wet season, waterborne diseases such as cholera increase due to the spread of bacteria via contaminated water sources. The risk of vector-borne diseases like malaria and dengue is likely to increase due to higher temperatures, which enhance the range, breeding and pathogen maturation period, allowing mosquitoes to become infectious more quickly. For example, the 2014–2015 El Niño was identified as an amplifying force to the Zika outbreak in the Americas. Decreased agricultural production will also aggravate widespread malnourishment and food insecurity. The lack of water treatment and sanitation, coupled with poor access to health care and education, chronic malnutrition and low government spending on public health, compounds human health vulnerability, with the indigenous population disproportionately affected. (4, 7, 10, 14)

POLICY CONTEXT
Since becoming party to the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and ratifying the Convention in 1995, Guatemala has taken actions to fulfill its commitments under the Convention, including signing (1998) and ratifying (1999) the Kyoto Protocol, establishing a Climate Change Unit (2001) within the Ministry for the Environment and Natural Resources (MARN), submitting two UNFCCC Communications, drafting a National Climate Change Policy, pledging its INDC to reduce greenhouse gas emissions (2015), and signing (2016) and ratifying (2017) the Paris Agreement. (6, 8)

INSTITUTIONAL FRAMEWORK
The 2009 Climate Change National Policy outlines the legal and political basis and sets up the guidelines for development of national adaptation and mitigation. In 2013, Congress passed the Climate Change Framework Law, which established the National Climate Change Fund (FONCC) and the National Climate Change Council (CNCC) to lead national policies on climate change and oversee the new FONCC. The CNCC is a collegial advisory body with public and private participation, chaired by the President.

NATIONAL STRATEGIES AND PLANS
• Initial National Communication (2001)
• Second National Communication (2016)
• Climate Change National Policy (2009)
• Climate Change Framework Law (2013)
• National Development Plan (2014)

KEY RESOURCES

# SELECTED ONGOING EXPERIENCES

<table>
<thead>
<tr>
<th>Selected Program</th>
<th>Amount</th>
<th>Donor</th>
<th>Year</th>
<th>Implementer</th>
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<tbody>
<tr>
<td>MásRiego</td>
<td>$3.4 million</td>
<td>USAID</td>
<td>2016–?</td>
<td>The Horticulture Innovation Lab, UC Davis</td>
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<td>Climate, Nature and Communities in Guatemala (CNCG)</td>
<td>$25 million</td>
<td>USAID</td>
<td>2013–2018</td>
<td>Rainforest Alliance</td>
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<td>Rural Development and Adaptation to Climate Change</td>
<td>~$0.85 million</td>
<td>GIZ</td>
<td>2013–2018</td>
<td>Ministry of Environment and Natural Resources of the Republic of Guatemala</td>
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<td>Climate Change Resilient Productive Landscapes in Guatemala</td>
<td>$5.4 million</td>
<td>UNDP Adaptation Fund</td>
<td>2015–2019</td>
<td>Ministry of Environment and Natural Resources (MARN)</td>
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<td>Nexos Locales Project</td>
<td>$16.2 million</td>
<td>USAID</td>
<td>2014–2019</td>
<td>DAI</td>
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<td>Yo Me Adapto</td>
<td>$0.5 million</td>
<td>USAID/OFDA</td>
<td>2015–2017</td>
<td>Pan American Development Foundation (PADF)</td>
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<td>Sustainable Forest Management and Multiple Benefits</td>
<td>$4.4 million</td>
<td>GEF</td>
<td>2013–2017</td>
<td>UNDP and Ministry of Environment and Natural Resources (MARN)</td>
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<tr>
<td>Central America Regional Climate Change Program (RCCP)</td>
<td>$23.5 million</td>
<td>USAID</td>
<td>2013–2018</td>
<td>Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), International Union for Conservation of Nature, CARE, Terra Global Capital LLC, and DAI</td>
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<td>Empowering Guatemala’s Indigenous Communities to Cope with Climate Change</td>
<td>$0.2 million</td>
<td>World Bank</td>
<td>2011–2013</td>
<td>ASOCIACION SOTZ’IL</td>
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<td>Program to Support the Climate Change Agenda of Guatemala</td>
<td>$250 million</td>
<td>IDB</td>
<td>2010–2030</td>
<td>Ministry of Finance (MINFIN)</td>
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