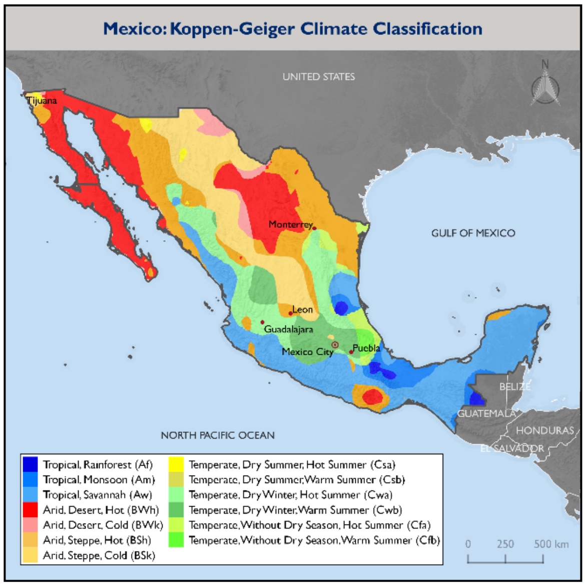
FROM THE AMERICAN PEOPLE

FACT SHEET

# CLIMATE RISK PROFILE

# MEXICO

## COUNTRY OVERVIEW




Mexico is an upper-middle income country of 127 million people, with nearly 80 percent now living in cities. Its location between two oceans and complex topography increase the country´s exposure to extreme hydro-meteorological events such as tropical cyclones, frosts, heat waves and floods. This geographic vulnerability is intensified by a sizeable wealth gap (53.2 percent of the population lives below the national poverty line) and urbanization. Aging transportation, power and water infrastructure is vulnerable to damage from flooding and strong winds, especially in coastal areas. In 2013, two powerful storms simultaneously hit both coasts within a 24-hour period resulting in $5.7 billion in damages. Coastal tourism, an important economic sector for Mexico, is also at risk, along with destruction of diverse marine ecosystems. In rural areas, extreme temperatures and erratic rainfall drastically affect agricultural productivity, including both crops and livestock. Since 1990, agriculture has accounted for 80 percent of weather-related financial losses in the country. (1, 2, 5, 6, 7, 16, 18)

### CLIMATE PROJECTIONS

1.4-2° C increase in temperatures by 2050

3-5% reductions in annual precipitation by 2050; increases in rainfall intensity of extreme rainfall events; increases in dry spell duration

0.4 - 0.7 m rise in sea levels by 2090

### KEY CLIMATE IMPACTS

**Infrastructure**
Losses to buildings, water/power systems, roads, airports, seaports

**Water Resources**
Degration of water quality
Reduced water supplies
Increased flooding

**Agriculture**
Reduced crop/livestock productivity
Increased food insecurity

**Ecosystems**
Reduced biodiversity and ecosystem services

**Coastal Zones**
Flooding of coastal areas
Coastal erosion
Damage to key tourist areas

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This document was prepared under the USAID Climate Change Integration Support (CCIS) Task Order No. AID-OAA-TO-15-00030 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

Mexico's climate is characterized by large regional differences as a result of its variable topography and geographic location. Mean annual temperature (1960-2015) is 21°C, ranging from 15 to 20°C in the central, upland areas to 23 to 27°C in the coastal lowlands. Seasonal temperature variations are small in the south, but range from less than 10˚C in winter to more than 30°C in summer in the northernmost regions. Mexico's mean annual precipitation is 750 mm (1960-2015). In the far north, rainfall is less than 50 mm per month throughout the year, while the southern regions and central highlands experience a distinct wet season from June to October, averaging 550 mm per month in the southernmost regions. Between July and October, both the Atlantic and Pacific coasts are vulnerable to hurricanes. Mexico's weather is strongly influenced by El Niño events, periodic disturbances to normal oceanic and atmospheric circulation patterns over the Pacific Ocean. El Niños bring relatively cool and wet weather to Mexico in winter, followed by hotter and drier conditions than normal in summer. In El Niño years, the number of Pacific hurricanes typically increases. (1, 4, 8, 9, 10, 14, 17)

### HISTORICAL CLIMATE

Climate trends since 1960 indicate:

- Between 1960 and 2015, mean annual temperature increased by 0.21°C per decade.
- Between 1960 and 2003, the annual average number of "hot" days and "hot" nights[1] increased by 9.9 and 5.6 percent, respectively.
- Mean annual rainfall increased a statistically insignificant 7 mm per decade over 1960-2015.
- The proportion of rainfall that occurred in heavy events[2] increased by 1.2 percent per decade, on average from 1960-2003.
- Coastal areas of Mexico experienced an estimated 1.8 to 2.4 mm per year increase in mean sea level over 1955 to 2003.
- An increase in frequency of major hurricanes from 1970-2009.

### FUTURE CLIMATE

Projected changes by 2050[3] include:

- Mean annual temperature is projected to increase by between 1.4 and 2°C.
- Projections of mean annual rainfall are broadly consistent, indicating 3 to 5 percent decreases.
- The number of consecutive dry days[4] is projected to increase by 3 to 5.5 days.
- A 13 to 18 percent increase in total annual precipitation on extreme rainfall days.[5]
- Sea level increases of 0.5 to 0.7 m on the Pacific coastline, and of 0.4 to 0.7 m on the Atlantic coastline by 2090, relative to 1986-2005.
- Uncertain changes in tropical cyclones, though rainfall intensity of tropical cyclones could increase in both the Gulf of Mexico and East Pacific.

# SECTOR IMPACTS AND VULNERABILITIES

### INFRASTRUCTURE

Extreme weather events such as hurricanes damage infrastructure, including housing, airports, seaports, roads, communication networks and oil platforms, disrupting supply lines, commercial operations and other economic activities. An increase in the frequency of heat waves in urban centers like Mexico City could translate into higher demand for air conditioning and cooling systems, putting power plants under severe stress, as they work less

| Climate Stressors and Climate Risks INFRASTRUCTURE | |
|---|---|
| **Stressors** | **Risks** |
| **Increased frequency of extreme storms** | Damage to power-generating facilities, transportation infrastructure (ports, roads), hospitals, housing and communication networks |

[1] "Hot" day or "hot" night is defined by the temperature exceeded on 10% of days or nights in current climate of that region and season.

[2] A "heavy" event is defined as a daily rainfall total which exceeds the threshold that is exceeded on 5% of rainy days in the current climate of that region and season.

[3] Relative to 1986 – 2015.

[4] Maximum number of consecutive days per year with less than 1 mm of precipitation.

[5] Annual total precipitation when daily precipitation exceeds the 99th percentile (calculated from days when it precipitated at least 1 mm).

efficiently under higher temperatures. Large urban populations live in informal settlements with poor housing and a lack public services, including emergency services, making them highly vulnerable to climate risks such as floods and landslides. In coastal areas, sea level rise and storm surge from coastal storms threaten water and electricity infrastructure with inundation and salinity damage. (7, 16, 19)

| | |
|---|---|
| **Increased temperatures** | Increased power demand; reduced power production, including power outages |
| **Sea level rise** | Flooding and salinity damage to electricity and water systems and other infrastructure in coastal cities |

## ECOSYSTEMS

Ranked second globally in number of ecosystem types and fourth in terms of species richness (accounting for 10-12 percent of the Earth's species), Mexico is designated as one of the five most biologically "mega-diverse" countries in the world by the Convention on Biological Diversity. However, this rich biodiversity faces habitat degradation and loss, overexploitation, introduction of invasive species, pollution, climate change and urbanization. In 2011 and 2012, extreme temperatures and droughts of unusual severity, extent and duration resulted in regional-scale forest dieback in northern and central Mexico. More frequent droughts in tropical forests may favor an increase in deciduous species. Increases in drought may lead to pest outbreaks, and an increase in bark beetles, which destroy forests, is projected for northwestern Mexico. Tropical cyclones and heavy rainfall events, along with ocean acidification, can damage mangroves and coral reefs, which can lead to declines in the production of marine fishes and other species that depend on these habitats. (4, 13)

**Climate Stressors and Climate Risks ECOSYSTEMS**

| Stressors | Risks |
|---|---|
| **Increased temperatures** | Declines in tropical forests and biodiversity loss |
| **Drought and reduced rainfall** | Increased risk of pest outbreaks (e.g., bark beetle) |
| | Loss of vegetative cover and increased erosion |
| **Increased frequency of extreme storms**<br>**Sea level rise** | Inundation and salinization of coastal habitats, leading to declines in ecosystem-based livelihoods such as fishing |

## COASTAL ZONES

Mexico has over 11,000 km of coastline along the Gulf of Mexico and Caribbean. The coastal zone is vulnerable to a range of climate stressors, including rising sea surface temperatures, ocean acidification, changes in ocean circulation and changes in patterns of extreme weather, including hurricanes. The Gulf of Mexico is home to eight major fishing ports and two industrial ports. The port of Manzanillo is Mexico's busiest port; it faces the largest potential economic losses from rising sea levels, as it would become increasingly difficult to access and navigate. Nearshore fishing and port activities are also disrupted by coastal storms that bring heavy rainfall, storm surge and strong winds. The southern states of Veracruz, Tabasco, Campeche and Quintana Roo are major tourist destinations and some of the most vulnerable states to severe weather. One of the biggest insurance losses in Latin American history was Hurricane Wilma in 2005, which damaged hotels and beaches in Cancun, resulting in $1.8 billion in damages. An analysis covering 1970 to 2009 reveals an increase in the frequency of major hurricanes (Categories 3, 4 and 5) in both the Gulf of Mexico and the Caribbean. (4, 7, 10, 14, 19)

**Climate Stressors and Climate Risks COASTAL ZONES**

| Stressors | Risks |
|---|---|
| **Increased sea surface temperatures** | Changes in coastal fisheries from rising sea surface temperatures |
| **Increased frequency of extreme storms** | Damage to coastal infrastructure and ecosystem services |
| | Beach erosion |
| **Sea level rise** | Inundation and salinity damage to coastal infrastructure |
| **Ocean acidification** | Loss of coral reefs from ocean warming and acidification |

## WATER RESOURCES

Most of inland Mexico is projected to experience reduced rainfall, including an increase in consecutive dry days, particularly in northern areas, leading to reductions in surface waters and the supply of freshwater. The decline in rainfall will affect runoff in rivers, water stored in dams and aquifer recharge. Saltwater intrusion into coastal aquifers from rising seas will further deplete freshwater supply. The State of Baja California may experience the greatest decline in annual precipitation – decreasing 40 percent between 2015 and 2039. Drought is expected to intensify in three regions (Central, Chiapas and Jalisco). Hydroelectric plants, particularly in the northern and northwestern parts of the country, will suffer production losses if water sources dry up or become less reliable. Water resources in Mexico are already stressed by non-climatic factors like population pressure, particularly in urban areas. In Mexico City, overexploitation of the aquifer has not only reduced groundwater levels, but it has also caused subsidence, undermining building foundations and infrastructure stability, increasing residents' vulnerability to earthquakes and heavy rains. By 2050, Mexico City is projected to experience a reduction of between 10 to 17 percent in per capita water supply. (4, 7, 11)

**Climate Stressors and Climate Risks**
**WATER RESOURCES**

| Stressors | Risks |
|---|---|
| **Increased temperatures** | Reduced water quality |
| | Reduced surface waters and groundwater recharge |
| **Drought and reduced rainfall** | Reduced hydropower potential and disruption of energy services |
| **Increased frequency of extreme storms** | Damage to water infrastructure from flooding and mudslides |
| | Urban drainage networks overwhelmed by flash floods |

## AGRICULTURE

Agriculture is the third most important economic activity and one of the sectors where climate change is expected to hit hardest, especially among smallholder farmers that rely on rainfed agricultural activities for their livelihoods. Between 1980 and 2000, extreme events affected 15 percent of smallholder farmers. Maize is the most important crop, occupying 33 percent of the total cultivated area, followed by beans, coffee, sugarcane, wheat and cattle. The two agricultural systems with the largest land area are the irrigated region (north) and the maize–bean region (central and southwest). Farmers in the north experience drought and frost, while the southwestern states of Veracruz and Tabasco are particularly vulnerable to floods and pest infestations. The 2010–2012 drought across northern Mexico was considered the most severe in a century, resulting in the loss of 3.2 million tons of maize and placing 2.5 million people at risk of food insecurity. A 2017 drought in Oaxaca, one of the worst in nearly 50 years, resulted in the loss of over 1,500 head of cattle in the Isthmus region. A study in Veracruz indicates that the effects of projected maximum summer temperatures on livestock heat stress could reach the "danger level" (at which losses can occur) by 2020 and continue to rise.

**Climate Stressors and Climate Risks**
**AGRICULTURE**

| Stressors | Risks |
|---|---|
| **Increased temperatures** | Increase in some pests and diseases |
| **Increased drought and reduced rainfall** | Crop yield declines (e.g., maize, beans, coffee, sugarcane) |
| | Increased livestock mortality due to heat stress |
| **Increased frequency of extreme storms** | Increased food insecurity among subsistence farmers/indigenous communities leading to possible migration to urban areas |

While water scarcity is an issue in the north, the southern parts of the country face tropical storms that often cause extensive damage to crops and livestock. Coffee, an economically important export crop supporting 500,000 primarily indigenous households, is projected to decline in production by 34 percent by 2020 in Veracruz, if historic temperature and precipitation trends continue. (4, 7, 14, 16, 17, 18)

## POLICY CONTEXT

Mexico's 2012 General Climate Change Law (GLCC) defines planning and policy instruments including institutional arrangements, and provides general guidance for the implementation of national climate policy.

### INSTITUTIONAL FRAMEWORK

Under the GLCC, the Mexican Government, led by the Ministry of Environment and Natural Resources, is mandated to formulate and guide national climate change policy. The National Institute for Ecology and Climate Change, a decentralized public agency of the federal government, and the National Climate Change System, were created to achieve effective coordination between the three levels of government and cooperate with the public and private sectors. At the sub-national level, states and municipalities have also embarked on state-level greenhouse gas (GHG) inventories and climate programs, which are reflected in their own Climate Change Plans. Since 2000, Mexico has published three National Strategies on Climate Change and adopted its first Special Program on Climate Change (PECC), one of the policy planning instruments derived from the GLCC. The PECC outlines a series of mitigation, adaptation and cross-cutting measures that are aligned with Mexico's National Climate Change National Strategy Vision 10-20-40. In addition, Mexico has presented five National Communications with their respective GHG inventories to UNFCCC, and in 2015, built on its tradition of leadership by becoming the first developing country to release its post-2020 climate action plan, or INDC. (5, 16)

### NATIONAL STRATEGIES AND PLANS

- Climate Change Mid-Century Strategy (2016)
- Mexico's Intended Nationally Determined Contribution (2015)
- First Biennial Update Report to the UNFCCC (2015)
- National Strategy for Reducing Emissions from Deforestation and Forest Degradation
- The Mexico Low Emissions Development Program (2013)
- Special Program on Climate Change 2014-2018
- Mexico's National Climate Change Strategy 10-20-40 (2013)
- National Development Plan (2013-2018) (Spanish only)
- Mexico's Fifth National Communication to the UNFCCC (2012) (Spanish only)
- The General Law on Climate Change (2012)

### KEY RESOURCES


1.Climate Services Center Germany. 2015. Climate Fact Sheet: Mexico.
2. Deheza, Elizabeth, and J. Mora. 2013. Climate Change, Migration and Security Best-Practice Policy and Operational Options for Mexico.
3.Federal Government of Mexico. 2013. National Climate Change Strategy. 10-20-40 Vision
4.Federal Government of Mexico. 2014. Special Climate Change Program 2014-2018
5.Federal Government of Mexico. 2015. Mexico's Intended Nationally Determined National Contribution.
6.Germanwatch. 2014. Global Climate Risk Index 2015: Who Suffers Most from Extreme Weather Events?
7.IPCC. 2014. Impacts, Adaptation, and Vulnerability. North America.
8.IPCC. 2013. Sea Level Change.
9.KNMI Climate Explorer
10.Met Office. 2011. Climate: Observations, projects, and impacts: Mexico.
11.OECD. 2013. Mexico: Water and Climate Change Adaptation, Country Profile
12.SEMARNAT/INECC. 2016. Mexico's Climate Change Mid-Century Strategy.
13. SEMARNAT/INECC. 2015. First Biennial Update Report to the United Nations Framework Convention on Climate Change.
14.UNDP. 2006. Climate Change Country Profiles: Mexico
15.USAID. 2015. Mexico CDCS FY2014-2018
16.USAID.2016 Analysis of Intended Nationally Determined Contributions (INDCs).
17.World Bank Climate Change Knowledge Portal: Mexico
18.World Bank; CIAT; CATIE. 2015. Climate Smart Agriculture in Mexico.

19.World Bank. 2013 Municipal Vulnerability to Climate Change and Climate-Related Events in Mexico.
20.World Bank. 2013. Country Partnership Strategy for the United Mexican States for the Period FY2014-2019.

Map Source: Adapted from Koppen-Geiger Classification information

## SELECTED ONGOING EXPERIENCES

| Selected Program | Amount | Donor | Year | Implementer |
|---|---|---|---|---|
| Coastal Watersheds Conservation in the Context of Climate Change Project | $39.5 million | World Bank | 2013-2019 | National Commission for Protected Areas |
| Sustainable Productive Landscapes | $11.7 million | GEF/World Bank | 2012-2017 | Ministry of Agriculture, Livestock, Rural Development, Fishing and Food (SAGARPA); Ministry of Environment and Natural Resources (SEMARNAT); National Commission for Knowledge and Use of Biodiversity (CONABIO) |
| Adaptation to Climate Change Impacts on the Coastal Wetlands | $4.5 million | GEF | 2009-2015 | Ministry of Environment and Natural Resources (SEMARNAT) through the National Institute for Ecology and Climate Change (INECC) and the Mexican Institute of Water Technology (IMTA) |
| Strengthening Management Effectiveness and Resilience of Protected Areas to Safeguard Biodiversity Threatened by Climate Change | $10 million | GEF/UNDP | 2013-2018 | National Commission for Protected Areas, National Forestry Commission, National Commission for Knowledge and Use of Biodiversity |